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Exposure to metal mixtures and neurodevelopment outcomes in 4-5-year-old children living in Spain

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BACKGROUND AND AIM:Humans are exposed to toxic metals/metalloids and essential elements (hereafter, "metals") simultaneously in real-life scenarios with potential additive, synergistic or antagonistic effects. Early life is a vulnerable window for metal exposure, with potential adverse health effects that may last throughout the life course. This study aims to explore the association between metal mixture exposures and the neurodevelopment of children in Spain.

METHOD: The study population (n = 962) belonged to the INMA Project. A standardised version of the McCarthy Scales of Children's Ability was used to assess 4-year-old children's neurodevelopment. The concentrations of As species, Co, Cu, Mo, Pb, Se and Zn were measured in spot urine samples adjusted for urine dilution. Principal component analysis was performed as a dimension reduction technique to identify latent metal mixtures. The association between the metal mixtures and children's

neurodevelopment function scores was explored using multiple linear regression adjusted for confounding factors.

RESULTS: Four principal components or metal mixtures were identified with a cumulative explained variance of 69%. The first component comprised the essential elements Cu, Se, and Zn, as well as the toxic metal Pb, and was linked to a decreased performance in global verbal, executive, verbal executive, and working memory function scores. The second component, comprising urinary inorganic As and monomethylarsonic acid concentrations, was associated with a reduced global motor and gross motor scores. The third component gathered Mo and Co and was related to an increased function scores in visual and verbal span, and global motor. The fourth component was generated from urinary arsenobetaine concentrations and was related to an increased fine motor.

CONCLUSIONS: Even relatively low metal exposures, relevant to the Spanish population and others, may impact children's neurodevelopment. Our main findings support the reduction of exposure to toxic metals during critical windows of early life.

Keywords: mixture, heavy metals, children's environmental health, respiratory outcomes, biomarkers of exposure.

Pro-vegetarian dietary patterns and metal exposure in Spanish children of 4-5 years

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BACKGROUND AND AIM: Food is an important source of vital nutrients, yet it can also contain nonessential-toxic elements. Dietary patterns are a more comprehensive and accurate way to assess the overall impact of combined food consumption. Pro-vegetarian dietary patterns (PVG) are a novel approach to evaluate the health effects of vegetarian diets, yet their effects on children remain unknown. Thus, we aim to examine the association between children's adherence to three PVG dietary patterns and exposure to essential and non-essential elements.

METHOD: The study population includes 723 children aged 4-5 years from the INfancia y Medio Ambiente (INMA) cohort in Spain. We constructed the three PVGs (general (gPVG), healthful (hPVG) and unhealthful (uPVG)) using dietary information from a validated Food Frequency Questionnaire. Urinary concentrations of Co, Cu, Zn, Se, Mo, Pb, and Cd were used as exposure biomarker. Urinary arsenic species concentrations were also measured, and the primary (PMI) and secondary (SMI) inorganic arsenic methylation indexes calculated.

RESULTS: Higher adherence to gPVG was associated with decreased Co and Se concentrations, an increased PMI, and reduced SMI. Increased adherence to hPVG was associated with decreased inorganic arsenic concentration. Higher adherence to uPVG was associated with reduced Mo concentration and SMI.

CONCLUSIONS: Ingestion of certain essential elements may be lowered with a greater adherence to a PVG pattern, which may impair children's ability to methylate inorganic arsenic. Our findings support a children's nutritional adequate diet with a variety of foods from each food group.

Keywords: Heavy metals, Food and nutrition, Mixtures analysis

EP-003[Air pollution » Particulate matter]

Estimating spatiotemporally resolved PM2.5 concentration across the contiguous United States using an ensemble model

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BACKGROUND AND AIM:Spatiotemporally resolved predictions of PM2.5 concentration are essential for studying associations between long-term and short-term exposures and adverse health outcomes in epidemiological studies. An improved statistical ensemble modeling approach with novel covariates was used to estimate daily 1x1 km PM2.5 concentrations across the contiguous US for the years 2000-2019, and 250m resolution in urban areas.

METHOD:An ensemble model was used to integrate daily PM2.5 predictions from six different base learners: 3 tree-based machine learning models (random forests, gradient boosting machine, and extreme gradient boosting), neural networks, an ensemble of individual generalized linear model predictors with two-way interactions, and a gaussian process approximations model. The ensemble modeling approach aims to provide predictions with minimized root mean square error (RMSE) compared to the base learners using a geographically weighted generalized additive model (GAM) which fused the predictions from multiple learners by allowing the weights of each model to vary over space. The spatial and temporal variables used as predictors within the individual base learners were: satellite-based products (aerosol optical depth (AOD), land surface temperature, vegetation indexes, light at night, fires), human modification of land, land cover variables, meteorology, topography, population density, modelled emissions, proximity, and density of multiple possible sources of air pollution. The model was calibrated using daily PM2.5 measured by monitors and its performance was evaluated using 5-folds cross validation where a random subset of monitoring sites was assigned to each fold.

RESULTS: The 1x1 km ensemble model showed an improved cross validated performance compared to the input base learners with an overall R2=0.74 and RMSE of 3.24 mg/m3 for the year 2010, and RMSE for annual average of 1.34.

CONCLUSIONS: The ensemble model suggests an improved statistical approach for integrating PM2.5 concentration predictions from multiple modeling approaches.

Keywords: Air pollution modeling, ensemble modeling, machine learning, satellite-based products

The role of spatial social polarization in racial and ethnic disparities in stillbirth

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BACKGROUND AND AIM:Despite evidence of the role of structural racism on disparities in adverse birth outcomes, its impact on stillbirth has not been sufficiently explored. Thus, we examined associations between neighborhood-level racialized economic segregation and stillbirth in greater Houston, TX, a racially and ethnically diverse and segregated metropolitan area.

METHOD: We abstracted information from 860,789 live birth and fetal death records (2007–2019) from the Texas Department of State Health Services, including geocoded addresses at the time of delivery, and used U.S. census data to generate a census-tract level measure of spatial polarization based on race/ethnicity and income (i.e., the Index for Concentration at the Extremes; ICE), which was categorized by tertiles (ranging from most deprived to most privileged). We employed logistic regression with generalized estimating equations (to account for correlation between mothers residing in the same census tract), adjusted for sociodemographic characteristics, to examine the association between the ICE and stillbirth. We stratified by race/ethnicity to inform the contribution of racialized economic segregation on disparities in stillbirth.

RESULTS: For all mothers, there was no evidence of an association between stillbirth and living in the most deprived and racially polarized neighborhoods. However, non-Hispanic Black mothers living in these neighborhoods had a 30% reduced odds of stillbirth (OR=0.70, 95% confidence interval (CI): 0.59, 0.84) as compared to non-Hispanic Black mothers living in the most privileged neighborhoods. Conversely, we observed positive, though not statistically significant, associations among non-Hispanic White (OR=1.15, 95% CI: 0.90, 1.46) and Hispanic (OR=1.09, 95% CI: 0.94, 1.27) mothers living in the most deprived neighborhoods.

CONCLUSIONS:Our finding that Black mothers living in deprived neighborhoods had lower odds of stillbirth relative to those who reside in the most privileged neighborhoods suggests that the availability of communal support to mothers in these communities may offset the potential effects of stress associated with economic deprivation.

Keywords: racial disparities, segregation, spatial social polarization, structural racism,

Persistent endocrine disrupting chemicals and incident uterine leiomyomata: a mixtures analysis

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BACKGROUND AND AIM: Uterine leiomyomata (UL) are benign, hormone-sensitive neoplasms that can cause substantial gynecologic morbidity. Our objective was to examine the association between biomarkers of exposure to a mixture of persistent EDCs and incident UL.

METHOD: We analyzed prospective data from the Study of Environment, Lifestyle, and Fibroids. Participants were aged 23-35 years, had an intact uterus, resided in the Detroit, MI area, and had no previous UL diagnosis. Participants completed a clinic visit and questionnaires at baseline (2010-2012) and every ~20 months through 10 years. The clinic visits involved blood collection and transvaginal ultrasound for detection of UL. We analyzed baseline plasma samples for 34 chemicals:

polychlorinated biphenyls, polybrominated flame retardants, organochlorine pesticides, and per- and poly-fluoroalkyl substances. Our analysis included 13 chemicals with >80% detection frequency and was restricted to the 1,069 participants without UL at baseline. We used Bayesian kernel machine regression (BKMR) and quantile g-computation to examine the association of the EDC mixture with incident UL, adjusting for age, education, body mass index, cigarette smoking, parity, time since last birth, and current depot medroxyprogesterone acetate use.

RESULTS:Thirty-one percent of participants had ultrasound detection of UL over follow-up. In BKMR analyses, the EDC mixture was weakly inversely associated with probit of UL. This association was driven primarily by PCB153, PCB180, p,p'-DDE, and PFDA. Alternatively, PCB138/158 was positively associated with probit of UL. There was little evidence of interaction between chemicals. In quantile g-computation analyses, the risk ratio for a one-quartile increase in the mixture was 0.87 (95% CI: 0.75, 1.01). PCB138/158 (positive), PCB153 (inverse), and PFDA (inverse) had the highest contribution to the mixture effect.

CONCLUSIONS: We found a weak inverse association between biomarkers of exposure to a mixture of persistent EDCs and incident UL, although PCB138/158 was positively associated with incident UL.

Keywords: mixtures analysis, epidemiology, chemical exposures, reproductive outcomes

EP-006[Chemical exposures » PFAS]

Case-cohort study of PFAS and hematologic malignancy risk in American Cancer Society's Cancer Prevention Study II Cohort

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) have been associated with hematologic malignancies in some but not all previous studies. Many studies did not consider histologic subtypes, yet there is evidence that risk factors for these cancers vary by subtype. We examined associations between PFAS exposure and risk of several hematologic malignancy subtypes. METHOD: We conducted a case-cohort study within the American Cancer Society's prospective Cancer Prevention Study II LifeLink cohort for which serum specimens were collected during 1998-2001 (ages ≥54 years). This study included a subcohort (500 men, 499 women) randomly selected from cohort members without prior cancer diagnoses at serum collection, and all persons with incident (after serum collection) hematologic cancers (n=635, first malignancies only). Hematologic cancer subtypes with at least 80 cases were analyzed separately. Concentrations of perfluorooctanoic acid, perfluorooctane sulfonate (PFOS), perfluorohexane sulfonic acid (PFHxS), and perfluorononanoic acid were measured in stored serum. Multivariable Cox proportional hazards regression was used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for associations between PFAS concentrations and risk of hematologic malignancy subtypes. Models accounted for the study design and controlled for sex, age and year at blood draw, education, race/ethnicity, smoking and alcohol use.

RESULTS:Serum PFHxS concentrations were positively associated with chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) among men [HR (95% CI) per unit (ng/ml) doubling: 1.34 (1.02–1.75), p=0.033] but not women. We also observed possible negative associations between PFAS serum concentrations and other hematologic malignancy subtypes [e.g., multiple myeloma and PFOS].

CONCLUSIONS: This study provides some evidence for different associations between PFAS and hematologic cancer risk by subtype -- a positive association between PFHxS and CLL/SLL among men, and possible negative associations between PFAS and other subtypes. Consideration of histologic types might help clarify inconsistencies in the literature on PFAS and hematologic cancer.

Keywords: PFAS, cancer

Air pollution exposure is associated with lower positive affect in older women

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BACKGROUND AND AIM: Exposure to ambient air pollution, including PM2.5 (particulate matter <2.5 μ m) and NO2 (nitrogen dioxide), may increase the risk for depressive symptoms in older adulthood, the impact on specific dimensions of DS is unclear. Our previous work has linked low positive affect with air pollution exposure and cerebrovascular and neurodegenerative diseases. Here we validated the factor structure of a commonly used measure of depressive symptoms in a sample of older women and examined cross-sectional associations between air pollution exposure and depressive symptom dimensions.

METHOD: We included 2,179 women (age=73.8±3.8 years) from the Women's Health Initiative Study of Cognitive Aging who completed an assessment of depressive symptoms with the 15-item Geriatric Depression Scale (GDS-15) at study enrollment. Three-year average of annual mean concentrations of ambient PM2.5 (in μ g/m3) and NO2 (in ppb) before this assessment were estimated at participants' addresses via spatiotemporal models. Structural equation models (SEMs) were constructed to validate the 3-factor solution consisting of positive affect, apathy/withdrawal, and dysphoria latent factors identified by previous meta-analyses. Next, SEMs were constructed to examine whether exposures were associated with each of the three latent factors adjusting for sociodemographic, lifestyle, and clinical characteristics.

RESULTS:The three-factor solution exhibited good model fit (comparative fit index=.99; Tucker-Lewis index=.98; root mean square error or approximation=.02). Higher exposures to NO2 (β =.140 per 10.36 ppb, p=.003) and PM2.5 (β =.111 per 3.65 µg/m3, p=.009) were significantly associated with lower positive affect. The effect sizes approximated the effect of not engaging in any weekly moderate to vigorous physical activity relative to 2-4 episodes a week (β =.135, p=.129). Exposure was not associated with apathy/withdraw or dysphoria symptoms (all p>0.05).

CONCLUSIONS: Consistent with our previous work, air pollution exposure may contribute to reduction of positive affect. Future studies need to examine the changes in brain structures and neural networks that underlie these associations.

Keywords: depressive symptoms, aging, air pollution, women

Reference values of barium in hair samples from children and adolescents in Alcalá de Henares (Spain)

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BACKGROUND AND AIM: Barium (Ba) is a toxic element poorly investigated in biomonitoring studies. To suggest tentative reference values for Ba in scalp hair from schoolchildren born/living in Alcalá de Henares (Madrid Region).

METHOD:Scalp-hair was collected from 120 children (70 girls, 6-9 years-old) and 97 adolescents (68 girls, 13-16 years-old) which met strict inclusion criteria. Following removal of exogenous contamination, Ba was monitored by ICP-MS after appropriate processing to remove external contamination. Reference values, i.e. the 95% confidence interval of the 95th population percentile (CI-PP95), were quantified using NADA package in R.

RESULTS: Levels of Ba were higher in female participants, being significantly higher in girls (p-value=5.94E-06); data is provided as median and IQR, in μ g/g, for children [0.271 (0.153, 0.421) vs. 0.104 (0.066, 0.164)] and teenagers [0.323 (<0.153, 0.777) vs. 0.112 (0.021, 0.595)]. CI-PP95 are provided for male and female for children [0.225-0.442 and 0.533-0.848] and teenagers [1.348-31.803 and 1.099-2.209], respectively. Our results were slightly lower than those reported as reference values for children and teenagers living in the Madrid Region (<0.2-1.8 μ g/g), which would be logical as most of the participants were living in Madrid city that supports higher levels of contamination and urbanisation than Alcalá. These authors also reported significantly higher levels in hair from female participants, although they found that Ba was higher in hair from children >15 years-old. However, levels of Ba in Alcalá schoolchildren's hair were much lower than those reported in populations exposed to Ba in drinking water that live close to oil industries in South Sudan (2.9-50 μ g/g), suggesting minimal environmental exposure to Ba in scalp hair proposed for children/adolescents living in Alcalá de Henares, can be used to identify individuals (male and female) who have been exposed to this toxic element.

Keywords: human hair, barium, exposure, Spanish schoolchildren

EP-009[Exposures » Food/nutrition]

Exposure and risk assessments to caffeine in young university students from Leicester, England

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BACKGROUND AND AIM: To assess intake of coffee, tea, energy (ED) and related drinks in a young population of students at De Montfort University (DMU, UK), to determine exposure and risk assessments to caffeine.

METHOD:Comprehensive nutrient intake was collected from 111 (20.45±1.16 yrs-old; 78 female) DMU students between 2015-16 from three major ethnic backgrounds (41 Asia, 41 Africa, 27 Europe), using a validated variant of the Nutrition Norfolk Food Frequency Questionnaire. Questionnaires were processed with Nutritics dietary software.

RESULTS:The dietary intake of caffeine was higher in female participants (90.483 vs. 75.579 mg/day), which could be attributed to the higher intake of coffee (104.69 vs. 65.68 g/day) and tea (161.29 vs. 106.97 g/day) in female students. In contrast, the intake of energy (88.14 vs. 63.14 g/day) and sports drinks (232.14 vs. 178.57 g/day) were higher in male participants. Although none of them showed statistical significance maybe due to the differences in the number of participants according to sex, our results agree with recent studies that have reported a considerable increase in the intake of EDs in young male adults. The intake of caffeine, tea and coffee did not show statistical differences according to ethnic background. The recorded body weights with Tanita(R) were used to report the intake of caffeine in milligrams per kilogram of body weight per day (1.408 vs. 1.057 mg/kg/day, respectively), which were lower than the reported intake in 18-24 years-old US population (1.7 mg/kg/day).

CONCLUSIONS:Although the total intake of caffeine in DMU students would be lower than the amount established by the FDA as safe (400 mg/day), the intake of caffeine in some participants (0.0170-5.8528 and 0.0209-6.6699 mg/kg/day, female and male, respectively) exceed the established reference range intake that can cause adverse effects (>3 mg/kg/day; cardiovascular/haematological, neurological and psycho-behavioural effects). The intake of caffeinated beverages should be reduced in university students.

Keywords: Caffeine intake, university students, Leicester.

Environmental monitoring of lanthanum in wild mushrooms from urban and rural areas across Leicestershire (UK)

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BACKGROUND AND AIM:A monitoring study in Leicestershire's topsoils (UK) revealed that lanthanum (La) exceeded the established soil screening level (SSL). To gain a better understanding of the environmental presence/distribution/risks of La by using wild mushrooms collected in the same areas. METHOD:106 mushrooms were collected from Leicester city and Bradgate Park. Species identification was confirmed by DNA barcoding. La was monitored by ICP-MS in cleaned/dried/homogenised mushrooms mineralised with HNO3/H2O2 [LoD=0.533 ng/g dry weight (dw)]. La was also monitored in 850 topsoils collected in these areas.

RESULTS: Significantly higher levels were found in mushrooms collected in the urban area (median and ranges, in μ g/g dw; p-value=0.04): 0.238 (0.013-10.580) vs. 0.198 (0.131-2.670), which might be attributed to the technological uses of La in catalytic converters and phosphors. Content of La varied between mushrooms collected across the four cardinal subareas in which Leicester city was divided (p-value=5E-18); the lower levels were observed in mushrooms sampled in NW areas [0.146 (0.123-4.866)], meanwhile the higher levels were found in those collected in the SW [1.286 (0.842-4.953)]. La also varied between major mushroom species collected (ranges, in μ g/g; p-value=1E-19): *Agaricus bitorquis* (edible; 0.123-0.180), *Panaeolus foenisecii* (poisonous; 0.298-10.580) and *Mycena citrinomarginata* (0.374-8.194; unclassified), which might suggest a minimal exposure to La despite consumption of edible wild mushrooms collected in Leicestershire. Although a similar distribution of La was found in the topsoils, i.e. significant (p-value=0.0153) higher levels in the SW (19.621 µg/g) and lower in the NW (16.447 µg/g), no correlation was found between the content of La in mushrooms and the respective topsoils.

CONCLUSIONS: The presence of La in wild mushrooms in Leicester was within the same ranges as those reported in other similar European cities. Although the risks would be minimal, La presence could contribute to the maximum level of intake of total REEs for vegetables set at 0.7 μ g/g.

Keywords: Lanthanum, mushrooms, Leicester, topsoils, risks.

Environmental distribution and exposure to heavy-rare earth elements in Leicestershire (UK)

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BACKGROUND AND AIM: The aim was to determine the presence/distribution/risks to ytterbium (Yb) and lutetium (Lu), heavy-rare earths (HREEs), present in topsoils from Leicestershire (UK). METHOD: A total of 850 samples were collected (2017-18); 26 composite samples were appropriately prepared after mixing topsoil samples collected per park/location (18 urban, 8 rural), which were further processed in duplicate. Both HREEs were measured in triplicate in each of the 52 composite samples by ICP-MS. Provisional sub-chronic oral reference dose for Lu was used to determine risks. RESULTS:Slightly higher levels of Yb [0.898 (0.492-1.142) vs. 0.828 (0.616-1.211)] and Lu [0.123 (0.069-0.162) vs. 0.117 (0.084-0.182)] were found in the topsoils collected in the rural areas (data presented as median and ranges, mg/kg), suggesting similar sources. However, Yb and Lu showed differences according to the urban subareas and followed a similar distribution; significantly higher medians of both elements in the NE (0.929, 0.134) and lower in the NW (0.720, 0.102), respectively (p-values=0.0209, all in mg/kg). Soil texture, specifically clay content, which can retain/absorb HREEs, might explain the distribution found in the urban subareas, as was significantly higher in topsoils sampled in the NE than in the NW (27 vs. 18.5%). The levels of Yb and Lu were lower than the reported background levels for UK soils by FOREGS (0.859 vs. 2.3; 0.121 vs. 0.3; mean averages in mg/kg), suggesting minimal anthropic contamination. Moreover, the levels of Yb in the urban area were much lower [0.859 vs. 1.9 (0.1-8.8; mean and range, in mg/kg)] than detected in London's topsoils. The noncarcinogenic risks quotients for ingestion (3.10E-06, 3.37E-06) and dermal contact (1.10E-07, 1.20E-07) in urban/rural areas for Lu, were lower than the threshold, respectively. CONCLUSIONS: In general, levels of Yb and Lu would represent a minimal risk for Leicestershire's population, although more toxicological knowledge for Yb is needed to quantify their risks.

Keywords: Ytterbium, lutetium, Leicester, topsoils, risks.

Human health risks of cerium contamination in urban and rural soils across Leicestershire (UK)

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BACKGROUND AND AIM: The aim was to determine the presence, distribution and risks to cerium (Ce) in topsoils from Leicestershire (UK).

METHOD:A total of 850 samples were collected (2017-18); 26 composite samples were appropriately prepared after mixing topsoil samples collected per park/location (18 urban, 8 rural), which were further processed in duplicate. Ce was measured in triplicate in each of the 52 composite samples by ICP-MS. Noncarcinogenic risks were characterised following US EPA methodologies. RESULTS:Slightly higher levels of Ce were found in the rural area, although without significance (data presented as median and interquartile ranges, in mg/kg): 39.825 (29.156, 51.610) vs. 38.745 (35.012, 43.746), suggesting a wide dispersion of this element. The urban/rural regions were

subdivided into the four ordinal directions to study the distribution of this element. A Duncan test showed significant differences in the presence of Ce throughout Leicester city (p=0.037; NE>SE>SW>NE), which might be attributed to the use of fertilisers, one of the major diffuse sources of rare earths in soils. The median level of Ce was lower than the described in soils (5-20 cm depth) sampled across London (50.9 mg/kg) and much lower than the described in topsoils monitored in urban parks in Beijing (82.7 mg/kg). Noncarcinogenic risks quotients for inhalation of Ce in resuspended soils (0.0248, 0.0255) were lower than the threshold for urban and rural areas, respectively.

CONCLUSIONS:Overall, Leicester's topsoils would be slightly less contaminated by Ce than other areas in Europe as they were lower than the described as background levels for European soils (39.2 vs. 48.2 mg/kg), and would represent a minimal risk through inhalation for the population living in Leicestershire. However, a better risk characterisation is needed due to the scarcity of toxicological data for Ce, including understanding the fate processes Ce undergoes in the environment to inform decontamination strategies.

Keywords: Exposure Assessment, Risk Assessment, Cerium

Environmental contamination and exposure to praseodymium in Leicestershire (UK)

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BACKGROUND AND AIM: The aim was to determine the environmental presence and distribution of praseodymium (Pr) across Leicestershire's topsoils (UK) and examine risk characterisation. METHOD: A total of 850 samples were collected (2017-18); 26 composite samples were appropriately prepared after mixing topsoil samples collected per park/location (18 urban, 8 rural), which were further processed in duplicate. Pr was measured in triplicate in each of the 52 composite samples by ICP-MS. Both areas were further subdivided into the four ordinal directions to study the distribution of Pr. Noncarcinogenic risks were characterised following US EPA methodologies. RESULTS: Levels of Pr were similar in both urban and rural areas, respectively (median and interquartile ranges, in mg/kg): 4.692 (4.250, 5.152) and 4.883 (3.469, 6.126). Significant differences were detected for the Pr monitored in the composite samples collected throughout Leicester city (p=0.0207) and rural areas (p=0.021), which revealed different concentration patterns NE>SW>SE>NW and SE>NE>SW>NW for each area, respectively, reflecting a wide distribution of Pr in Leicestershire soils. The median level of Pr in both areas were lower than the background values described for this element in European topsoils (FOREGS; 5.6 mg/kg), but were higher than the described in topsoils from the industrialised town of Maribor (Slovenia; 3.13 mg/kg). Noncarcinogenic risks quotients for ingestion (1.10E-05) and dermal contact (3.90E-07) due to Pr in urban topsoils

were lower than the threshold.

CONCLUSIONS:Although the levels of Pr in Leicestershire topsoils would be lower than those described as background in Europe and in the Upper Continental Crust (9.1 mg/kg), further monitoring studies would be needed to have a better understanding of the potential sources (natural/anthropic) of Pr in Leicestershire, including agricultural practices, waste disposal, metal recycling, vehicular/industrial emissions and urbanisation, as a slight contamination by this metal was detected in Leicester when comparing with other industrialised towns in Europe.

Keywords: Exposures, Risk assessment, Praseodymium

Dietary exposure to cerium in a young (18-23 yrs-old) population in Leicester (England)

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BACKGROUND AND AIM: Although the use of cerium (Ce) is increasing in Europe due to its multiple applications, the risks derived from chronic exposures to Ce are currently not well stablished. To assess exposure to Ce in undergraduate students at De Montfort University (DMU, England) with a specific focus on food intake.

METHOD: Comprehensive nutrient intake was collected from $111 (20.45 \pm 1.16 \text{ vrs-old}; 33 \text{ male and})$ 78 female) DMU students using a validated variant of the European Prospective Investigation into Cancer and Nutrition Norfolk Food Frequency Questionnaire (EPIC-Norfolk FFQ). Ce was analysed in scalp-hair voluntarily provided by 73 of these participants (58 female) by ICP-MS after appropriate removal of exogenous contamination. The limit of detection was 0.0125 µg/g. Data was processed with the statistical package 'NADA' freely available in R, as Ce was detected only in 21 hair samples. RESULTS: The presence of Ce in hair did not show sex-dependency, possibly due to its low detection in hair from male participants $[n=2; range=0.0203-0.1331, P95=0.0541, in \mu g/g]$. Thus, Ce was detected in 19 female participants (median and IQR, in $\mu g/g$): [0.0068 (0.0026, 0.0179)]. Ce was positively correlated with alcohol (r=0.3436; p<0.01) and tea (r=0.2440; p<0.05) intake. However, alcohol (p-value=0.0686) and tea (p-value=0.3332) intake did not show differences due to sex in this group of the population observed after performing a Mann-Whitney U test study. Large market-based studies have reported that the highest concentrations of Ce are usually found in plant foods (vegetables, cereals, potatoes, beans). Meanwhile the intake of vegetables and pulses in the population studied did not show sex dependency, significant differences were detected in the intake of cereals (p-value=0.0016), although they were higher in male participants. CONCLUSIONS: The levels of Ce found were lower than those reported in the literature, suggesting

CONCLUSIONS: The levels of Ce found were lower than those reported in the literature, suggesting minor environmental exposure in the population monitored.

Keywords: Exposures, Food/nutrition, Cerium

Biomonitoring mercury in young students attending a British university

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BACKGROUND AND AIM: Hair mercury (Hg) levels are considered a good biomarker of exposure to this pollutant. To evaluate the exposure to Hg in undergraduate De Montfort University (DMU) students. METHOD: Nutrient intake was collected from $111 (20.45 \pm 1.16 \text{ yrs-old}; 33 \text{ male and 78 female}) DMU$ students from different ethnic backgrounds (41 Asia, 41 Africa, 27 Europe, 1 Central America and 1 Caribbean), using a validated variant of the Nutrition Norfolk Food Frequency Questionnaire (EPIC-Norfolk FFO). Hg was analysed in scalp-hair provided by 73 of the participants (58 female) by ICP-MS. RESULTS: Ha was detected in 63 hair samples (49 female; $LoD=0.0310 \mu a/a$) and were significantly higher in male participants (p-value<0.05; data presented as mean and range, in $\mu g/g$): [0.9794 (0.0891-6.6073) vs. 0.2956 (0.0443-1.6732)]. The concentrations of total-Hg are higher than the mean average reported in Polish individuals aged 21-22 years-old (0.435 vs. 0.150 μ g/g) but lower than the geometric mean reported in Spanish individuals aged 18-29 years-old (0.30 vs. 1.65 μ g/g). Hq was only correlated with chocolate intake (r=-0.2957; p-value<0.05). However, chocolate intake did not show differences due to sex in the population monitored. Similar results were observed for the intake of fish/seafood (the major source of Hg in the diet), i.e. intake did not show significance due to sex (p-value=0.826) or ethnic background (p-value=0.589). However, the intake of fish was much higher in male participants (72.656 vs. 53.907 g/day), which could explain the sex differences found in total-Hg in hair.

CONCLUSIONS:Although the levels of Hg found in hair would highlight a generally lower exposure to Hg in the population studied when comparing with other studies on populations that traditionally eat more fish/seafood, some individuals presented higher concentrations of total-Hg than the USEPA recommended reference level (1 μ g/g), individuals that should be followed up with dietary recommendations.

Keywords: Exposures, Food/nutrition, Exposure Assessment, Mercury

Environmental exposure of children to erbium in Alcalá de Henares (Spain)

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BACKGROUND AND AIM: High-technology rare earth elements (REEs) are contaminants of emerging concern. To determine the environmental presence and exposure to Er, a minimally studied REE in topsoils, in children born and residing in Alcalá de Henares (Spain)

METHOD:Scalp-hair was collected from 120 children (6 to 9-years-old; 70 girls). Erbium (Er) was analysed by ICP-MS after appropriate removal of exogenous contamination using Triton X-100/bath sonication. Er was also monitored in 70/167 topsoil samples randomly sampled from different urban parks across Alcalá.

RESULTS:The limits of detection of Er in hair and topsoils were (in $\mu g/g$): 0.00025; 0.0005). Data was processed using 'NADA' statistical package, due to the censored data found in hair (32.5%). Levels of Er in scalp hair was slightly higher in male participants (95th percentile and range, in $\mu g/g$): 0.00143 (0.00026-0.00157) vs. 0.00103 (0.00026-0.00117). In contrast, Er was detected in all topsoil samples monitored (median and range, in mg/kg): Er 0.93 (0.1287-1.3833), which would suggest little anthropic input as they were within the background value range reported for soils in Spain (FOREGS; 0.3-13 mg/kg). Moreover, levels of Er in hair showed statistical significance according to zones of residency (p-value=1.04E-10); the mean concentration of Er was higher in children's hair living in areas with a higher density of green areas than in those with higher number of buildings and industrial activities, respectively (0.00073 vs. 0.00038 and 0.00043 $\mu g/g$)

CONCLUSIONS:Our results suggest that monitored child population in Alcalá de Henares have not been significantly exposed to Er, as the concentration was much lower than that reported in exposed children (0.0281 μ g/g, 0-3 years-old) and adolescents hair (0.0159 μ g/g; 11-15 years-old) living in mining areas in China. However, further efforts should be carried out to determine the (eco)toxicological values of Er, to be able to characterise the risks to human health due to this element.

Keywords: Exposure assessment, Children's environmental health, Erbium

EP-017[Exposures » Other (to be specified with keywords in the keywords section)]

Temporal variation and carcinogenic risks to arsenic in Alcalá de Henares (Spain)

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BACKGROUND AND AIM: The aim was to assess a sixteen years temporal variation period on the presence and distribution of total arsenic (As) in urban/industrial topsoils collected across Alcalá de Henares (Madrid Region, Spain), and to estimate their carcinogenic risks.

METHOD:Ninety topsoil (66 urban/24 industrial) samples collected in July 2017 were appropriately processed/digested in a microwave system. As was analysed by ICP-MS; data was compared with topsoils collected in the same locations in 2001 (97/22).

RESULTS: As was detected in all topsoil samples collected in both monitoring studies (LoDs=0.01 and 0.07 mg/kg, respectively). A significant increase of total-As was observed for both main areas (data presented as mean averages, in mg/kg), respectively: 5.69 vs. 4.83 (17.8%) and 7.66 vs. 6.63 (15.53%). The observed increases would be logical, as arsenic and its compounds are considered immobile in soils, so their presence would increase over time by different anthropogenic sources that are relevant in Alcalá, including the production of glass and ceramics, and the use of semiconductor materials, whose production of which has increased due to the urbanisation/industrial growth that Alcalá has experienced recently. Moreover, traffic volume would also have had a summative effect. Significantly higher levels of As were detected in samples collected within urban (9.603 vs. 4.345, 4.561, 4.089 mg/kg; p-value=0.0006) and industrial (8.386 vs. 6.447 mg/kg; p-value=0.0133) areas. A similar trend was found in 2001 although without significance, which could support the relevance of the industrial activities in Alcalá in the presence/distribution of this metalloid. CONCLUSIONS: Carcinogenic risks for the population of Alcalá from the ingestion/inhalation of As in soils and resuspended soils seem to be small (5.71E-06, 1.41E-08). However, the total content in Alcalá's urban soils was much higher than the established soil screening level (0.68 mg/kg) by the US EPA for cancer risk following lifetime exposure to As in residential topsoils.

Keywords: Exposure assesment, metalloid, soil

Investigating the variation of boron in scalp-hair from three different population groups in Alcalá de Henares (Spain)

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BACKGROUND AND AIM: To study the content of boron (B) in scalp hair from school children born/living in Alcalá de Henares (Madrid Region), as B-hair analysis has been suggested as a useful exposure tool.

METHOD:Samples were collected from 120 children (70 girls, 6-9 years-old) and 97 adolescents (68 girls, 13-16 years-old) which met strict inclusion criteria to minimise factors that may affect elemental content in hair. B was monitored by ICP-MS after appropriate removal of exogenous contamination. Data was processed with the NADA package available in R due to high levels of censored data (89.2%, LoD=2.679; 94.8%, LoD=3.341 in μ g/g, respectively).

RESULTS:Although not significant, levels of B were higher in children and female participants; data provided as ranges and 95-percentiles in $\mu g/g$, for children [overall 4.859 (2.732-7.415), males 4.061 (2.732-7.373), females 4.734 (3.348-7.415)] and adolescents [overall 3.362 (3.447-4.505), males 3.469 (P97.5 value) (<3.341-3.766), females 3.410 (3.447-4.505)]. Our results are in agreement with a previous study carried out in young adults living in the Madrid Region (20-24 years-old; range=1.33-4.86 $\mu g/g$), in which higher levels of B found in females was attributed to differences in the intake of vegetables, pulses and fruit. However, other authors have described that men would be more tolerable to the levels of B. Moreover, it has been reported that B is ten times higher in infants than in their mothers, which might explain the slightly higher levels of this element in children. CONCLUSIONS:Despite the ranges of B in both Alcalá's schoolchildren groups being within the adequate reference ranges reported in Croatian (0.771-6.510 men, 0.472–3.89 women) and Polish (<LoD-14.37) adults (all in $\mu g/g$), the high levels of censored data might highlight an inadequate intake of B in the diet that should be investigated, as B may play an important role in obesity and bone metabolism.

Keywords: human hair, boron, exposure, schoolchildren

Applicability of wild mushrooms to monitor environmental contamination of europium in Leicester, England

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BACKGROUND AND AIM: Although the current levels of europium (Eu) in topsoils monitored across Leicestershire (UK) did not represent an oral/dermal toxic risk for the population, wild mushrooms were collected in the same areas to gain a better picture of its environmental distribution and risks. METHOD: 106 mushrooms were collected from Leicester city and Bradgate Park, and species were identified by DNA barcoding. Eu was monitored by ICP-MS in cleaned/dried/homogenised mushrooms $[LoD=0.00056 \mu q/q dry weight (dw)]$ and in 850 topsoils collected in these areas. RESULTS: Eu concentrations were higher in mushrooms collected in urban areas, although without significance (median and ranges, in µg/g dw): 0.0016 (0.0004-0.2891) vs. 0.0013 (0.00036-0.0529), which might be attributed to fertilisers. However, levels of Eu varied between mushrooms collected across the four cardinal subareas in which the city was divided (p-value=7E-9), which might indicate differences in urbanisation, as Eu is used in flat screen displays and optical fibres. Although a correlation between the content of Eu in mushrooms and their respective topsoil/subareas was not found, a similar distribution was found. Thus, significantly higher median concentrations of Eu were found in the NE (0.0047, 0.8110) and lower in the NW (0.00087, 0.5960), in mushrooms and topsoils (all in $\mu g/g$ dw and $\mu g/g$, respectively). Moreover, Eu significantly varied between the three main mushroom species collected (ranges, in µg/g dw; p-value=7E-15): Agaricus bitorquis (edible; 0.00079-0.00706), Panaeolus foenisecii (poisonous; 0.00104-0.17146) and Mycena citrinomarginata (unclassified; 0.00123-0.07117). Moreover, Eu was only detected in 54.5% of the A. bitorquis samples, although detected in all the other main species collected.

CONCLUSIONS: The levels of Eu found were similar/lower than those reported in other major monitoring studies performed in other European countries, suggesting that the environmental presence of Eu would represent a minimal risk for Leicestershire's population, including those individuals that pick up wild mushrooms for consumption.

Keywords: Europium, mushrooms, Leicester, topsoils, risks.

Utility of wild soil mushrooms to monitor cerium and characterise oral risks

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BACKGROUND AND AIM: A study of cerium (Ce) in urban/rural topsoils from Leicestershire (England) showed minimal risk through inhalation for the population. Wild mushrooms were collected to identify oral risks for Ce.

METHOD:106 mushrooms were collected from Leicester city and Bradgate Park. Species identification was confirmed by DNA barcoding. Ce was monitored by ICP-MS in cleaned/dried/homogenised mushrooms mineralised with HNO3/H2O2 [LoD=0.795 ng/g dry weight (dw)] and in 850 topsoils collected in these areas. Organic matter content, pH, electric conductivity (EC) and soil textures were determined in topsoils using standard methods.

RESULTS:Higher levels of Ce were found in mushrooms collected in urban areas (median and ranges, in μ g/g dw): 0.352 (0.019-16.260) vs. 0.198 (0.196-5.084). Moreover, lower levels were detected in mushrooms sampled in NW urban areas [0.225 (0.185-7.094)], meanwhile higher levels were found in samples collected in the SW [1.930 (1.293-7.457)]. Although a similar pattern was found in the urban topsoils, i.e. lower levels of Ce in the NW (p=0.037; NE>SW>SE>NW), no correlation was shown with the mushroom content. The differences observed in mushrooms could be attributed to different factors, including the use of fertilisers, as Ce in mushrooms showed significantly negative correlation with topsoil EC (-0.2630; significance level of 10%, p-value=0.0980). EC content (in dS/m) was significantly higher in rural areas (0.4615 vs. 0.3404; p-value=0.0086) and higher in NW vs. NE (0.396 vs. 0.304; p-value=0.0741) urban topsoils. Ce also significantly varied between major mushroom species collected (ranges, in μ g/g): Agaricus bitorquis (edible; 0.185-0.297), Panaeolus foenisecii (poisonous; 0.481-16.260) and Mycena citrinomarginata (unclassified; 0.557-12.256), and were within the values reported in large monitoring studies.

CONCLUSIONS:Our results would be in line with those studies that have reported that wild mushrooms show a weak predilection to bioconcentrate Ce. The presence of Ce in wild mushrooms would not represent a risk for the Leicester's population.

Keywords: Cerium, mushrooms, Leicester, topsoils, risks.

Environmental exposure to scandium and yttrium in Leicestershire (UK)

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BACKGROUND AND AIM: The aim was to determine the presence/distribution/risks to yttrium (Y) and scandium (Sc), usually included as rare earth elements (REEs), present in topsoils from Leicestershire (UK).

METHOD:850 topsoil samples were collected (2017-18); elements were measured by ICP-MS. Areas were further subdivided into the four ordinal directions to study distribution. Noncarcinogenic risks were characterised for Y.

RESULTS:Sc [7.762 (4.067-12.217) vs. 5.942 (3.315-9.830)] and Y [11.586 (5.795-16.041) vs. 10.620 (7.532-16.338)] showed higher median concentrations in the topsoils collected in the rural areas (median and ranges, all in mg/kg), although only Sc showed significance (p-value=0.0148). The application of fungicides and fertilisers might explain partially our results, as Sc and Y tend to occur in the same ore deposits as REEs which are associated with manufacture/use of fertilisers. Moreover, natural factors, might explain the distribution found. Thus, clay content, which can retain/absorb REEs, was significantly higher in rural topsoils (28 vs. 22.23 %). Similar distributions were found in urban subareas; significant higher medians (p-value=0.017) of both elements in the NE (6.516, 11.748 mg/kg) and lower in the NW (5.125, 8.855 mg/kg). However, only Y showed statistical significance for the rural subareas (p-value=0.006), being much lower in topsoils sampled in the NW (6.309 mg/kg). Clay content was also significantly lower/lower in topsoils sampled in the NE, for urban and rural subareas, respectively.

CONCLUSIONS: The mean concentrations of Sc (6.089 vs. 8.3 mg/kg) and Y (10.931 vs. 21.1 mg/kg) in Leicestershire's topsoils were lower than those reported in urban soils in London, and lower than those described as background for Sc in the UK (9.4 mg/kg), suggesting a lower contamination in Leicestershire. The risks to Y would be minimal as noncarcinogenic risks quotients for ingestion (4.98E-03, 5.43E-03) and dermal contact (1.77E-04, 1.93E-04) in urban/rural areas, were lower than the threshold, respectively.

Keywords: Scandium, yttrium, Leicester, topsoils, distribution

Environmental monitoring and risk assessments for gadolinium in topsoils from Alcalá de Henares (Spain)

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BACKGROUND AND AIM: The global demand for gadolinium (Gd) is increasing rapidly due to its technological uses. To study its presence, distribution and potential risks in Alcalá de Henares's topsoils (Spain).

METHOD:Ninety-four topsoil samples were collected in July 2017 from: urban (66), industrial (24) and public gardens (4). Gd was analysed by ICP-MS after acid digestion with nitric acid (69%) and chlorhydric acid (37%). Noncarcinogenic risks were characterised following US EPA methodologies. RESULTS:Gd was detected (LoD=0.0007 mg/kg) in all samples collected in the three areas monitored, which respectively were (median and interquartile limits; mg/kg): 2.902 (1.908, 3.366), 3.999 (3.469, 4.705), and 3.616 (3.490, 3.694). Significant (p-value=3.84E-06) higher mean concentrations of Gd were found in the industrial and garden topsoils, which would be logical due to its technological/industrial applications and its presence in fertilisers. Similarly, slightly higher mean concentrations were found in the urban (3.163, 2.823, 2.568, 2.220 mg/kg; NS) and industrial (4.365 vs. 3.505 mg/kg; p-value=0.0396) areas. Our results suggest minimal anthropic input of Gd in soils in Alcalá, as the levels were lower than the background values reported for Spanish soils [FOREGS, mean and reference range (in mg/kg); 2.694 (0.348-4.951) vs. 5.4 (0.9-24)], and slightly lower than the median reported for European topsoils (3.85 mg/kg). Thus, the median level of Gd was lower than that reported for urban topsoils from Beijing (4.46 mg/kg), suggesting some anthropic input in the topsoils monitored in the industrial area.

CONCLUSIONS:Noncarcinogenic risks quotients for inhalation of Gd in resuspended soils (8.35E-04, 1.15E-03) were lower than the threshold for urban and rural areas, respectively, representing a minor risk for human health. Moreover, understanding the fate processes Gd undergoes in the environment is critical to identify interventions/techniques for the decontamination of Gd, environmental presence of which will increase owing to its myriad of technological applications.

Keywords: Gadolinium, topsoils, presence, distribution, risks.

Food intake in a sample of young university students living in Leicester, England

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BACKGROUND AND AIM: To assess the food intake in a young population of students at De Montfort University (DMU, UK).

METHOD: Comprehensive nutrient intake was collected from $111 (20.45 \pm 1.16 \text{ yrs-old}; 78 \text{ female})$ DMU students from three major ethnic backgrounds (41 Asia, 41 Africa, 27 Europe), using a validated variant of the Nutrition Norfolk Food Frequency Questionnaire. Questionnaires were processed with Nutritics dietary software. BMI values were calculated with the formula $BMI = kg/m^2$. Body total and visceral fat, water, muscle and bone mass were directly obtained by a Tanita scale. RESULTS: The total intake of protein, fat and carbohydrates was significantly higher in male counterparts, which can explain the significant intake of energy (3064.9 vs. 2310.8 kcal/day; pvalue=0.0011) in men. According to their BMI values, 25.7% and 8.3% of this population were overweight and obese, meanwhile 9.2% were underweight. Female participants support the highest percentages of individuals overweight and obese; greater incidence of overweight was shown in students from African and European background (29.3 and 33.3%), meanwhile the highest percentage of obesity was seen in European students (14.8). The highest percentages of students with normal weight (63.4) and underweight (17.1) were observed in participants from African and Asian backgrounds, respectively. Percentages of muscle and bone mass presented statistical differences due to ethnic background, being higher in students from European background (49.9 and 2.6 vs. 45.3 and 2.41, 45 and 2.39, in African and Asian students, respectively).

CONCLUSIONS: The significant differences in the total fat, cereals, vegetables, pulses, and crisps and snacks intakes might explain that at least one-third of European and African students were overweight, meanwhile almost a quarter of European and Asian were obese, which places them at increased health risk, highlighting the need of public health interventions that promote healthy diets in these groups of the population.

Keywords: Food intake, diet, university students, overweight, Leicester.

Exposure to praseodymium in young university students from Leicester, England

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BACKGROUND AND AIM:Rare earth elements (REEs) have arisen as a public health concern due to their numerous applications in modern societies. To assess dietary exposure to praseodymium (Pr) in young adults (18-23 yrs-old) at De Montfort University (DMU, Leicester, England).

METHOD: Comprehensive nutrient intake data was collected from 111 (20.45 \pm 1.16 yrs-old; 78 female) DMU students using a validated variant of the European Prospective Investigation into Cancer and Nutrition Norfolk Food Frequency Questionnaire (EPIC-Norfolk FFQ). Pr was analysed in scalp-hair provided by 73 of these participants (58 female) by ICP-MS after appropriate removal of exogenous contamination. Data was processed with the statistical package 'NADA' in R due to high presence of censored results (62%; LoD=0.0007 µg/g).

RESULTS:Pr was detected in hair from only one male participant [P95=0.0009, in µg/g], but detected in 27 female participants (median and IQR, in µg/g): [0.00068 (0.000246, 0.00185)]. Although controversial, different authors have suggested that REEs would affect females more seriously than men, and young females would be more sensitive to small quantities of these elements, which could explain our results. Pr was positively correlated with alcohol intake (r=0.251; p-value<0.05) and negatively with crisps and snacks intake (r=-0.2381; p-value<0.05; which includes different food products, e.g. crisps, ice-cream, cereal bars). The differences in the intake of these two categories might explain the sex differences found for Pr in hair in the population monitored. Thus, the intake of alcohol (2.282 vs. 1.790 g/day) and crisps/snacks (47.922 vs. 74.152 g/day) was higher and lower in female participants, respectively.

CONCLUSIONS: Generally, the presence of Pr in participants' hair was lower than than reported in environmentally exposed groups, and slightly lower to the reported in healthy, unexposed Chinese women (IQR 0.0025-0.0042 μ g/g), suggesting that DMU students would have shown a low exposure to Pr.

Keywords: Pr, human hair, dietary intake, university students.

Potential presence and distribution of humanrelated microsporidia in different soil types from Makeni, Sierra Leone

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BACKGROUND AND AIM:Spores of *Encephalitozoon* spp., an emerging genus of microsporidia affecting humans, were detected for the first time by our group in farm/wild animals from different recreational areas/farms across Bombali District (Sierra Leone). To study their presence in different soil types collected across Makeni (Sierra Leone) to gain better understanding of their presence and risks. METHOD:A soil sample was collected from the surface (topsoils; first 3-5 cm) and subsoil (10-20 cm) from 28 different points in Summer 2022, including: a small farm (10) and a poultry farm (3), a municipal slaughterhouse (2) and different areas that households share with their farm animals, mostly chickens and ducks (13). Following appropriate preconcentration methods, soil samples were screened for the presence of *Encephalitozoon* spores by immunofluorescent-antibody test using a specific monoclonal antibody (Mab) of murine origin IgG2a, patented as a diagnostic tool for miscrosporidiasis caused by the genus *Encephalitozoon*.

RESULTS:Structures compatible with *Encephalitozoon* were found in 6 of the 28 soil samples examined (21.42%), four of them corresponding to the subsoil samples, suggesting a potential mobility of spores within soil. Positive samples were collected in pig breeding areas (in topsoil and subsoil), one in subsoil collected in the poultry farm and three soil samples (1 surface, 2 subsoil) collected in areas shared by families and their farm animals.

CONCLUSIONS: Previous studies conducted in 2019 by our research team revealed a presence of microsporidia higher than 40% in animal faecal samples collected in the same locations, mainly of the genus *Encephalitozoon*, mostly of the species *E. cuniculi*. Owing to their zoonotic nature, animals could play a significant role in the contamination of the soils. Although our results should be considered as preliminary, spores could remain in these soils due to their resistance, representing a risk for the local population.

Keywords: Microsporidia, Encephalitozoon, soil samples, Makeni, Sierra Leone.

Presence of platinum, palladium and rhodium in children living in Alcalá de Henares (Spain) and the environment

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BACKGROUND AND AIM: The use of automobile catalytic converters has led to concerning concentrations of platinum (Pt), palladium (Pd) and rhodium (Rh), in urban environments. A human and environmental monitoring programme was performed to determine the environmental presence and exposure to these pollutants in Alcalá de Henares (Spain).

METHOD:Scalp-hair was collected from 120 children (6 to 9-years-old; 70 girls) born and residing in Alcalá. Elements were monitored in scalp hair by ICP-MS; limits of detection (LoD) were 0.0051, 0.0007 and 0.0018 μ g/g, respectively. Additionally, Pt and Rh were monitored in 97 topsoil samples randomly sampled from different urban parks across the city after appropriate mineral digestion; LoDs were 0.38 and 0.22 mg/kg, respectively. Data was processed in the 'NADA' statistical package. RESULTS:Pd and Rh were detected in only a few of the scalp samples collected, specifically in 9.24% and 5%, respectively, which might be attributed to the higher mobility and biological uptake rates of Pd and Rh compared with Pt. Concentrations in μ g/g were as follows (values provided as 95 percentiles and ranges), being slightly higher in boys' hair: Pd [(0.0010, 0.00091-0.00112) vs. (0.00076, 0.00072-0.00137)] and Rh [(0.0024, 0.00187-0.00372) vs. (<0.0018, 0.00227-0.00984)]. In contrast to hair, Pt was detected (median and IQR, in mg/kg) in 41.24% [0.27 (0.26-0.81)] and Rh in 15.46% [0.15 (0.15-0.16)] of the topsoil samples monitored, which may suggest that the Alcalá child population monitored has not been significantly exposed to Pd, Pt and Rh, as hair has been suggested as an appropriate tool to measure their exposure.

CONCLUSIONS: In general, the presence of Pt and Rh Alcalá's soils would not represent a significant risk for the population. Human hair would be a safe and non-invasive tool to follow-up exposure to metals related with automobile catalytic converters in urban environments and identify future risks from these contaminants.

Keywords: Platinum group elements, human hair, monitoring, Spanish children, soils.

Dietary exposure to arsenic in young (18-23 yrsold) university students in Leicester, England

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BACKGROUND AND AIM: To evaluate dietary exposure to arsenic (As) in young adults (18-22 yearsold) attending De Montfort University (DMU, UK).

METHOD:Nutrient intake was collected from 111 (78 female) DMU students using a validated variant of the Nutrition Norfolk Food Frequency Questionnaire (EPIC-Norfolk FFQ). As was analysed in scalphair provided by 73 of the participants (58 female) by ICP-MS, after removal of exogenous contamination. Owing to the percentage of censored data (61.6%; LoD=0.0196 μ g/g), data was processed with the NADA software available in R.

RESULTS:Levels of As were significantly higher in male participants (p < 0.05; data presented as median and IQR, in µg/g): [0.0238 (<0.0196-0.1495) vs. 0.0084 (0.0025-0.0277)]. The concentrations of As were higher and lower than the mean averages reported in Spanish unexposed individuals aged 20-24 years-old for men (<0.001 µg/g) and women (0.011 µg/g), respectively; and lower than the geometric mean reported in individuals aged 18-39 years-old (0.0676 vs. 0.0899 µg/g) from Cornwall (south-west England), who were studied following reports of levels of As exceeding the 10 µg/L prescribed concentration in private water supplies. The sex differences on the concentration of As in hair could be explained by the intake of fish/seafood (72.656 vs. 53.907 g/day; non-significant) and cereals (436.165 vs. 308.750 g/day; p-value=0.0016), which were much higher in male participants. A positive and significant correlation was also found between hair As and cereals intake (r=0.252; p-value<0.05), and could explain our results as fish/seafood and rice (cereals) are foods with the highest content in As.

CONCLUSIONS: Although the levels of As found in hair would suggest a generally low exposure to As in the population studied, some individuals should be followed up for monitoring and dietary recommendations, as some individuals presented levels of As (0.0199-0.610 μ g/g) higher than the range suggested for chronic exposure to As (0.1-0.5 μ g/g).

Keywords: As, human hair, dietary exposure, university students.

Trans fatty acids intake in a sample of young university students from Leicester, England

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BACKGROUND AND AIM: To assess intake of trans fatty acids (TFA) in a young population of students at De Montfort University (DMU, UK), after voluntary food product reformulation in 2011. METHOD: Comprehensive nutrient intake was collected from $111 (20.45 \pm 1.16 \text{ yrs-old}; 78 \text{ female})$ DMU students between 2015-16 from three major ethnic backgrounds (41 Asia, 41 Africa, 27 Europe), using a validated variant of the Nutrition Norfolk Food Frequency Questionnaire. Questionnaires were processed with Nutritics dietary software. BMI values were calculated with the formula BMI = kg/m2. RESULTS: According to their BMI values, 25.7% and 8.3% of this population were overweight and obese, meanwhile 9.2% were underweight. Overweight is three times that of the national average in this age group, 10.6%. The dietary intake of total fat (100.55 vs. 81.72 all in g/day; p-value=0.032) and saturated (SFA; 34.73 vs. 29.84; NS), monounsaturated (MUFA; 37.54 vs. 30.42; pvalue=0.042), polyunsaturated fatty acids (PUFA; 14.61 vs. 12.91; NS) and TFA (1.58 vs 1.27; pvalue=0.017) was higher in male counterparts, which can explain the significantly higher intake of energy (3064.9 vs. 2310.8 kcal/day; p-value=0.0011) in men. The intake of total-fat (pvalue=0.0007), MUFA (p-value=0.0224) and PUFA (p-value=0.0012) were significantly higher in students from Asia and Europe. However, although without significance, the higher intakes of TFA were seen in Asian [values as mean and range (in g/day); 1.435 (0.290-5.047)] and African [1.370 (0.416-3.906)] students versus European [1.232 (0.305-2.815)]. CONCLUSIONS: The dietary intake of total-fat, SFA, MUFA, PUFA and TFA were slightly higher than

those reported in general English population (19-64 years-old). Moreover, some DMU students shown to have diets with intake of TFA above the WHO TFA limit (2.2 g/day for a 2000-calorie diet), which could place them at increased health risk, highlighting the need of public health interventions that promote healthy diets in these population groups.

Keywords: FTA intake, fat, university students, overweight, Leicester.

Dietary and environmental exposure to gadolinium in young adults from Leicester, England

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BACKGROUND AND AIM: To assess environmental and dietary exposure to gadolinium (Gd) in young adults at De Montfort University (DMU, Leicester, England).

METHOD: Nutrient intake was collected from 111 (18-23 years-old; 78 female) DMU students using a validated food frequency questionnaire. Gd was analysed in scalp-hair provided by 73 of these participants (58 female) by ICP-MS after appropriate removal of exogenous contamination. 450 topsoil samples were collected per urban park across Leicester city and prepared as composite samples to measure Gd (LoD= $0.0017 \mu g/g$) to estimate environmental exposure. Data was processed with 'NADA' in R, due to a high presence of censored results in hair (60.3%; LoD=0.0006 $\mu q/q$). RESULTS: Higher levels of Gd were detected in hair from female participants although without significance, possibly due to the low number of samples from male participants in which Gd was detected (n=4 vs. 25); data is provided as median and IQR (in $\mu g/g$): 0.00051 (0.00021, 0.00123) vs. 0.00033 (0.00017, 0.00065). It has been reported that young females would be more sensitive to even small quantities of rare earths, which could explain our results. Thus, the levels of Gd found in the urban topsoils (median= $3.094 \mu q/q$) were lower than the reported in topsoils from Beijing urban parks (4.48 μ g/g) and the Upper Continental Crust (6.1 μ g/g), suggesting that Leicester would be less contaminated than other more industrialised cities. Gd was positively correlated with alcohol (r=0.339; p-value<0.01) and tea consumption (r=0.295; p-value<0.01). Although non-significantly different, the higher intake of alcohol (2.28 vs. 1.79 g/day) and tea (161.29 vs. 106.97 g/day) in female counterparts might explain the sex differences found for Gd in hair. CONCLUSIONS: The presence of Gd in the hair samples monitored was much lower than those

reported in environmentally exposed groups living in smelting/mining areas, suggesting that DMU students would have had a low exposure to Gd.

Keywords: Gd, human hair, dietary intake, environmental exposure, university students.

First detection of emerging human parasites microsporidia in grass from recreational and urban parks from, Leicester, UK

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BACKGROUND AND AIM: Encephalitozoon spp. (E. intestinalis, E. hellem and E. cuniculi), emerging microsporidian species affecting humans, were detected in water/topsoil from Leicestershire (UK). To determine their potential presence and circulation in the grass from different parks and recreational areas frequently visited across Leicestershire.

METHOD:190 grass samples were collected over a year (June 2017 to August 2018) to study temporal variation, in and around Leicester. After appropriate pre-treatment to resuspend any microsporidian spore present in the grass and avoiding soil contamination, DNA was extracted from each pre-concentrated sample using the using Fast-Prep for Soil® kit. SYBR Green real-time polymerase chain reaction technique was used for specific detection of Encephalitozoon spp., using established methodologies.

RESULTS:Spores of Encephalitozoon spp. were detected in 11 (11.57%) grass samples, specifically E. intestinalis in six samples collected from urban and rural parks (2 in Bradgate, and one in Humberstone, Victoria, New Walk and Abbey) and E. hellem in five samples across both main areas (Bradgate, Evington, Willowbrook, Humberstone and Victoria). E. cuniculi was not detected in any of the grass samples. Our results would indicate a low-moderate distribution of these parasites. Moreover, Encephalitozoon spp. was also detected across the different seasons, with the highest presence in Summer 2017 and 2018 (n=4/each season) followed by Winter 17/18 (n=2) and one in Autumn 2017, suggesting some circulation in the environment.

CONCLUSIONS: To our knowledge, this is the first report reporting the presence of Encephalitozoon spp. in grass across Leicestershire; citizens could be exposed to these pathogens when playing sports in these areas, or by contact of cornea with the grass. The zoonotic role of Encephalitozoon spp. and the environmental resistance of their spores in soil, might facilitate their spread within grass. Further genotyping studies are required to tailor appropriate public health interventions to minimise their infections.

Keywords: microsporidia, urban parks, zoonotic role
Assessing the exposure to uranium and thorium in healthy Spanish teenagers

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BACKGROUND AND AIM: To assess the exposure to uranium-238 (U) and thorium-232 (Th) in healthy teenagers living in Alcalá de Henares (Spain).

METHOD:Scalp hair was collected from 97 adolescents (13-16 years-old; 68 girls) from Alcalá. U and Th were monitored by ICP-MS after appropriate removal of exogenous contamination with Triton X-100/sonication. Data was processed using 'NADA' statistical package.

RESULTS:The limits of detection in hair were (in $\mu g/g$): U (0.0018) and Th (0.0011). Levels of censored data were 5.4% and 35.5%, respectively. Concentrations of U and Th were significantly higher (p-value=0.0017) and higher in female counterparts, respectively as follows (data provided as median and IQR, in $\mu g/g$): [0.0194 (0.0059, 0.0296) vs. 0.0055 (0.0030, 0.0135)] and [0.0015 (<0.0011, 0.0023) vs. 0.0014 (<0.0011, 0.0029)]. Levels of both radionuclides were slightly higher than those reported by our group in Alcalá's children (6-9-years-old; median for U was 0.011, meanwhile Th was detected only in 4.2% of children), which would be in line with scientific evidence suggesting that elemental content in hair increases with age. However, the concentrations of both radionuclides in teenagers' hair were much lower than those reported in exposed children aged 7-15 years-old (0.1495 $\mu g/g$) that live close to an industrial-scale gold mine in Soweto, South Africa, suggesting minimal environmental exposure. Moreover, Th showed statistical significance according to zones of residency (p-value=0.0028), being higher in teenagers' hair living in areas that support more industrial activities [0.00298 vs 0.0022 (which support high levels of traffic), 0.00171 and 0.00159 $\mu g/g$].

CONCLUSIONS: Teenagers living in Alcalá have minimal exposure to both radionuclides, not representing a risk for the population. Further studies should try to identify potential environmental/dietary sources of these radionuclides in the population living in Alcalá de Henares, especially Th, as this showed some increase with age in the population groups monitored.

Keywords: Radionuclides, uranium, human hair, monitoring, Spanish teenagers

A strategy using the fission yeast *Schizosaccharomyces pombe* to investigate the toxic effects of environmental chemicals

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BACKGROUND AND AIM: The aim of this study was the development of a systematic strategy to investigate the main effects of environmental chemicals using the fission yeast Schizosaccharomyces pombe

METHOD: The changes in the growth in liquid medium of different S. pombe mutant strains have been compared after 16, 18 and 20 hours of exposure. Four chemical compounds with perfectly known different mechanisms of action were applied: 1) carbendazim, that causes interference in microtubules, 2) hydrogen peroxide, that causes oxidative stress, 3) potassium chloride, that causes osmotic stress and 4) hydroxyurea, that induces DNA damage. Finally, triclosan, an antibacterial and antifungal agent present in some consumer products, including toothpaste, soaps, detergents, toys, and surgical cleaning treatments was evaluated.

RESULTS: Microtubule disruption by carbendazim was detected thanks to the sensitivity of the mph1 Δ strain. Oxidative stress induced by hydrogen peroxide compromised particularly the growth in sty1 Δ , sty1 Δ pmk1 Δ and pap1 Δ strains. DNA damage induced by hydroxyurea was correlated to the sensibility of the rad3 Δ strain. The global detoxification and multidrug resistance were investigated using Pmd1, Bfr1, Mfs1 and Caf5 Schizosaccharomyces pombe deficient strains. Furthermore, the antibacterial and antifungal agent triclosan was evaluated using the alternative strategy, demonstrating that its main mechanism of action on yeast was oxidative stress.

CONCLUSIONS: The application of a systematic strategy using several deficient strains of the fission yeast Schizosaccharomyces pombe was useful for the investigation of the main toxic effects of pollutants.

Keywords: Environmental chemicals, yeast, triclosan, toxicity

Associations between long-term exposure to air pollution, noise, and body composition in the Austrian LEAD cohort

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BACKGROUND AND AIM: Air pollution and noise exposure has been linked to an increased risk of various cardiometabolic diseases. However, evidence is limited regarding their potential effects on body composition. This study aimed to investigate the associations between traffic-related air pollution, chronic noise, and body composition.

METHOD: We used repeated measures from the LEAD (Lung, hEart, sociAl, boDy) cohort study conducted in Vienna, Austria. Body mass index (BMI; kg/m²), fat mass index (FMI; z-score) and lean mass index (LMI; z-score) were measured using dual-energy x-ray absorptiometry (DXA) at the baseline (t0; 2011-ongoing) and follow-up (t1; 2017-ongoing) exams. The annual concentrations of particulate matter (PM10) and nitrogen dioxide (NO₂) were estimated using the GRAMM/GRAL dispersion air pollution model (2015-2021). Transportation noise was modeled for 2017 for mean weighted 24-hour (LDEN) and night-time (LNIGHT) noise according to the European Union Directive 2002/49/EC. The participants' exposures were assigned based on their residential addresses. Linear mixed-effects models with random participant intercepts and linear regression models stratified by age were used for cross-sectional and longitudinal analyses, respectively. Models were adjusted for lifestyle, demographics, and co-exposure.

RESULTS:A total of 19,202 observations (nt0=12,717, nt1=6,485) from participants aged 6-86 years (mean age at t0: 41.0 years; 52.9% female; mean PM10=21 μ g/m3) were analyzed. Among children, higher PM10 exposure was cross-sectionally associated with higher FMI z-scores (0.09 (95% CI: 0.03, 0.16)) and lower LMI z-scores (-0.05 (95% CI: -0.10, -0.002) per 1.8 μ g/m³). The cross-sectional associations observed among adults were similar, albeit not significant. No associations were observed for noise exposures. Longitudinal analyses, investigating changes in body composition over time, did not reveal conclusive associations.

CONCLUSIONS: Air pollution exposure was cross-sectionally associated with body composition in children However, estimates from longitudinal analyses, while mostly positive, were not conclusive. This study contributes to the evidence on the detrimental effects of air pollution on obesity.

Keywords: Air pollution, Obesity and metabolic disorders, Noise

Trajectories of non-asbestos air toxic exposure among mesothelioma patients: A latent class mixed modeling approach

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BACKGROUND AND AIM: To examine the heterogeneous trajectories of non-asbestos air toxic exposure among mesothelioma patients.

METHOD:Patients' residential histories were obtained by linking mesothelioma cases diagnosed during 2011-2015 from the New York State Cancer Registry to LexisNexis administrative data and inpatient claims data. Percentile ranking of lifetime cancer risk from inhalation of non-asbestos air toxics was based on the National Air Toxic Assessment. To compare data across years during patient's residential history, yearly excess risk was calculated by dividing exposures at individual census tracts by the state-level average and subtracting one. We used a latent class mixed model to identify distinct risk trajectories among patients with a 15-year residential history prior to cancer diagnosis (n=909). We further examined differences in trajectory groups by patient characteristics using bi-variate analysis and a multinomial logistic regression model.

RESULTS:The majority of the patients were non-Hispanic White (89.7%), male (75.5%), and with distant stage at diagnosis (64.8%). We identified 5 distinct trajectories of cancer risk: "Persistent low-risk" (24.8%), "Increased low-risk" (24.1%), "Increased high-risk" (22.2%), "Tempered low-risk" (16.2%), and "Persistent moderate-risk" (12.8%). Patient characteristics did not differ across trajectory groups, except for race and Hispanic ethnicity (p<0.0001). The proportion of non-Hispanic White patients was the highest in the "Persistent low-risk" (99.6%) while the lowest in the "Increased high-risk" (75.2%). Compared to their counterparts, non-Hispanic White patients had a significantly lower odds of being in trajectory groups other than the "Persistent low-risk" group (all adjusted OR<0.1, all upper 95% confidence intervals <0.7).

CONCLUSIONS: We quantified the heterogeneous experiences of cancer risks associated with ambient air toxics among a cohort of mesothelioma patients. In addition, we found patient's race and ethnicity differed across the identified trajectories, likely a reflection of disparities in patients' residential mobility prior to their cancer diagnoses.

Keywords: Long-term exposure, Exposure Assessment, Environmental epidemiology, Cancer and cancer precursors, Environmental disparities

Data-driven identification of epidemiological factors associated with youth type 2 diabetes and prediabetes

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BACKGROUND AND AIM: The prevalence of Type 2 diabetes (DM) and prediabetes (preDM) has been increasing among youth in recent decades in the United States, prompting an emerging need for understanding and identifying their associated risk factors. Such efforts, however, have been hindered by the lack of easily accessible high quality data. We aimed to build a platform to share high quality epidemiological data to address this significant gap and facilitate youth preDM/DM research. METHOD: Building on data from the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2018, we cleaned and harmonized variables relevant to preDM/DM (fasting plasma glucose level $\geq 100 \text{ mg/dL}$ and/or HbA1C $\geq 5.7\%$) for youth aged 12-19 years (n=15,149). We identified factors associated with preDM/DM risk using bivariate statistical analyses and our Ensemble Integration (EI) framework for multi-domain machine learning. We developed a Prediabates/diabetes in youth ONline Dashboard (POND) to share the data and codes.

RESULTS:We extracted 95 variables potentially relevant to preDM/DM risk organized into 4 domains (socioeconomic status, health status, diet, and other lifestyle behaviors). The bivariate analyses identified 27 significant correlates of preDM/DM, including race/ethnicity, health insurance, BMI, added sugar intake, and screen time. Many but not all of these factors were also identified based on the EI methodology. The EI approach also identified additional predictive variables, including some known (e.g., meat and fruit intake and family income) and less recognized factors (e.g., number of rooms in homes and times healthcare was received in the past year).

CONCLUSIONS:Leveraging the rich information in NHANES, we built one of the largest datasets for studying youth preDM/DM, and presented user cases of the data using complimentary statistical and machine learning methods. Our data-sharing platform, POND, facilitates a wide range of applications and development of youth preDM/DM studies.

Keywords: Food/nutrition, Exposures, Socio-economic factors, Environmental epidemiology

Occupational Factors and the Risk of Chronic Diseases among Technology Industry Workers in Hsinchu: A Retrospective Cohort Study

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BACKGROUND AND AIM: Workers in the technology industry in Hsinchu are generally exposed to high stress and long working hours, and the impact on health risks is not yet known. Therefore, this project aims to investigate the association between the risk of common chronic diseases and occupational factors.

METHOD:A cohort study design was used to follow up the working population who attended a health check program at National Taiwan University Hsin-chu Branch from 2016 to 2020. The main explanatory variable was occupation, which was divided into three major categories: engineers, technicians, and office workers (control groups). Confounding factors included age, sex, and industry. A generalized estimating equation (GEE) was used as a repeated measures model to investigate the effect of occupation on risks of chronic diseases.

RESULTS:A total of 953 engineers, 40 technicians, and 303 office workers were enrolled in the study. Common (prevalence \geq 5%) chronic diseases among the participants included hyperlipidemia, metabolic syndrome, nonalcoholic fatty liver disease (NAFLD), chronic hepatitis B, gallbladder polyps, peptic ulcers, and urolithiasis. The engineer group had a lower risk of metabolic syndrome (odds ratio 0.658 [0.468, 0.925]) but a higher risk of NAFLD (odds ratio 1.496 [1.130, 1.981]) and the yearly increasing risk of peptic ulcers (odds ratio 1.430 [1.318, 1.552]) was higher. The technician group had a higher yearly increasing risk of peptic ulcers (odds ratio 1.432 (1.255, 1.635)), and urolithiasis (odds ratio 1.390 [1.083, 1.783]), and the rate of kidney function decline (β -0.865 [-1.589, -0.141]) was more rapid.

CONCLUSIONS: The risks of common chronic diseases among workers in the technology industry in Hsinchu was significantly associated with occupation, and significant time-response relationships were found.

Keywords: Cardiovascular diseases, Occupational epidemiology, Outcomes Other

Thermoregulation in response to exercising at a moderate metabolic rate when wearing personal protective and emergency response equipment

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BACKGROUND AND AIM:Personal protective equipment (PPE) is the last line of defense against exposure to chemical hazards. However, the PPE ensemble applied in emergency rescue adds significant thermal burden to their users and risks heat stress when they are used. This study investigated the thermal stress imposed upon PPE users as a result of donning PPE used in emergency response (Level A/B Ensemble) and in non-emergency situations (Level C/D Ensemble). METHOD:Ten male and ten female participants wore PPE for 60 min and walked on simulated stairs at a moderate metabolic rate (130-200 W/m²) from 21st to 35th min in a climatic chamber preset at 25°C. The heart rate and core temperature were monitored to indicate core thermoregulation in experiment, and the skin capillary blood flow, skin moisture, transepidermal water loss, and skin temperature measured to observe heat exchange between the skin and the ambient environment. The thermoregulatory dynamics involved in dissipating excessive metabolic heat for maintaining thermal balance were described as change in observed thermo-physiological quantities.

RESULTS: The changes in core and skin-based thermo-physiological indicators were significantly greater when donning Level A and B Ensemble than when wearing Level C and D. The period required for the thermoregulatory indicators of PPE users to return to baseline lengthened as the heat stress from wearing PPE ensemble increased, with those for the heart rate after donning Level A and B Ensemble being more than 25 min.

CONCLUSIONS: Significant heat stress arose from donning PPE in emergency response missions and risked overrunning heat strain capacity of the users, even when the users were only engaged in exercise of moderate metabolic consumption. Periodical monitoring of thermo-physiology (e.g., heart rate and sweating rate) is recommended when using PPE to alert potential heat stress. This study was funded by Taiwan's National Science and Technology Council.

Keywords: exposure assessment, risk assessment, climate

Thermal burden from wearing personal protective equipment enhanced for healthcare personnel ("Bunny Suit") during COVID-19 pandemic

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BACKGROUND AND AIM:During COVID-19 pandemic, workers in medical facilities routinely used fullbody personal protective equipment (PPE) to safe-guard against potential infection. However, the heat exchange between the body and the ambient environment was reduced due to low permeability and insulation of PPE, resulting in buildup of excess metabolic heat inside PPE and risking heat stress. This study evaluated the generation of metabolic heat as manifested in thermoregulation due to wearing the PPE enhanced for healthcare personnel, the "Bunny Suit."

METHOD:A total of 16 participants (8 males and 8 females) wearing designated garments exercised in a climatic chamber preset at a temperature of 25°C, and they were observed for the time course of change in thermo-physiological quantities, including skin capillary blood flow (SCBF), skin moisture, and transepidermal water loss (TEWL). The maneuvers involved in the exercise, in the order of performance, were wearing designated garments and stair-walking for 15 min (an activity of moderate metabolic rate between 130 and 200 W/m²), removing garments (15 min), and sitting and resting (10 min). The studied PPEs included Bunny Suit (Level D protective suit, medical isolation gown, N95 mask, face shield, and gloves) and Level D Ensemble (Level D suit, powered air-purifying respirator, and gloves.)

RESULTS: When stair-walking, the SCBF of the participants wearing Bunny Suit was consistently greater than the levels determined when wearing Level D Ensemble. The difference in skin moisture between two garment groups during exercise was insignificant. However, the TEWL determined wearing Bunny Suit was significantly higher than those measured wearing Level D Ensemble, signaling a requirement of advanced heat dissipation when wearing the Bunny Suit.

CONCLUSIONS: When enhanced PPE are used to protect healthcare professionals, potential heat stress from PPE use and heat strain capacity of personnel must be evaluated and monitored to avoid thermal hazards.

Keywords: exposure assessment, risk assessment, COVID-19

Individual susceptibility to the acute impact of air pollution on resting heart rate among the elderly

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BACKGROUND AND AIM: Elevated resting heart rate is a significant predictor of cardiovascular disease and all-cause mortality. This study aims to investigate the impact of air pollution on resting heart rate and individual susceptibility among elderly individuals.

METHOD:Seventy elderly individuals (>65 years old) from Datong, Zhongshan, and Wanhua districts of Taipei City participated in the study. They completed questionnaires, blood tests, and body composition measurements in May-June 2020 and wore Garmin@ smartwatches throughout the study until early August 2020. Acute air pollution exposure was defined as the averaged lag-1-day concentration of air pollutants from Datong, Zhongshan, and Wanhua monitoring stations. Mixed-effect modeling was used to evaluate the effect of air pollution on resting heart rate, with an interaction term included to examine the modifying effect of individual factors.

RESULTS:Each interquartile range increase in PM2.5, PM10, NO2, CO, SO2, and non-methane hydrocarbons (NMHC) was linked to a corresponding increase of 0.20, 0.22, 0.27, 0.47, 0.19, and 0.53 beats per minute in resting heart rate, respectively. Further analysis using two-pollutant modeling and AIC/BIC criteria identified NMHC as the pollutant with the strongest association with resting heart rate. Individual factors, including genotypes of GSTP1 Ile105Val, GSTT1-null, and GSTM1-null, inadequate control status of diabetes with HbA1c more than 7.5%, loss of a loved one in the past year, higher blood neutrophil and monocyte percentage, and lower eosinophil percentage, were found to enhance the exposure-response relationship.

CONCLUSIONS: Acute air pollution exposures, especially NMHC, increase resting heart rate among the elderly. Individual genotype, physiological status, and exposure to external stressors may amplify the impact of air pollution on heart rate.

Keywords: air pollution, non-methane hydrocarbons, resting heart rate, wearable device, individual susceptibility

A mysterious rash outbreak over Pescadores Islands in Taiwan Strait: an airborne caterpillar contact dermatitis by ultrastructure mapping

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BACKGROUND AND AIM: A mysterious skin rash (papular lesions) outbreak broke out for unknown reasons in Taiwan's Pescadores Islands mid-autumn 2021, causing much anxiety in the population already nervous about the ongoing COVID-19 epidemic.

METHOD: We conducted a field survey for possible culprit agents. Skin samples were taken by rapidglue adhesives from the affected skin. Electron microscopy from the skin samples as well as caterpillar seta was performed. Additional neurotransmitter analysis by mass spectrometry were conducted on the skin samples.

RESULTS:A field survey found a large increase in caterpillars, Euproctis taiwana, in September 2021, the warmest September in recent years. Electron microscopy performed on superficial skin samples (3-6 cells thick) of affected and healthy skin (n=5 and 3, respectively) and caterpillar setae revealed ultrastructural similarities between setae spurs ($0.15-0.2\mu$ m) and tiny pits (0.2μ m) on affected skin as well as similar vegetative debris (0.75μ m) on both setae and affected skin. Mass spectrometry showed large increases in tyrosine, serine, and histamine, known mediators of arthropod insult.

CONCLUSIONS: The co-occurrence of Euproctis taiwana population growth, excessive warming, strong monsoon winds may lead to this unusual autumn outbreak late September. The lifting of COVID-19 related travel restriction against earlier that month probably exacerbated it.

Keywords: airborne caterpillar dermatitis, electron microscope, global warming

Urinary heavy metals and psychosocial behavior of preschool children: a mixed exposure analysis

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BACKGROUND AND AIM: The neurotoxic effects of certain heavy metals are well established, but only a few studies have investigated the joint effect of concurrent exposure to multiple ones. The study aims to evaluate the association between mixed exposure to neurotoxic metals and the psychosocial behavior of preschool children.

METHOD: Using a stratified sampling strategy, we recruited participants from 105 kindergartens in 41 townships of Taiwan and excluded those with blood lead levels \geq 3.5 µg/L. The first-morning void urines were collected and analyzed for cadmium, magnesium, arsenic, chromium, lead, and nickel concentrations using ICP-MS. We applied the parentally reported Strengths and Difficulties Questionnaire (SQD) and Swanson, Nolan, and Pelham IV (SNAP-IV) scales to evaluate the psychosocial behaviors. Multiple linear regressions were utilized to evaluate the associations between each heavy metal and the outcomes, while the mixed effect of concurrent exposure was estimated by using a Quantile g-computation approach.

RESULTS: A total of 977 preschool children were included in the study, and the mean (SD) age was 5.7 (0.7) years old. In single pollutant models, we observed adverse effects of urinary magnesium, nickel, arsenic, and lead on the specific subsets of SDQ. Furthermore, the combined effect of the six heavy metals significantly affected the hyperactivity/inattention symptoms (beta = 0.46, 95% CI:

0.13~0.78, with all metals increased by one quartile), and chromium and lead were the two major effect contributors. Similar detrimental effects of the urinary cadmium and lead were also observed in the SNAP-IV subsets, although the joint effect analysis was not significant.

CONCLUSIONS: The study provided evidence that concurrent exposure to multiple heavy metals may exert increased risks of hyperactivity/inattention in children compared to single pollutant exposure. Further studies are needed to verify our findings regarding mixed exposure to multiple neurotoxic metals.

Keywords: neurotoxic metals, psychosocial behavior, children, mixed exposure

EP-042[Chemical exposures » Other (to be specified with keywords in the keywords section)]

Dietary intake of acrylamide and increased risk of mortality: evidence from the E3N French prospective cohort

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BACKGROUND AND AIM: Acrylamide is an organic compound classified as probably carcinogenic to humans because of sufficient evidence in animals but not in humans. Its other health risks are not entirely clear. We aimed to study the relationship between acrylamide dietary intake and mortality in the E3N (Etude Epidémiologique auprès de femmes de l'Education Nationale) French cohort. METHOD: We studied 72 585 women of the E3N prospective cohort, which completed a food frequency questionnaire in 1993. The E3N food consumption database and the second French total diet study food contamination database (based on food prepared "as consumed") were used to estimate participants' acrylamide dietary intake. We estimated the associations between acrylamide dietary intake and all-cause or cause-specific mortality using Cox proportional hazard models. RESULTS: During the follow-up (1993-2014), we identified 6 441 deaths. The mean acrylamide dietary intake was 32.6 µg/day, with coffee consumption as the principal contributor (48.6%). In the fully adjusted model, we found a U-shaped association between acrylamide dietary intake and all-cause mortality and a linear positive association with cardiovascular disease (HR for one STD increment [95%CI]: 1.11 [1.02; 1.21]), all-cancer (HR [95%CI]: 1.05 [1.01; 1.10]) and lung cancer (HR [95%CI]: 1.22 [1.09; 1.38]) mortality, while we observed no association with breast (HR [95%CI]: 0.94 [0.86; 1.03]) and colorectal (HR [95%CI]: 1.12 [0.97; 1.29]) cancer mortality. We highlighted an interaction between acrylamide dietary intake and smoking status in the models for all-cause and all-cancer mortality: when stratifying on smoking status, associations were positive and statistically significant only in current smokers.

CONCLUSIONS: This study on a large prospective cohort following more than 70 000 women for more than 20 years suggests that a higher acrylamide dietary intake is associated with an increased risk of mortality. Therefore, it is essential to keep reducing acrylamide formation and prevent dietary intake of acrylamide, especially among smokers.

Keywords: environmental epidemiology, female, nutrition, mortality, long-term exposure

EP-043[Chemical exposures » Fluoride]

Drinking water fluoride and hip fracture incidence in England: Analysis of 2013-2020 data

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BACKGROUND AND AIM: To examine associations between drinking water fluoride concentrations and incidence rates of hip fracture for all of England using smaller area data and controlling for age, sex, ethnicity, deprivation, and water hardness.

METHOD:All data was publicly available from UK government sources. Age-standardized hip fracture hospitalization incidence rates for the years 2013-2020 for those age 60+ years, by geographical level of Clinical Commissioning Group (CCG). Drinking water fluoride concentration CCG average was estimated with GIS software from published water fluoride concentration maps. Water hardness for all CCGs was similarly obtained using GIS and published maps. Percent of population age 60+ years considered income-deprived and percent non-White ethnicity was obtained from UK Census. Each covariate was chosen because previous evidence suggested associations with hip fracture risk. Linear and spline regression models were evaluated to assess associations.

RESULTS:Mean hip fracture rate for 2013-2020 was 400 per 100,000 person-years. Spline regression models adjusting for all four co-variates indicated non-linearity. Water fluoride concentration, water hardness, deprivation, and percent non-White all had statistically significant associations with hip fracture rate. Model-predicted hip fracture rate with covariates set at their mean values increased from 378 (95%CI 361-395) to 454 (95%CI 433-474) as water fluoride increased from 0.05 to 0.7 mg/L, a range from the lowest concentrations in England to that commonly used in artificial fluoridation. Significant interactions were found between water fluoride and percents income deprived and non-White. Water hardness and percent non-White were protective against hip fracture. Deprivation was associated with increased hip fracture rate.

CONCLUSIONS: Water fluoride at concentrations commonly used in artificial fluoridation (0.7 mg/L) was associated with a significant 20% increased rate of hip fracture in older adults, compared to the lowest natural fluoride concentrations in England, controlling for age, water hardness, deprivation, and ethnicity.

Keywords: hip fracture, water quality, public health, spatial statistics, environmental epidemiology

Updated dose-response assessment and metaanalysis of fluoride developmental neurotoxicity studies rated higher quality by National Toxicology Program

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BACKGROUND AND AIM: The US National Toxicology Program (NTP) updated their systematic review of fluoride (F) human developmental neurotoxicity studies in 2022. In response to National Academies (NASEM) committee recommendations the present study assessed dose-response relationships in NTP-identified studies using rigorous methods consistent with Environmental Protection Agency risk assessments.

METHOD:Studies rated lower risk of bias (RoB) in the updated NTP review were examined using three approaches to assess dose-response relationships and possible thresholds. The first approach assessed consistency of effect direction by comparing the number and proportion of studies finding statistically significant adverse associations of IQ with F at mean exposures <1.5 or \geq 1.5 mg/L water F (or urine F) compared to studies finding no significant effect or a significant beneficial effect. The second approach used subgroup meta-analysis to compare pooled estimates of studies with individual-level IQ outcome data with mean F <1.5 compared to mean F \geq 1.5 mg/L. The third approach was meta-regression of IQ loss at mean exposure by mean exposure for studies with individual-level data. Linear and spline meta-regression models were assessed.

RESULTS:NTP rated 31 studies lower RoB. Over 90% of studies in both exposure ranges (<1.5 and ≥1.5 mg/L F) found statistically significant adverse associations. Subgroup meta-analysis found similar magnitude of effect in both exposure range subgroups, averaging -3 IQ points per 1 mg/L F for the two subgroups. Linear meta-regression also found a statistically significant pooled effect-magnitude of -3 IQ points per 1 mg/L F. Spline meta-regression did not suggest any threshold. CONCLUSIONS:A large number of high-quality studies consistently showed statistically significant adverse neurocognitive effects at both higher and lower exposure levels. Three dose-response assessment approaches were robust in finding no evidence of a safe threshold for IQ loss.

Keywords: fluoride, children's environmental health, risk assessment, environmental epidemiology, public health

Pesticide exposure and respiratory health outcomes of avocado farmworkers in Michoacan, Mexico

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BACKGROUND AND AIM: There is limited epidemiologic data on the association between occupational pesticide exposure and respiratory health. We aimed to examine the association of exposure to insecticides, fungicides, and herbicides, individually and as a mixture, with respiratory health outcomes among avocado workers from Michoacán, Mexico

METHOD: We conducted a cross-sectional study of 105 avocado workers between May and August 2021. We quantified 13 insecticides, fungicide, or herbicide metabolites in urine samples collected during two study visits (8-10 weeks apart). We collected survey data on self-reported pesticide use during the 12 months prior to the baseline survey and estimated yearly exposure-intensity scores (EIS) using a semi-quantitative exposure algorithm. Respiratory symptoms during the 12 months prior to the follow-up survey including wheeze, chest tightness, wheezing after exercise, and night cough were also assessed via questionnaire. We examined associations of combined EIS and individual urinary metabolite concentrations with respiratory health outcomes using generalized linear regression models. Mixture effects were assessed using Bayesian Weighted Quantile Sum regression.

RESULTS:Annual combined EIS were associated with higher odds of night cough (OR: 1.02, 95% CI: 1.00, 1.04). Additionally, in individual models, higher concentrations of pyrethroid metabolites, 3-phenoxybenzoic acid, cis-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylic acid (DCCA), and trans-DCCA were associated with higher odds of night cough (OR per 2-fold increase in concentrations: 2.04, 95% CI: 1.17, 3.76; OR: 2.52, 95% CI: 1.33, 5.25; OR: 2.56, 95% CI: 1.18, 6.02; respectively). We found similar joint mixture effects between the pesticide mixtures and higher odds of night cough (OR: 5.02, 95% CI: 1.36, 22.76); pyrethroids were the main contributor of the

mixture (43%). CONCLUSIONS:Our findings indicate that exposure to pesticides, but particularly to pyrethroids, may be associated with adverse respiratory health outcomes among avocado workers. Future directions include examining occupational pesticide exposure and lung function within this population. **Keywords:** pesticide, mixtures, respiratory health, asthma, wheeze

Long-term exposure to arsenic in drinking water and risk of cardiovascular diseases among women living in California

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BACKGROUND AND AIM: High levels of arsenic in drinking water (wAs) have been linked to cardiovascular disease (CVD), but risks remain uncertain at lower levels present in US community water supplies (CWS), currently regulated at the federal-level (maximum contaminant level $[MCL]=10\mu q/L$). Our study evaluated the relationship between long-term wAs exposure and CVD risk in the California Teachers Study prospective cohort (enrolled 1995-1996). METHOD: We computed wAs exposure as the average of annual measurements corresponding to CWS serving participants' residential addresses from 1995-2005 (N=94,402). CVD outcomes from statewide healthcare administrative records through 2018 included incident cases of stroke (n=6,919), myocardial infarction (n=3,365), and coronary revascularization procedures (n=3,539), a proxy for severe coronary artery disease. We estimated hazard ratios (HRs) and 95% confidence intervals (95CIs) for wAs exposure and CVD outcomes. We evaluated wAs exposure using penalized splines and categorized at concentrations relevant to the MCL (<1, 1-<3, 3-<5, 5-<10, \geq 10µg/L) and percentiles (<50th, 50th-75th, 75th-95th, \geq 95th). Models were adjusted for baseline age, socioeconomic status, race/ethnicity, BMI and smoking status. We also conducted analyses stratified by smoking status. RESULTS: Median (75th, 95th percentiles) wAs were 0.96µg/L (1.76, 3.92). The adjusted HR (95%CI) of wAs ≥10 vs. <1µg was 1.09 (0.87, 1.38) for any CVD outcome, 1.05 (0.78, 1.41) for stroke, 0.68 (0.40, 1.15) for myocardial infarction, and 1.64 (1.17, 2.28) for coronary revascularization procedures. Risk of coronary revascularization procedures comparing \geq 95th vs. <50th percentiles was HR=1.14 (95%CI=0.97, 1.35), cases=169, ptrend=0.027. Among ever smokers, we found evidence of a linear and statistically significant association between wAs and coronary revascularization procedures (ptrend<0.01). Among never smokers, the corresponding association was non-linear and risk was observed only $\geq 10\mu q/L$ (ptrend=0.73).

CONCLUSIONS:Our findings suggest long-term wAs exposure at relatively low levels in CWS could lead to atherosclerosis that requires coronary revascularization. We observed greater susceptibility among ever smokers.

Keywords: Water quality, Heavy metals, Environmental epidemiology, Cardiovascular diseases

Complex interaction effects of air pollution and temperature on blood pressure: Evidence from the SALIA cohort study

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BACKGROUND AND AIM:Systolic and diastolic blood pressures have always been closely associated with environmental factors such as temperature and air pollution. However, the interaction effect between these environmental factors in modeling blood pressure is often not considered. We investigated the short-term combined effect of temperature and air pollution on blood pressure. METHOD:We examined the blood pressure in older women from the German SALIA cohort during the 2007-2013 follow-up examination. A generalized additive model with a bivariate tensor product was employed to capture the complex interaction effect of temperature and air pollutants such as particulate matter (PM2.5), nitrogen dioxide (NO2), and ozone (O3) with systolic (SBP) and diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse pressure (PP). The interaction was monitored over a lag period of up to 13 days. The estimated effects were calculated based on a cut-off level of temperature determined by an inflection point in the graph.

RESULTS:We observed a non-linear interaction effect of environmental factors on blood pressure. On warmer days with temperatures above 10°C, the effect of air pollutants was significantly associated with blood pressure. For example, a one-unit increase in PM2.5 concentration (μ g/m³) was associated with a 0.46% (95% CI: 0.06%, 0.98%) increase in SBP, a 0.67% (95% CI: 0.17%,1.18%) increase in DBP, and a 0.6% (95% CI: 0.15%, 1.05%) increase in MAP. We found no significant relationship between air pollution and blood pressure in colder temperatures.

CONCLUSIONS: We discovered an intricate synergistic relationship between temperature and air pollution on systolic and diastolic blood pressures. Considering the linear effect, we found a minimal statistically significant association between air pollutants and blood pressure. However, we discovered a highly significant association when considering the non-linear interactions between temperature and air pollution.

Keywords: Air Pollution, Temperature, Modeling, Short-term exposure.

Spatio-temporal diversity and metagenome analysis of biological aerosols over some discrete locations of Northeast India

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BACKGROUND AND AIM: Human health issues due to air pollution are common issues to be addressed at the global level and biological aerosols contribute a major part to it. Even though, the Northeastern region in India is known for its healthy air quality within the country but is reported be deteriorated in recent times. Henceforth, the biological aerosols collected from eight discrete locations in all four seasons in a year were characterized in terms of viable (bacterial diversity) and non-viable components (fungal spores, animal debris, and non-biological components, particulate matters: inhalable, thoracic, and alveolic).

METHOD:All the aerosol samples were collected using GRIMM Portable Laser Aerosol Spectrometer-11.A which is capable of continuous monitoring of airborne particles as well as for measuring the particle count distribution. The microbial diversity of the aerosol samples was analyzed by DNA-based metagenomic approach and the culturable microbes were analyzed for their sensitivity against brad and narrow spectrum antibiotics. The living and non-living components were differentiated by fluorescence microscopic technique by using suitable fluorescence dye.

RESULTS:The non-viable (non-biological) components contributed the major part (30-89%) of the total components in the aerosol samples with pollens (4-20%), animal debris (1-24%), and fungal spores (1-17%). The DNA-based metagenomic approach showed 184 bacterial (operational taxonomic units) with 28,028 abundance count comprising 7 major phylum, 6 classes, 10 orders, 15 families, 13 genera, and 8 species in the samples collected during pre-monsoon season. Overall, 8-10% of the total culturable microbes during pre-monsoon season exhibited β -hemolysis which may pose a potential threat to human health.

CONCLUSIONS: This study gives a snapshot of both viable and non-viable components of aerosols throughout a year in the selected locations and the results would be beneficial for the policymakers and NGOs to create awareness among the people for suitable precautions to be followed.

Keywords: Particulate matter, Particle components, Microbiome, Air pollution

Prenatal exposure to disinfection by-products (DBPs) through drinking water and their effects on placental function

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BACKGROUND AND AIM: Exposure to disinfection by-products (DBPs) and in utero have been associated with adverse pregnancy and birth outcomes in epidemiological studies. Associations remain unclear for the placenta that is a critical organ during pregnancy for the development of the fetus and vulnerable to environmental insults. This study aimed to comprehensively assess exposure to DBPs in drinking water during pregnancy in the Barcelona Life Study Cohort (BiSC) as well as to estimate associations in relation to placental function.

METHOD:A total of 1086 pregnant women living in the Barcelona Metropolitan area were recruited at the first trimester of pregnancy and followed by surveys until delivery (2018-2021). Water ingestion habits were ascertained at the first and third trimesters through questionnaires. Routinely monitored DBPs (trihalomethanes, THMs) were obtained from the local public health authority for the pregnancy period (N=183) and non-regulated DBPs were analysed in a subset. Concentrations of DBPs were modelled based on geolocation and temporal variation to predict concentrations in the residential water supply of each participant from conception until delivery. Association analysis and mixture modelling are ongoing.

RESULTS: Median (Interquartile range) concentrations (μ g/L) of THMs were 18.6 (7.3-27.6) for chloroform, 9.4(5.6-12.4) for dibromochloromethane, 6.4 (2.9-10.3) for bromodichloromethane, and 26.1(16.2-36.0) for bromoform. Drinking water consumed at home was bottled (64%), filtered (21%), and unfiltered (15%) tap water.

CONCLUSIONS: The study population is exposed to THMs with a significant component of brominated species in drinking water, concentrations of DBPs were below the regulatory limits set by the EU Drinking Water Directive (EU DWD 2020/2184).

Keywords: water quality, chemical exposures, pregnancy outcome

EP-050[Air pollution » Short-term exposure]

Association between Air Pollution and COVID-19 in Hanoi and Ho Chi Minh Cities in Vietnam in 2021

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BACKGROUND AND AIM: Air pollution make various serve effects on respiratory diseases. However, the association between air pollution and COVID-19 incidents is still under debate. Particularly, studies in Southeast Asia countries with higher annual temperatures and relative humidity, and higher air pollution concentrations have been limited. T study aimed to explore the association between air pollution and COVID-19 incidents in Hanoi and Ho Chi Minh cities of Vietnam.

METHOD: The interrupted time-series study design was applied. For considering the effects of the lockdown, the study period was divided into three periods: before, during, and after the lockdown in 2021. Daily COVID-19 cases were obtained from the Vietnam Ministry of Health and Air Pollutants (PM2.5, PM10, NO2, and O3) data from the World Air Quality website respectively. The incident rate ratios (IRR) and their 95% confidence intervals (CIs) were calculated by Poisson regression and the negative binomial regression model.

RESULTS: Significant positive associations of PM2.5 were observed after the lockdown period in both cities. Indeed, every 10 μ g/m3 increase in the mean concentration of PM2.5, corresponds to the IRR fluctuating from 1.101 (95% CI: 1.065 – 1.143) at Lag 0 to 1.05 (1.007 – 1.096) at Lag 6 after lockdown period in Hanoi city. In Ho Chi Minh City, after the lockdown, IRR ranges from 1.017 (0.998 – 1.037) at Lag 0 to 1.014 (0.993 – 1.035) at Lag 7. Also, significantly positive associations of PM10, NO2, and O3 were observed in Hanoi city. Conversely, before and during the lockdown, these associations were not observed in both cities.

CONCLUSIONS: In countries with high air pollution, they have already suffered in health effects from air pollution. In addition, air pollution would elevate the risks of COVID-19 incidents. The public health interventions such as establishing warning systems for air pollution on COVID-19 should be considered.

Keywords: Air pollution, COVID-19, VIETNAM 2021

The Interaction Between Extreme Temperature and PM2.5 on Mortality in Nine U.S. States

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BACKGROUND AND AIM: Previous studies have shown modification of the effect of PM2.5 on all-cause mortality by ambient temperature, but findings have been conflicted and few studies have looked specifically at extreme temperatures (especially extreme cold). We aimed to estimate the interaction between co-exposures to both PM2.5 and temperature extremes.

METHOD: We conducted a case-crossover study with bidirectional control sampling. We used 4,644,810 adult, non-accidental mortality records obtained from the departments of public health of 9 U.S. states, PM2.5 data from a 1-km exposure model, and temperature and relative humidity from the 1-km Daymet and 4-km gridMET surface weather models, respectively. We looked at same-day up to the 8-day moving average of PM2.5. Extreme heat was defined as days where the minimum temperature in a given Census tract in a given year was greater than the 99th percentile of minimum temperature in that tract in that year. We used a similar definition for extreme cold, focusing on the 1st percentile of maximum temperature instead. We modeled the modification with an interaction term and controlled for relative humidity. Less stringent definitions of extreme temperature were also explored.

RESULTS:We found significant modification of effect of PM2.5 on mortality by extreme temperature. This finding was consistent across both extremes of temperature at various cutoffs and also across different moving averages of PM2.5. We observed the largest interactions for same-day PM2.5, with interaction odds ratios of 1.0018 (95% CI: 1.0015, 1.0021) for both extreme heat and extreme cold for each 5 µg m-3 increase in PM2.5. We observed the smallest interactions with the 3-day moving average of PM2.5, with interaction odds ratios of 1.0014 (95% CI: 10011, 1.0017). CONCLUSIONS:Exposure to extreme temperature significantly worsens the effect of PM2.5 on mortality. This finding was robust across our sensitivity analyses.

Keywords: Air pollution, climate, mortality, short-term exposure

Fine-scale Disparities in Exposure to Particulate Matter Components in U.S. Urban Areas

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BACKGROUND AND AIM: Extensive work has shown that communities of color are exposed to more air pollution than their White counterparts. However, these studies have largely used coarse measures of air pollution and demographics, smoothing over finer-scale heterogeneities in both. Additionally, few studies have looked at how these disparities have changed over time or at particulate matter components specifically. We aimed to address these gaps by assessing particle component exposure disparities at the Census block level over three decades in urban areas across the U.S. METHOD: We merged the ambient concentrations of 15 different components of PM2.5 in urban areas from a 50-m exposure model with block-level demographic data, block group- and tract-level socioeconomic data, and the nearest combined statistical area (CSA) centroid from the U.S. Census Bureau, resulting in about 4 million records per decade. We fit linear mixed effects models for each component for each decade to model how ambient concentrations varied with area-level demographics and socioeconomics over time. We used spatiotemporally-defined clusters to account for similarities between neighborhoods that were planned and built in the same area and time period. We additionally included fixed effects for each CSA to account for regional differences in demographics and pollution and conducted stratified analyses to investigate how the relationships changed by Census region. RESULTS: We found that communities of color, especially Black and Native communities, tended to be exposed more to particle components, though the relationships differ by component. Our stratified analyses additionally indicated that these disparities differ by region. We found that disparities have been decreasing over time but are still present.

CONCLUSIONS: Our findings indicate that efforts to reduce disparities in exposure to air pollution in the U.S. have made much progress, but disparities still persist to varying degrees across the country.

Keywords: Air pollution, big data, environmental disparities, environmental justice

EP-053[Exposure assessment methods » Exposure assessment-general]

Childhood lead exposure and source investigation in Patna, Bihar, India: Building deeper understanding through international collaboration

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BACKGROUND AND AIM:Despite the well-documented impacts of lead on children, exposure to this toxic metal remains a pressing public health issue, particularly in LMICs. Ongoing research has revealed varied sources of exposure across different regions of the world. One source of concern in India are lead-acid battery (LAB) manufacturing and recycling sites; ~90% of such sites assessed in the Indian states of Bihar and Jharkhand were found to have elevated levels of lead in soil. However, following the remediation of one such site in the city of Patna, a consistent reduction in blood lead levels among local children was not observed. Other potential sources had been reported in India, but their relative contribution had not yet been characterized.

METHOD:An international consortium of US- and Indian-based organizations implemented a representative, cross-sectional population-based cluster design survey, which evaluated the blood lead levels (BLLs) and risk factors in 135 children <6 years old in areas considered to be impacted by LAB operations and control areas.

RESULTS: Households in proximity to LAB operations were compared to households distal to these operations. Overall, the geometric mean (GM) BLL was 11.6 μ g/dL, with ~87% of children exceeding the WHO's threshold value of 5 μ g/dL. GM BLLs of children in proximal and distal households were not significantly different. Lead concentrations in certain environmental media (soil and dust) were significantly higher in proximal households whereas concentrations in spices and turmeric specifically were higher in distal households.

CONCLUSIONS: The results demonstrate the complexity of exposure scenarios even within a single city. The results raised new research questions into under-studied sources such as metal cookware. This study has prompted new research into the extent of spice adulteration across North India, and the prevalence of elevated blood leads across Bihar, the results of which are forthcoming.

Keywords: Heavy metals, children's environmental health, exposures, multi-media, international collaboration

Persistent Organic Pesticides and Risk of Amyotrophic Lateral Sclerosis among National ALS Registry Cases and Matched Controls

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BACKGROUND AND AIM:Neurotoxic chemicals including pesticides have been suggested in the etiology of ALS. Studies have examined self-reported exposure to pesticides and risk of ALS; however, only one study has considered serum levels of organochlorine pesticides (OCP) and risk of ALS. Our aim is to examine the association of persistent OCP and ALS risk within a national sample of cases from the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) National ALS Registry.

METHOD:CDC identified 280 ALS cases through their Registry and Biorepository between 2013 and 2018 with survey and serum OCP with analyses performed by SGS AXYS Analytical Services Ltd (British Columbia). University of Pittsburgh received data and identified age, sex, and county-matched controls with survey data and serum samples (N=243), measured for concentrations of 29 OCP. Conditional logistic regression with adjustment for covariates was conducted to consider associations between ALS risk and serum OCP levels in cases and controls.

RESULTS:Six of the OCPS with Level of Detection (LOD) \geq 70% were: 4,4'-DDE, hexachlorobenzene, trans-Nonachlor, β -Endosulfan, a-Endosulfan and oxychlordane. Conditional logistic regression controlling for smoking and education revealed a-Endosulfan and oxychlordane revealed increased risk of ALS: OR=1.04 (95%CI:1.02-1.06) and OR-1.02 (95%CI:1.00-1.04). Of nine additional OCPs \leq 50% levels of detection, non-parametric analysis revealed Heptachlor significantly associated with ALS risk (OR: 3.57,95%CI:1.5-8.5.) In the human body, chlordane impacts many areas, including the nervous system making it of particular interest to research investigating neurodegenerative diseases. ALS risk (OR: 3.57,95% CI:1.5-8.5.)

CONCLUSIONS:Despite many OCPS were banned in 70's and 80's in the US, their use abroad and long half-lives continue to exert possible neurotoxic health effects. β -endosulfan was not banned until 2016 and heptachlor in the 1988. In the human body, chlordane impacts many areas, including the nervous system making it of particular interest to research investigating neurodegenerative diseases.

Keywords: pesticides, neurodegenerative outcomes, risk assessment

EP-055[Air pollution » Particulate matter]

Association between ambience fine particulate matter (PM10) and Skin brown Spots in Taipei City Community

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BACKGROUND AND AIM: There have been few epidemiological studies exploring the association between environmental exposures and skin health in the past. As a result, the evaluation of cosmetic efficacy and skin health risk assessment has relied heavily on toxicological data. However, a new law, the Product Information File of Cosmetic Hygiene and Safety Act, will come into effect on July 1, 2024. This law prohibits the use of animal test data and clinical trial data for cosmetic safety and efficacy assessment. Therefore, this study aims to investigate the relevance of environmental exposures to skin health, which will be useful for cosmetic safety and efficacy assessment.

METHOD:Between 2018 and 2019, we recruited 456 participants in Taipei's communities (as the urban area), The participants were residents aged 20 to 70 years who had lived in Taipei City for more than 1 year and had no communicable diseases. The skin brown spots were measured by the VISIA 7 Imaging System device (Canfield, NJ, USA) and facial image analysis software. We estimated the level of outdoor PM10 exposure based on participants' residential addresses by using Land Use Regression model to estimate PM10 concentrations. We also collected information on covariates by self-administered questionnaires. Finally, we conducted linear regression models to examine the association between air pollutants exposure and skin brown spots.

RESULTS: A positive and statistically significant association between PM10 exposure and skin brown spots was identified. The risk of skin brown spots increased with the score of exposure to PM10 over 1 year in Taipei community (Zscore b=1.01, 95% CI: 0.19–1.81).

CONCLUSIONS: Higher exposure to (PM10) is associated with a higher risk of skin brown Spots.

Keywords: PM10, Skin brown Spots, Skin exposure

Association of long-term exposure to air pollutants mixture and incident cardiovascular disease in a highly polluted region of China

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BACKGROUND AND AIM:Despite growing evidence that links long-term air pollution exposure to cardiovascular disease (CVD), the combined effects of air pollutants and particulate matter with an aerodynamic diameter of less than 2.5 μ m (PM_{2.5}) have not been studied well. The aim of this study was to assess the association of long-term air pollutants with incident CVD and the combined effect of the air pollutants mixture.

METHOD:A prospective cohort study was performed based on the cohort study on CHronic disease of the Community Natural population in the Beijing-Tianjin-Hebei region (CHCN-BTH). In all, 26,851 adults were included. Three-year residential exposure to air pollutants (PM2.5, O₃, PM10, PM1, NO₂, SO₂ and CO) and PM_{2.5} components [black carbon (BC), NH₄⁺, SO₄²⁻, NO₃⁻and organic matter (OM)] were calculated based on well-validated models. Proportional hazards models and quantile g-Computation were applied to assess the association of air pollutants and pollutant mixture with CVD, respectively.

RESULTS:During the 56,090 person-years follow-up, 629 participants reported incident CVD. Adjusted hazard ratios (95% confidence intervals) of CVD per interquartile range increase in O_3 , PM_{2.5}, PM1, NO₂, BC, and OM concentrations were 4.521 (2.612, 7.825), 2.394 (1.830, 3.133), 2.372 (1.195, 4.705), 1.363 (1.189, 1.563), 3.836 (2.381, 6.182), and 3.066 (2.007, 4.686), respectively. In multipollutant models, the combined effect of air pollutant mixture on CVD was 2.366 (2.298, 2.436). PM2.5 and O₃ contributed 54.3% and 44.5% of the combined effect of the air pollutant mixture, respectively. After using PM2.5 components instead of PM_{2.5} as part of the mixture, OM drove 55.2% of the combined effect.

CONCLUSIONS: The findings indicated associations of air pollutant mixtures with CVD incidence. $PM_{2.5}$ (especially OM) and O₃ might strongly contribute to air pollutant mixtures that lead to incident CVD.

Keywords: Long-term exposure, Ozone, Particulate matter, Mixtures, Cardiovascular diseases

Joint and mediation effects of ambient air pollutants and PM2.5 components on renal function in China

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BACKGROUND AND AIM: While growing evidence links long-term air pollution exposure with chronic kidney disease (CKD), combined effects of pollutants mixture and multiple mediation effects of metabolic risk factors were rarely discussed. The study aimed to evaluate the combined effects of pollutants mixture and multiple mediation effects of metabolic risk factors on CKD progression. METHOD: We included 8,996 baseline CKD-free adults from the CHCN-BTH cohort study during 2017-2021. Three-year individual air pollutants exposure [particulate matter $\leq 2.5 \mu m$ (PM_{2.5}), PM10, PM1, ozone (O₃), nitrogen dioxide (NO₂), sulfur dioxide (SO₂) and carbon monoxide (CO)] and PM_{2.5} components [black carbon (BC), ammonium (NH₄⁺), nitrate (NO₃⁻), sulfate (SO₄²⁻) and organic matter (OM)] were assessed using well-validated methods. Generalized linear mixed models were applied to examine the associations between air pollutants and CKD progression. Quantile g-Computation was used to assess the combined effects of air pollutant mixtures. Causal mediation analysis and Bayesian mediation analysis were employed to estimate the univariate and multivariate mediation effects of air pollutant fixed to effect and multivariate mediation effects of air pollutant mixtures.

RESULTS:During the follow-up, 399 participants had an incident of CKD progression. Interquartile range (IQR) increases in BC [OR: 1.010 (95%CI: 1.008–1.012)], $SO_4^{2^-}$ [1.024 (1.019–1.029)] and OM [1.028 (1.023–1.033)] were robustly associated with incident CKD progression, while a protective effect was observed for O₃ [0.965 (0.957–0.974)]. Incident CKD progression was associated with PM_{2.5} components mixture [BC, $SO_4^{2^-}$ and OM, 1.023 (1.017–1.29)]. Univariate mediation analysis showed that high-density lipoprotein (HDL) mediated 13.9% and 14.1% effects of O₃ and $SO_4^{2^-}$. Fasting plasma glucose (FPG) also showed minor mediation effects remained significant in Bayesian mediation analysis.

CONCLUSIONS: The findings indicated the effect of PM2.5 component mixtures on CKD progression. Metabolic risk factors might not mediate the effects of air pollutants. Further study is warranted to clarify the potential mechanism involved.

Keywords: Particulate matter, Long-term exposure, Other (chronic kidney disease), Mixtures, Other (Bayesian mediation analysis)

EP-059[Outcomes » Other (to be specified with keywords in the keywords section)]

Prevalence and factors associated with chronic kidney disease in diabetic and hypertensive patients

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BACKGROUND AND AIM: Chronic kidney disease (CKD) is a serious public health problem worldwide. It is often asymptomatic in the early stages, making early diagnosis difficult. Some people are more susceptible to developing CKD, including hypertensive and diabetic patients. In this context, the objective of this study is to assess the prevalence and factors associated with CKD in diabetic and hypertensive patients.

METHOD:This is a survey carried out with 672 hypertensive patients and 324 diabetics, registered in the Family Health Strategies (ESF), in the urban area of Rio Branco, Acre, in 2019. Chronic kidney disease was defined by GFR < 60 ml/1.72m², estimated from the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula, and the presence of albuminuria > 29 mg/g. Bivariate analyzes and logistic regression models were performed, with a significance level of 5%. RESULTS:The prevalence of CKD in hypertensive patients was 27.3% and 40.0% in diabetics. In the logistic regression, a statistically significant association was observed in hypertensive patients between CKD and illiterate individuals (OR = 1.87; 95%CI 1.14; 3.07), with uncontrolled hypertension (OR = 2.38; 95%CI 1.45; 3.94) and sedentary (OR = 1.63; 95%CI 1.02; 2.60). In diabetics, the variables evaluated lost statistical significance after adjustment.

CONCLUSIONS: The high prevalence of CKD among hypertensive and diabetic patients should be a cause for concern due to the impact on quality of life and mortality. Important factors must be addressed, such as controlling morbidities and changing unhealthy habits.

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Keywords: Cardiovascular diseases, Outcomes, Epidemiology.

Exposure to pesticides and breast cancer in the city of Petrópolis, Brazil

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BACKGROUND AND AIM: Breast cancer is a public health issue worldwide and a disease which requires prevention and control owing to its high rates of incidence and mortality, and most cases of cancer are associated with environmental exposure, including pesticides. Since 2008, Brazil has ranked as one of the largest users of pesticides worldwide and the city of Petropolis is a main agricultural center. Against this background, the objective of the present study was to investigate the association between self-reported pesticide exposure and female breast cancer, according to risk factors related to exposure to estrogen, in women hospitalized in the city of Petropolis, a city where this relationship has not previously been investigated.

METHOD:A hospital-based case-control study was conducted in Petrópolis city, Brazil. The study data were obtained through interviews, and the magnitude of the association between self-reported pesticide exposure and breast cancer was determined using unconditional logistic regression. RESULTS:A higher estimated risk for breast cancer was found in women exposed to pesticides for 10 or more years, where this association was not statistically significant after adjusting for potential confounders (OR = 1.40; 95% CI 0.85 - 2.49). A positive statistically significant association was found between breast cancer and higher educational level or previous use of hormone replacement therapy (HRT), whereas having had 2 or more pregnancies to term proved a protective factor. CONCLUSIONS:Further studies elucidating the contribution of pesticide exposure to the development of breast cancer are needed, given that current findings in the literature are conflicting.

Keywords: Chemical exposures, Pesticides, Cancer and cancer precursors, Environmental epidemiology, Female.

EP-061[Air pollution » Particulate matter]

Particulate matter characterization from biomass-fuel usage in rural South Indian kitchens

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BACKGROUND AND AIM: The most significant source of indoor air pollution (IAP) in rural areas remains using unclean fuels like solid biomass for cooking activities. It releases high concentrations of air pollutants, specifically particulate matter (PM), into the indoor air. Therefore, burning such fuels in enclosed spaces such as small household kitchens is a major risk factor for aggravation of respiratory diseases like chronic obstructive pulmonary disease (COPD). To understand this in detail, a monitoring campaign was carried out in selected houses from Mysuru, Karnataka.

METHOD:Continuous real-time measurement of PM was carried out to understand its diurnal variations. The houses were chosen to include varied cookstoves (traditional and improved) and kitchen (separate and open) configurations as well as with and without COPD patients. PM samples were also collected from the kitchen microenvironments to study the personal exposure of the cooks. The collected samples underwent morphological and chemical analyses to characterize them methodically.

RESULTS: The results showed that indoor separate kitchens had 3.5 times higher PM concentrations than open kitchens. Similarly, kitchens using improved cookstoves showed pollutant concentrations up to 1.8 times lower than the traditional mud or concrete cookstoves commonly used in rural areas. Cooking activities released 10-20 times higher PM concentrations. Physico-chemical characterization of the PM samples showed higher levels of carbon, heavy metals, and toxic compounds in houses with COPD patients.

CONCLUSIONS: Cooking using solid biomass fuels remains the central issue in rural India. The study compares PM exposures from different cookstoves and kitchen settings as well as between houses with and without COPD patients. The PM concentrations and analyses reveal that separate kitchens using traditional cookstoves with biomass fuels are the worst-case scenario. These kitchen and cookstove setups must be improvised, considering exposure and the likelihood of future health issues.

Keywords: Particle components, Exposure assessment, Heavy metals, Respiratory outcomes

Association between arsenic exposure and incidence metabolic syndrome in older Chinese population

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BACKGROUND AND AIM: Growing evidences showed that heavy metals exposure may be associated with metabolic diseases. Nevertheless, the relationship between arsenic (As) exposure and metabolic syndrome (MetS) in older adults is still uncertain and the underlying mechanism of its association remains unclear. We aimed to prospectively investigate the associations of blood As exposure and its co-exposure to other metals with incident MetS.

METHOD: The study participants included people aged 65 and above among the Yiwu Elderly Cohort. The whole blood levels of As as well as other 13 metals were measured using the inductively coupled plasma mass spectrometry (ICP-MS) at baseline. MetS events were defined according to the criteria of the International Diabetes Federation (IDF). Linear regression and multivariable logistic regression models were applied to estimate the association of As with MetS. The Bayesian kernel machine regression (BKMR) was used to explore the association of metal interactions with MetS.

RESULTS: We found a dose-dependent negative association between As and the incidence of MetS in the restricted cubic spline curve. In the fully adjusted model, for each increase in IQR concentration of As, the risk of MetS increased 1.4-fold. In the logistic model, compared with the lowest quartile of As, the highest quartile group significantly increased the risk of MetS after adjusting for potential confounders. In the BKMR model, As was considered to be most likely associated with MetS (PIP > 0.5) and we found the negative association between As and MetS risk was stronger at higher level of iron (Fe).

CONCLUSIONS: Higher blood As was remarkably associated with the elevated incidence of MetS in elderly Chinese population. Potential interaction effects of As and Fe on MetS may exist. These findings suggested future studies should further confirm the potential role of As in MetS.

Keywords: arsenic, metabolic syndrome, iron, BKMR analysis

Source and health risk of antibiotic exposure of Tibetan pregnant women in China: A biomonitoring-based study

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BACKGROUND AND AIM: Tibetan people are one Chinese ethnic minority living in Qinghai-Tibet Plateau with an average altitude of more than 4,500 meters. High altitude could cause a different antibiotic exposure in terms of source and health risk, but relevant information is limited in Tibetan people. METHOD: We investigated 476 Tibetan pregnant women in Lhasa, Tibet in 2021 and measured 30 antibiotics from five categories in urine, including 13 veterinary antibiotics (VAs), five human antibiotics (HAs), and 12 human/veterinary antibiotics (H/VAs). Food consumption was investigated by a brief food frequency questionnaire. Health risk was assessed by hazard quotient (HQ) and hazard index (HI) based on acceptable daily intakes (ADIs).

RESULTS:All antibiotics were overall detected in 34.7% of urine samples with the 75th percentile concentration of 0.19 ng/mL (0.35 ug/g creatinine). HAs, VAs, and H/VAs were respectively detected in 5.3%, 13.0%, and 25.0% of urine samples, with the 95th percentiles of 0.01 ng/mL (0.01 ug/g creatinine), 0.50 ng/mL (0.99 ug/g creatinine), and 3.58 ng/mL (5.02 ug/g creatinine), respectively. Maternal age, smoking of family members, and housework time were associated with detection frequencies of HAs, VAs, or sum of all antibiotics. Pregnant women with a more frequent consumption of fresh milk, egg, yoghourt, poultry meat, and fish had a higher detection frequency of VAs or H/VAs. Only ciprofloxacin and tetracycline had a HQ of larger than one based on microbiological effect in 1.26% and 0.21% of pregnant women, respectively and a HI of larger than one was found in 1.47% of pregnant women.

CONCLUSIONS: An evident antibiotic exposure from various sources was seen in Tibetan pregnant women with some basic characteristics of pregnant women as potential predictors. Several animalderived food items were important sources of exposure to antibiotic with a fraction of pregnant women in the health risk related to microbiological disruption of gut microbiota.

Keywords: Pharmaceuticals, Long-term exposure, Risk assessment, Pregnancy outcomes
Characteristics of bioaerosols in kindergarten classrooms in Miaoli City

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BACKGROUND AND AIM:Preschool children have spent probably 90% of their time indoor, thus the indoor air quality would crucially affect their health. Notably, some may spend more than 10 hours per day in kindergarten in Taiwan due to their parents' work pattern. Airborne bioaerosol (i.e. bacterium, fugus) poses a high health risk for children; thus, this study aimed to investigate the airborne aerosol in kindergarten and its potential controlling factors.

METHOD: This study utilized Anderson bioaerosol samplers to collect samples at a flow rate of 28.3 L/min for 5~10 minutes during March, 2021 to December 2022 in kindergartens located in Miaoli. In addition, we also used simple commercialized indoor air quality (IAQ) sensors to collect some indoor pollutants' levels in order to estimate possible IAQ. The dominate bacteria were also identified. RESULTS: The results indicated that the level of fugus was higher than that of bacterium in the indoor environment; in addition, the predominant bacteria were Gram-positive bacterium. The concentrations of fugus, total bacterium, Gram-positive bacterium, in summer were 1415 CFU/m³, 582 CFU/m³, 594 CFU/m³, respectively. The level of bacterium was associated with the level of CO₂ (p =0.034, r = 0.335), whereas the level of fugus was associated with relative humidity (p =0.003, r = 0.457) and CO₂ (p =0.028, r = 0.353). The dominant bacteria were *Staphylococcus spp.* and *Micrococcus spp.*. If U.V. or ozone was applied to inhibit the growth (or to diminish) the indoor levels of bacterium and fugus, we found the inactivation efficiencies were 72.4%, 75.6% for bacterium and 85.4%, 66.9% for fugus, respectively.

CONCLUSIONS: The application of U.V. or ozone would significantly inactivate indoor airborne bacterium (*Staphylococcus spp.* and *Micrococcus spp.*) and fugus, therefore, can improve the IAQ for kindergarten in terms of bioaerosol and prevent preschool children from potential health risk.

Keywords: Children's environmental health, Microbes

Association between phthalate exposure and sleep quality: results from a nationwide analysis of pregnant women

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BACKGROUND AND AIM: Evidence linking environmental toxicants to sleep quality is growing, but these associations during pregnancy remain unclear. In the present study, we examined association between phthalate exposure and sleep quality among pregnant women using repeated exposure measurements.

METHOD:Spot urine samples collected from a nationwide sample of 2,324 pregnant women at two time points during pregnancy were analyzed for exposure biomarkers of eight phthalate metabolites. We investigated associations between summary and individual phthalate metabolites and self-reported sleep measures using generalized ordinal logistic regression and generalized estimating equations models adjusted for age, body mass index, education, gestational age, income, physical activity, smoking, occupation, chronic health condition, depression, and urinary cotinine level. RESULTS:Multiple individual phthalates and summary measures of phthalate mixtures, including the phthalates from plastic sources (Σ Plastic), di-(2-ethyhexyl) phthalate (Σ DEHP), anti-androgenic phthalates (Σ AA), and all phthalate metabolites (Σ Phthalates), were associated with lower sleep efficiency. To illustrate, every 1-unit log increase in Σ AA was associated with a reduction of sleep efficiency by 1.26% (95% confidence interval [CI]: -2.30, -0.21; q < 0.05). Σ AA and Σ Phthalates were associated with shorter sleep duration and longer sleep latency. Associations between Σ DEHP and Σ Plastic and sleep efficiency differed by urinary cotinine level (p-interaction < 0.01). CONCLUSIONS:Results indicate that higher phthalate exposure may be related to low sleep efficiency, short sleep duration, and prolonged sleep latency during pregnancy.

Keywords: Sleep, phthalates, Pittsburgh Sleep Quality Index, pregnant women

EP-066[Air pollution » Particulate matter]

Ambient particulate matter and surrounding greenness in relation to sleep quality among pregnant women: A nationwide cohort study

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BACKGROUND AND AIM: Both particulate air pollution and residential greenness have been shown to be associated with sleep quality in the general population, but its influence on maternal sleep quality during pregnancy has not been assessed. This study aimed to explore the individual and interactive effects of exposure to particulate matter (PM) air pollution and residential greenness on sleep quality among pregnant women.

METHOD: We analyzed 4,876 pregnant women from the Korean Children's Environmental Health Study. Prenatal sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). Average concentrations of PM (PM2.5 and PM10) during pregnancy were estimated through land use regression, and residential greenness in a 1000 m buffer around participants' residences was estimated based on the Normalized Difference Vegetation Index (NDVI1000-m). We used modified Poisson regression models to estimate the effects of NDVI, PM, and their interaction on poor sleep quality (PSQI > 5), adjusted for a range of covariates.

RESULTS:After adjustment for confounders, each 10 µg/m3 increase in PM2.5 and PM10 exposure was associated with higher risks of poor sleep quality (Relative Risk (RR) 1.06, 95% confidence interval (CI): 1.02, 1.11; RR 1.08 (95% CI: 1.05, 1.12), respectively), each 0.1-unit decrease in NDVI1000-m was associated with a higher risk of poor sleep quality (RR 1.03, 95% CI: 1.01, 1.05), and the interaction term between PM2.5 and NDVI1000-m was 1.06 (95% CI: 1.01, 1.11) with a p-value of 0.010. Associations of PM with poor sleep quality differed by depressive symptoms.

CONCLUSIONS:Our study showed that exposure to PM was associated with an increased risk of poor sleep quality, whereas residing in greener areas was associated with a lower risk of poor sleep among pregnant women. This suggests that green space planning and air pollution control can jointly improve the quality of sleep.

Keywords: Environment, particulate matter, pregnancy, residential greenness, sleep quality

Health effects from Hebei Spirit oil spill using Environmental Risk Score for Oxidative Stress in Korean residents: A HEROS study

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BACKGROUND AND AIM: The Hebei Spirit spilled crude oil in the Yellow Sea of Korea, December 2007. Oil spills are complex exposure to environmental pollutants, including metals and polycyclic aromatic hydrocarbons (PAHs), which can induce oxidative stress and associated with various diseases. This study aims to evaluate the health effects of oxidative stress from oil spills using the environmental risk score (ERS) to measure the multiple pollutants using repeated measured data.

METHOD:Our analysis included 618 participants from a prospective cohort data generated by the Health Effect Research on Hebei Spirit Oil Spill study (HEROS), consisting of participants who participated to cleanup activities or lived near the oil spill site from 2009 to 2014. We used four metals in urine (Hg and Cd) and blood (Mn and Pb), and two urinary PAHs metabolites (2-naphthol and 1hydroxypyrene) to construct multiple pollutants. As oxidative stress markers, urinary 8-hydroxy-2'deoxyguanosine and Malondialdehyde were used. We derived ERS from nine statistical models: elastic net models, adaptive elastic net models, weighted quantile sum regression, Bayesian weighted quantile sum regression, Bayesian kernel machine regression, Bayesian additive regression tree, and super learner. To evaluate and compare the performance of ERS, we performed a logistic regression model for the oxidative stress risk group, defined as having more than 95 percentiles value in general population for each marker, and plotted 95% confidence ellipses of ERS.

RESULTS:Levels of oxidative stress markers were significantly different depending on clean-up activities. The performance of ERS based on super learner (ERS-SL) was the best among the nine models. We confirmed the odds ratio from ERS-SL was more stable than using a single pollutant and the oxidative stress risk group had higher levels of ERS-SL than the non-risk group. CONCLUSIONS:This study highlights the health effect of oxidative stress associated with exposure to

CONCLUSIONS: This study highlights the health effect of oxidative stress associated with exposure to multiple pollutants caused by oil spills using ERS.

Keywords: Multi-pollutant, Exposure assessment-biomarkers of exposure, Mixtures analysis, Environmental epidemiology

EP-068[Cancer and cancer-precursors » Other (to be specified with keywords in the keywords section)]

Cancer familial history and clinical-environment interaction on benign breast diseases risks among Brazilian women

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BACKGROUND AND AIM: A better understanding of cancer familial history role in women with benign breast diseases could guide breast cancer high-risk surveillance. AIM: To analyze the interaction between a family history of cancer and clinical-environment factors on BBD risks. METHOD: This is an interaction study using a case-only approach among 353 women with breast biopsies from two reference-hospitals in Rio de Janeiro between 2013 and 2018. Participants were classified according to cancer familial history (none, all cancer; breast/ovary/prostate cancer; breast/ovary cancer; and breast cancer only). Non-conditional logistic regression was used to estimate crude and adjusted interaction OR between clinical-environmental factors and cancer familial history, and respective 95% confidence interval (95%CI), according to the presence of proliferation, and atypia. We estimated correlations between the age of familial cancer at diagnosis and age at BBD diagnosis, with 95% CI, using a linear regression model. RESULTS: For proliferative lesions, significant interaction OR (iOR) between all cancer familial history and age ≤ 50 years (iOR=2.29;CI95%:1.09-4.79), and 1st. Pregnancy>30yo (iOR=3.19:CI95% 1.01-10); while age \leq 50 years interacted with familial history of breast/ovary/prostate (iOR=3.42;CI95%:1.47-7.93), breast/ovary (iOR=3.39:CI95%1.23-9.32), and breast only (iOR=2.85;CI95%:1.02-7.95). Regarding the risk of BBD with atypia, age \leq 50 years interacted with cancer familial history of any site (iOR=14.40;CI95%:2.29-90.6), breast/ovary/prostate (iOR=14.40;CI95%:2.29-90.6), breast/ovary (iOR=11.87;CI95%:1.19-118.5), breast only (iOR=11.87;CI95%:1.19-118.5). Mother/father's age at diagnosis of any cancer (B=0.50;95%CI:0.01-0.55) was statistically associated with proliferative BBD age. CONCLUSIONS: The risk of proliferative BBD increased with the interaction between all cancer familial history and age \leq 50 years, and 1st. Pregnancy>30yo; and between age \leq 50 years with familial cancer history of breast/ovary/prostate, breast/ovary, and breast only. BBD with atypia risk increased with the interaction between age \leq 50 years and cancer familial history of all sites, breast/ovary/prostate, breast/ovary, and breast only. The older the mother and father cancer diagnosis, the older proliferative BBD women are at diagnosis.

Keywords: breast cancer, cancer precursors, familial cancer history, case-only study, clinicalenvironment interaction

Stomach cancer incidence trends in selected Latin America populations: age, period, and birth-cohort effects

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BACKGROUND AND AIM: to explore the age, period, and birth-cohort effects on stomach cancer incidence trends during 3 decades in selected Latin American populations.

METHOD:A time-trend study was performed using Cancer Incidence in Five Continents data from highquality population-based cancer registries (PBCRs) in Latin American countries. Crude and agestandardized incidence rates (ASRs) were calculated. Time trends in ASRs were assessed using the average annual percentage change (AAPC). Age-period-cohort effects were estimated by Poisson regression for individuals aged between 20 and 79 years with stomach cancer informed by PBCRs from 1983 to 2012 in Cali (Colombia); from 1982 to 2011 in Costa Rica; and from 1988 to 2012 for Goiania (Brazil) and Quito (Ecuador). The goodness-of-fit model was tested using the deviance of the models. RESULTS:Decreases in age-standardized incidence rates were observed for both genders in all populations covered by PBCRs. Age affected the rates significantly in all areas, with curve slopes reaching peaks in the older age groups. Increased trends were observed in recent cohorts for both genders in Cali, and among women in Quito. In Costa Rica and Goiania, decreasing trends were observed among recent cohorts for both genders. The period effect showed an increased ratio rate for both genders in Costa Rica (1997-2001), and Goiania (2003-2007), while Quito (1998-2002) presented a decrease.

CONCLUSIONS: Despite the decreasing gastric cancer trends in the past 30 years observed for both genders in all studied populations, positive cohort effects were seen for both genders in Cali, and among women in Quito, while decreasing trends were observed in Goiania and Costa Rica for recent cohorts. The economic market opening process may have led to changes in the risk factor exposures over successive generations. These geographic and gender variations may reflect cultural/ethnic/gender differences and differences in dietary and smoking rate patterns.

Keywords: gastric cancer incidence, trend analysis, age-period-cohort analysis, ecological study, Latin-America

Gastric cancer cases in Brazil: Clinicalenvironment profile, prevalence and associated factors to treatment treatment

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BACKGROUND AND AIM: Characterize the clinical-environment profile of hospital-based gastric cancer cases, estimate gastric cancer treatment-delays prevalence and associated factors in Brazil from 2007 to 2017.

METHOD: This is an exploratory study of hospital-based gastric cancer cases identified at Brazilian Hospital-based Cancer Registries from 2007 to 2017. Cases were identified at the national SIS-HBCR database, according to the State of residency. All public cancer hospitals report cancer cases regularly, while private cancer hospitals only report spontaneously. Days from 1st specialist appointment to diagnosis, and from diagnosis to treatment were estimated and later categorized into <30/>30 days and \leq 60/>60 days, respectively. Treatment-delay prevalences were estimated according to State of residency, and clinical-environment factors. Associated factors were estimated by crude and adjusted logistic regression, with respective 95% confidential interval(95%CI).

RESULTS: From 76.157 primary gastric cancer cases, 65% were male, 28.9% were aged 60-69, 14.6% were illiterate, 48.7% were incomplete middle school, 62% had a partner, and 48.5% lived in Southeastern Brazil. Surgery was the main treatment(51.1%), while 43.2% of cases were diagnosed with stage-IV, 23% stage-III, 18.9% stage-II, and 14.9% stage-0/I. Median time for diagnosis was 11 days. Among those with diagnosis without treatment, treatment-delay median was 63 days, 64 days for surgery, 62 days for chemotherapy, and 76 days for radiotherapy. Treatment-delay prevalence was 49%, and associated factors were age >40y/o(OR=1.42;95%CI:1.19-1.71), living in southeastern (OR=2.20;95%CI:1.96-2.47), and northern (OR=3.52;95%CI:2.91-4.26), being illiterate (OR=2.29;95%CI:1.70-3.08), having private health-service (OR=0.80;95%CI:0.70-0.90), stage-0/IA (OR=2.16;95CI:1.79-2.61) and IB/IIIA (OR=1.44;95%CI:1.31-1.57), receiving radiotherapy (OR=1.40;95%CI:1.16-1.69), and chemotherapy (OR=1.13;95%CI:1.03-1.25). CONCLUSIONS: In Brazil, hospital-based gastric cancer cases are mostly men, aged 60+, low educated, with advanced stages. Treatment-delays were over 50% for those with a diagnosis without treatment. Age >40y/o, living in southeastern and northern, being illiterate, having health secure, stage-0/IA and IB/IIIA, radiotherapy, and chemotherapy were independently associated with treatment-delay.

Keywords: gastric cancer, cancer treatment delays, Socio-economic factors, environmental disparities, epidemiology

Associations between agrichemical mixtures and childhood cancer in Nebraska counties- a **Generalized Weighted Quantile Sum Regression** based approach

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BACKGROUND AND AIM: Human exposure to agrichemical mixtures occurs frequently in agriculturally dominant US states, including Nebraska. Nebraska's age-adjusted incidence rates (AAR) for childhood cancers are among the highest in the US. Previous studies indicated associations between agrichemical exposures (atrazine and nitrates) and pediatric cancer rate, assuming single pollutant exposure with conventional statistical models. OBJECTIVES: To evaluate the joint association between agrichemical mixtures exposure and pediatric cancer. Additionally, to identify chemicals of concern while adjusting for social vulnerability factors.

METHOD: Agrichemical exposures at a county scale were quantified using USGS Pesticide National Synthesis Project for Nebraska's most frequently applied pesticides from 1992 to 2014. Outcomes were quantified using pediatric cancer diagnosed among children < 20 years of age (1992-2014) from the Nebraska cancer registry. We adjusted for social vulnerability factors such as race, income, employment, and access to care, obtained from the American Community Survey 5-Year estimates. The associations between 30 agrichemicals frequently applied in Nebraska, and pediatric cancer (including sub-types) at a county scale were assessed using the Generalized Weighted Quantile Sum Regression (gWQS) model. The joint association model was fit assuming a Poisson distribution and using pediatric population as an offset-term and a-priori-based social vulnerability factors as covariates. Furthermore, we included repeated holdout validation to identify variance in our effect estimates.

RESULTS: We observed a statistically significant positive association between the 30 agrichemicals and pediatric cancer. These associations were not limited to overall cancers but also to Central Nervous System tumors (CNS) and leukemia. The strength of associations was stronger among CNS cancers $(\beta = 0.36, CI = 0.14, 0.57)$ compared to overall cancer ($\beta = 0.30, CI = 0.16, 0.44$) and leukemia $(\beta=0.23, CI=0.09, 0.38)$. The insecticide Tefluthrin and herbicide Quizalofop contributed higher weights to the joint association between exposure mixture and overall cancer.

CONCLUSIONS: These findings may explain the agrichemical mixture effects on childhood cancer

Keywords: chemical exposures, mixtures, pesticides, socio-economic factors, cancer

Personal breathing zone concentrations of PM2.5 among workers in different occupational groups at a brick kiln in Nepal

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BACKGROUND AND AIM:Chronic obstructive pulmonary disease (COPD) is the third leading cause of death globally. Brick workers in Nepal are uniquely vulnerable to developing COPD. Understanding brick workers' total aerosol exposures is complicated due to multiple contributing sources, including brick kiln smoke, ambient air pollution, brick dust, and household air pollution. The objective of this study was to use 24-hr breathing zone (PBZ) monitoring to characterize particulate matter less than 2.5 μ m (PM2.5) exposures among brick workers across work and living microenvironments. METHOD:In this observational, cross-sectional study, adult Nepalese brick workers (N = 48) were sampled from five occupational groups (administration, firemaster, green brick hand molder, green brick machine molder, top loader) at a single brick kiln in Bhaktapur, Nepal, in March 2023. PBZ samples were collected for approximately 24 hours using RTI MicroPEMs, a miniaturized, wearable aerosol monitor that allows for sampling of PM2.5 aerosols using both gravimetric (filter-based) and nephelometer-based (datalogged) readings. Linear regression models were used to calculate geometric mean (GM) PM2.5 concentrations and determine whether GM PM2.5 concentrations differed by occupational group.

RESULTS:The overall GM PM2.5 concentration in the PBZ of the brick workers was 74.90 μ g/m3 (95% confidence interval [CI]: 58.85, 95.34). GM PM2.5 concentrations were significantly different (p = 0.0002) among workers in the five occupational groups with administration having the lowest concentrations (GM: 20.96 μ g/m3; 95% CI: 11.51, 38.17) and green brick hand molders having the highest concentrations (GM: 115.14 μ g/m3; 95% CI: 82.35, 160.99).

CONCLUSIONS: This study improves on previous studies of brick workers in Nepal by using a larger sample size, using PBZ sampling, and including workers in administration and top loading. Although all five occupational groups had GM PM2.5 concentrations above the World Health Organization's recommendations, non-administration occupational groups had particularly high concentrations and should be targeted for interventions.

Keywords: air pollution, particulate matter

Ambient fine particulate matter exposure and risk of non-Hodgkin lymphoma in the NIH-AARP Diet and Health Study

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BACKGROUND AND AIM: Particulate and dust exposure has been associated with non-Hodgkin lymphoma (NHL) in occupational settings, but studies of ambient PM2.5 are scarce. We aimed to investigate this association for the first time by histologic subtype. METHOD: We estimated outdoor PM2.5 concentrations at the residential enrollment (1995-1996) address for 451,202 participants of the NIH-AARP Diet and Health Study, a cohort located in 6 states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) and 2 metropolitan areas (Atlanta, Georgia, and Detroit, Michigan). We used annual estimates from a national spatiotemporal model to assess PM2.5 concentrations for a 5-year pre-enrollment period (1990-1994). We used Cox regression to estimate associations (hazard ratio, HR; 95% confidence interval, 95%CI) with NHL and major histologic subtypes per interguartile range (IOR; $4.4\mu q/m3$) increase in PM2.5, adjusting for demographic characteristics, body mass index (BMI), smoking status and intensity, and census-tract median household income. We also examined models stratified by BMI and state. RESULTS: There were 6,466 incident cases of NHL diagnosed through 2011. We found a positive and statistically significant association with follicular lymphoma (HRIQR=1.16; 95%CI=1.02-1.31; 788 cases); associations for other subtypes were not apparent. An overall NHL association was not apparent (HRIQR=0.99; 95%CI=0.95-1.04), and no differences were observed by BMI (p-interaction >0.05). NHL risk was significantly elevated with PM2.5 levels in Pennsylvania (HRIOR=1.28; 95%CI=1.06-1.54), but a test for interaction by state was not significant (p-interaction >0.05). CONCLUSIONS: Our findings from this large U.S. cohort indicate that PM2.5 may be associated with risk of follicular lymphoma. Future investigations of NHL and PM2.5 should consider histologic subtypes and examine whether differences in regional PM constituency influence risk.

Keywords: air pollution, particulate matter, Cancer and cancer precursors

Ingested nitrate and nitrite and risk of renal cell carcinoma in the Agricultural Health Study

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BACKGROUND AND AIM:Limited studies have shown associations of ingested nitrate and nitrite with renal cell carcinoma (RCC) incidence. We evaluated exposure from drinking water and diet and RCC incidence in the Agricultural Health Study, a cohort of pesticide applicators and their spouses in Iowa and North Carolina.

METHOD: For applicators and spouses, we used the enrollment water source (1993-1997; N=74,919) to compute average nitrate concentrations in public water supplies (25% of participants) from historical monitoring data and estimated nitrate concentrations in private wells (71%) using random forest models. We excluded 4% using other water sources. We used Cox regression models adjusted for age, state, body mass index, and smoking status to estimate hazard ratios (HR) and 95% confidence intervals (CI) for nitrate exposure quintiles. Among those who completed the NCI Dietary History Questionnaire at first follow-up (N=28,446), we calculated HRs for tertiles of daily intakes of nutrient density-adjusted dietary nitrate and nitrite (mg/1000 kcal) and examined associations for water nitrate stratified by median levels of red meat and vitamin C consumption, factors linked to increased and decreased endogenous nitrosation, respectively.

RESULTS:We identified 345 RCC cases (139 with diet information) through 2019 (Iowa) and 2014 (North Carolina). Drinking water nitrate concentrations were not associated with risk (HR Q5>3.75mg/L vs. Q1<0.7mg/L=0.93, 95%CI:0.66–1.31, p-trend=0.84); associations did not vary by red meat or vitamin C consumption. Higher dietary nitrate intake was associated with increased RCC risk (HR T3 vs. T1=2.3, 95%CI:1.5-3.7, p-trend<0.0001). Dietary nitrite from plants but not animal sources was associated with elevated risk (HR T3 vs. T1=1.5, 95%CI:0.95-2.4, p-trend=0.06). CONCLUSIONS:Our study findings do not support an association between nitrate concentrations in drinking water and risk of RCC. Novel findings of increased risk among participants with higher dietary nitrate and plant nitrite consumption merit additional investigation to better understand how these factors may increase RCC risk.

Keywords: Incidence, Cancer and cancer precursors, Water quality, Food/nutrition, Exposures

Exposure to per- and polyfluoroalkyl substances and plasma proteomics in young adults: The Meta-AIR study

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BACKGROUND AND AIM: Exposure to per- and polyfluoroalkyl substances (PFAS) has been linked with many adverse health outcomes including cardiovascular, liver, and kidney diseases, and adverse reproductive and developmental outcomes. However, the underlying biological activity and toxicity information of PFAS in humans are not fully elucidated. We evaluated the associations of PFAS exposure with the proteomics profile in young adults.

METHOD:This cross-sectional study included 137 young adults with a history of overweight or obesity from the Southern California Children's Health Meta-AIR study. Plasma PFAS (i.e., PFOS, PFOA, PFHxS, PFHpS, PFNA, PFDA) were quantified using liquid-chromatography high-resolution mass spectrometry. Plasma proteins (n=384) in cardiometabolic panel were measured utilizing the proximity extension assay. A proteome-wide association study (PWAS) examined associations of exposure to log2 transformed individual PFAS and PFAS mixtures with 346 unique proteins using linear regression adjusting for age, sex, race/ethnicity, and parental education. Hierarchical clustering was performed using complete-linkage to identify protein clusters associated with PFAS. UniProtKB/Swiss-Prot, a protein database, was used to annotate the protein functions.

RESULTS:Overall, 104 proteins were marginally associated with at least one PFAS (p<0.05). Hierarchical clustering on the test statistics identified a cluster of PFAS down-regulated proteins and a cluster of PFAS up-regulated proteins. PFAS mixtures were marginally associated with up-regulation of nine proteins with functions of initiation of innate immune response (i.e., LBP, SPON2), proinflammation (i.e., LBP, GDF15), protein digestion (i.e., CELA3A, PRSS2), anti-apoptosis (i.e., TIMP1), oxidative stress (i.e., GDF15), as well as with down-regulation of nine proteins with functions of immune regulation (i.e., FCGR2A, ADGRE5), both anti-angiogenesis (i.e., COL4A1, THBS4) and proangiogenesis (i.e., NOTCH3, IL19), and neural development (i.e., NOTCH3, CNTN1). CONCLUSIONS:PFAS exposure was associated with broad alterations of the proteomic profile in young adults. The biological functions of these proteins provide insight on the underlying mechanisms of PFAS toxicity on adverse health outcomes.

Keywords: per- and polyfluoroalkyl substances, PFAS, proteomics, biological processes

EP-076[Chemical exposures » Endocrine disrupting chemicals]

Thyroid hormones mediate the association between single and mixed polycyclic aromatic hydrocarbons exposure with visceral adipose accumulation

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BACKGROUND AND AIM:Polycyclic aromatic hydrocarbons (PAHs) have been reported to be associated with obesity-related cardiovascular risk, and visceral adiposity carries a major contribution to the obesity-induced disease burden. Therefore, exploring the effect of PAHs on visceral adipose tissue accumulation is of great significance for early warning and targeted intervention. The present study aimed to examine the association between PAHs exposure with visceral adiposity and further explore the potential mediating role of thyroid hormones.

METHOD: We investigated levels of nine urinary PAHs metabolites and serum thyroid-stimulating hormone (TSH) and free thyroxine (FT4) in 2190 adult participants in the National Health and Nutrition Examination Survey (NHANES) between 2007 to 2012 and quantified their visceral adiposity and lipid accumulation status by two indicators: visceral adiposity index (VAI) and lipid accumulation products (LAP). Multiple linear regressions were used to assess the effect of single PAHs components on visceral adiposity. Then, we used weighted quantile sum (WQS) regression models and Bayesian kernel machine regression (BKMR) models to estimate the association of mixed PAHs exposure with visceral adiposity. Finally, mediation analysis was used to explore the mediating role of FT4 and TSH in this association.

RESULTS: Multiple linear regressions showed that multiple urinary PAHs metabolites were significantly associated with both VAI and LAP after fully adjusting for covariates. The WQS indices of PAH mixtures showed significant positive effects on VAI (0.305, 95 % CI: 0.109-0.501) and LAP (8.600, 95 % CI: 4.577-12.623). The BKMR model indicated that VAI and LAP tended to increase significantly with the concentration of PAHs mixture. Furthermore, the mediated analysis showed that FT4 mediated the effect of single or mixed PAHs on visceral fat.

CONCLUSIONS: In conclusion, our results suggest that PAHs exposure may increase visceral adipose accumulation by decreasing FT4 levels.

Keywords: Mixtures, Endocrine disrupting chemicals, Obesity and metabolic disorders, Mixtures analysis, Environmental epidemiology.

EP-077[Exposures » Environmental disparities]

Concentrated animal feeding operations (CAFOs) in relation to environmental justice metrics and related variables in Wisconsin, United States

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BACKGROUND AND AIM: The growth of concentrated animal feeding operations (CAFOs) has caused significant environmental detriments and raised concerns regarding environmental justice with CAFOs exposure. This study examined environmental disparities in exposure to CAFOs with several environmental justice metrics and considered exposure intensity.

METHOD: We obtained data on permitted CAFOs (July 2021) from the Wisconsin Department of Natural Resources. We used Census tract level variables from the 2010 Census to evaluate environmental disparities by environmental justice metrics and related variables (i.e., percentages of Non-Hispanic White, Non-Hispanic Black, or Hispanic; percentage living below the poverty level; median annual household income; income inequality (Gini index); percentage with education less than high school diploma; racial isolation (RI) for Non-Hispanic Black; and educational isolation (EI) for population without a college degree). We assessed exposure to CAFOs as the sum of animal units (AUs) within each Census tract and investigated exposure disparities by comparing distributions of environmental justice metrics based on CAFO status (i.e., never, expired, or current) and Census tract-level CAFOs exposure intensity categories (i.e., from low exposure (quartile 1) to high exposure (quartile 4)). RESULTS:CAFOs in Wisconsin were generally located in areas with lower percentages of racial minorities and high SES communities; however, within the areas with current CAFO exposure, areas with high CAFOs exposure intensity had higher percentages of non-Hispanic Black and Hispanic, and lower percentages of non-Hispanic White populations compared to areas with low CAFOs exposure. CONCLUSIONS: Our findings add to the growing body of literature on environmental disparities associated with CAFOs exposure. These results have implication of future studies on environmental justice and CAFOs exposure and suggest the need for further research using accurate exposure assessment in other regions.

Keywords: Environmental justice, Disparities

Evaluating PM2.5 concentrations in homes of on-site workers at a Nepalese brick manufacturing facility

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BACKGROUND AND AIM: Increasing concern about air pollution and health impacts has led to the development of low-cost monitors suitable for wide-scale deployments and use by citizen scientists. Moreover, technological advancements have reduced the size, weight, and power requirements of devices such that they may be readily transported in sufficient quantity into under-resourced communities where vehicle travel to homes and mains electricity supply in the home is unavailable. The objective of this project was to utilize the recently released AirU+ v2.2 low-cost particle sensor to monitor indoor particulate matter less than 2.5 µm (PM2.5) aerosols pollution in the homes of two types of brick manufacturing workers in Bhaktapur, Nepal, in March 2023. METHOD: A subset of 48 workers who lived on-site voluntarily participated in an observational, crosssectional study investigating inhalation exposures and chronic obstructive pulmonary disease (COPD). Workers participating in automated brick molding had a distinct home structure (n=6) that was different from the homes (n=6) of workers manually forming bricks. Stationary AirU sensors were placed in each workers' homes for an average of 60.55 hours. Linear regression models were used to calculate mean PM2.5 concentrations in the homes overall and by brick molding group. RESULTS: The overall mean PM2.5 concentration in the homes was 139.19 µg/m3 (95% confidence interval [CI]: 119.89, 158.50) and the PM2.5 concentrations in the homes of automated brick molders (mean: 116.82; 95% CI: 98.29, 135.34 μ g/m3) were significantly different (p = 0.0034) from concentrations in the homes of manual brick molders (mean: 161.57; 95% CI: 143.05, 180.09 µg/m3).

CONCLUSIONS: This is the first study to compare the indoor PM2.5 concentrations of these two types of brick molding workers in Nepal. Although indoor concentrations of PM2.5 were highest in the homes of manual brick molders, interventions to lower PM2.5 concentrations in the homes of both types of brick molders are warranted.

Keywords: air pollution, particulate matter

Particulate matter phthalate, polycyclic aromatic hydrocarbons, and toxic metal concentrations in tailpipe and non-tailpipe emissions near highways

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BACKGROUND AND AIM: Highway emissions are large contributors to particulate matter exposures. METHOD: PM2.5 and PM10 filter samples were collected upwind and downwind of two southern California highways and analyzed for phthalates, potentially toxic metals, ions, organic and elemental carbon, polycyclic aromatic hydrocarbons (PAHs), and marker species for source apportionment. Source samples of road dusts, brake dusts, and tire dusts were also obtained, suspended, sampled onto filters through size selective inlets, and analyzed for the same components. RESULTS: Phthalate concentrations were as high as 4 µg/m3 and were dominated by bis(2ethylhexyl)phthalate (DEHP) followed by di-n-octyl phthalate (DnBP); these are plasticizing agents used in some tire manufacturing. Average PAH concentrations ranged from 5.1 to 8.6 µg/m3 and were dominated by engine exhaust contributions. Brake pads contained potentially toxic metals such as copper, zinc, barium and lead and were enriched in ambient air near the highways. PM2.5 and PM10 mass concentrations averaged 10-15 and \sim 30 µg/m3, respectively. The most abundant PM2.5 components were: organic matter (OM; \sim 30–40%), mineral dust (\sim 25–30%), and elemental carbon (EC; ~10-15%). For PM10, mineral dust (~40-45%), OM (~25%), nitrate (~6-11%), and EC (6-8%) were the dominant component. High correlations were found for elements with common sources, such as markers for brake wear and road dust.

CONCLUSIONS:On average, contributions from non-tailpipe fractions (brake and tire wear) to PM2.5 exceeded those of tailpipe fractions (diesel and gasoline emissions) at one of the highways (\sim 30% vs. 20%) while they were comparable at another highway that experienced twice the diesel traffic (15–17% vs. 15–19%). For PM10, non-tailpipe contributions were 2 – 3 times the tailpipe contributions. Brake wear particles were more abundant than tire wear particles, though there was a higher uncertainty in the tire wear contribution estimates.

Keywords: Air pollution, Particulate matter, Traffic-related, Particle components

Secondary students from Callao, Peru, discover critical points of lead contamination

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BACKGROUND AND AIM:Lead contamination is a health risk that has not been resolved and is related to conditions of poverty, which affects the global burden of disease, so it is necessary to identify critical points in communities exposed to lead and its risk levels.

OBJECTIVES: Establish the levels of lead contamination in Callao to establish a risk map from here. METHOD:MATERIALS-METHODS: Surface soil samples were evaluated in the main streets and sidewalks of Callao, following the National and International Soil Sampling Standards. The samples are then analyzed to determine the lead concentration. The lead values obtained were used in order to elaborate a risk map based on the ERSA criteria.

RESULTS: RESULTS: The risk levels for lead contamination, and supported by national and international regulations, were: low risk <140 mg/kg, medium risk >140 - <800mg/kg and high risk >800mg/kg. 50% of the collected soil samples present lead values with medium risk >140 - <800mg/kg and 30% with high risk >800mg/kg.

CONCLUSIONS: CONCLUSIONS: The level of risk of exposure to lead associated with contaminated soils in Callao has a distribution similar to that reported internationally and to the findings reported by our group in previous works. These results can be taken as an input to establish public health policies aimed at reducing exposure to lead and preventing diseases, especially in children, pregnant women and the elderly.

Keywords: Students, Callao, hotspots, contamination, lead

Occurrence and burden of burns from cooking in peri-urban Cameroon, Ghana, and Kenya: results from surveys of household cooks

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BACKGROUND AND AIM: Over 90% of all global burns occur in low-and-middle-income-countries, disproportionately affecting women, who are typically the primary cooks, and children. We determined the occurrence, severity, and causes of cooking-related burns, and assessed whether the choice of primary cooking fuel (biomass fuels versus liquefied petroleum gas (LPG)) impacted their prevalence. METHOD: Cross-sectional surveys were administered to women cooking either primarily with LPG or exclusively with biomass fuels in peri-urban communities of Kenya, Cameroon, and Ghana. Information was collected on sociodemographics, cooking patterns, and experience of cooking-related burns (adult and child) in the previous 12 months. Factors contributing to the prevalence, severity, and cause of burns were assessed by fuel type using logistic regression analysis. RESULTS: One in 10 adults (10%, 128 of 1240) and 42 in 1240 (3%) children reported experiencing a burn in the last 12 months. The self-reported occurrence of burns in adults was higher (24%) in Cameroon than in Ghana and Kenya (3% and 3%, respectively). For children, the prevalence of burns was similar across the three countries (4%, 3%, and 3% respectively). Among those reporting a burn, severity (scarring) was high in both adults (73%) and children (83%). The three most common causes of child burns included touching hot objects (31%), hot stoves (12%), or direct exposure to flames (14%). Choice of stove (LPG or biomass fuel) did not appear to be associated with adult burns in Ghana and Kenya (OR=0.73 and OR=1.42 p>0.05 respectively). Children in households primarily cooking with LPG had lower odds of experiencing burns (OR=0.30, 95%CI 0.05-1.59), although this did not reach statistical significance. The use of an LPG stove, however, appeared to reduce the risk of severe burns in children (OR=0.49, 95%CI 0.25-0.92).

CONCLUSIONS: Cooking-related burns are a frequent and debilitating issue for both adults and children. The experience of burns is highly context-specific.

Keywords: Outcomes, Other (cooking-related burns), Epidemiology

EP-082[Air pollution » Wildfires]

Physicochemical characterization of Canadian Wildfire Related Air Pollution in the U.S. Northeast

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BACKGROUND AND AIM:During June 2023, the smoke from Canadian wildfires drifted into the Northeastern United States, making New York City on June 6th the most polluted city in the world. Our objective is to provide a physicochemical characterization of the particulate wildfire pollutants by collecting integrated and real-time measurements during the peak days of the wildfire incident. METHOD:Mass concentration for ultrafine, fine, and coarse PM was obtained with the use of a Harvard Compact Cascade Impactor. Size distributions were obtained with real time instrumentation (TSI SMPS 3082; TSI APS 3321). Integrated samples were used for identification of chemical composition: elemental analysis via ICP-MS and OC/EC analysis via FID. Multiple-Path Particle Dosimetry Modeling was used to estimate total particle deposition in the human alveolar region for a 72-h constant exposure period.

RESULTS: Average mass concentrations onf June 6th-7th for PM0.1, PM0.1-2.5, PM2.5-10, PM10 and above were 95.2 μ g/m3, 111.7 μ g/m3, 53.4 μ g/m3, and 49.8 μ g/m3, respectively. Peak PM2.5 concentrations on June 7th reached 330 μ g/m3, with a large contribution from ultrafine particles (PM0.1 = 165 μ g/m3). Average particle number concentration for particles with mobility diameter <200 nm was substantially higher (Average PNC=6053) than for larger particles between 500nm – 20 μ m (Average PNC= 854.8). Organic carbon content was predominant (OC/EC ratio = 23.6). The relative abundance of the five most prevalent metals were Fe (48.9%), Ba(12.8%), Ti(10.8%), Mn (4.4%) and Al (4.3%). The pulmonary deposition of PM0.1 reached 1.42 mg, and a total deposition of 2.3mg for all studied size fractions.

CONCLUSIONS: The strong presence of ultrafine PM concentrations in mass and particle number concentrations, as well as distinct PM composition is suggestive of different dose-response functions in comparison to traffic related air pollution. Toxicological studies with the collected material are ongoing and should inform further about the human health impacts of wildfire air pollution.

Keywords: wildfires, ultrafine particles, chemical composition, air pollution, climate change

EP-083[One health » Tropical health]

Mapping household-scale livestock husbandry in LMICs by animal taxon: a Bayesian prediction model of a key infectious diseases risk factor

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BACKGROUND AND AIM: Around 70% of the world's 880 million rural poor depend on traditional animal husbandry for their livelihoods which, while having economic and health benefits, can be a source of infections through exposure to fecal contamination and respiratory pathogens. Over 60% of human pathogens are zoonotic, and recent pandemics have resulted from the spillover of zoonotic pathogens such as Ebola, SARS-CoV2 and Mpox yet there have been few attempts to estimate the interface of human and domestic animal interaction at a global scale. This represents a barrier to the improved understanding of the dynamics of endemic and emerging infectious diseases. This analysis aimed to map the distribution of household-scale livestock husbandry in LMICs by animal taxon. METHOD: Data on animal ownership were compiled from around 300 nationally representative. population-based household surveys, and species were classified into ruminants, monogastrics and poultry. A novel georeferencing methodology was implemented and a suite of time-static environmental and demographic spatial covariates were compiled based on their hypothesized associations with the outcome variables. Variable values were extracted at the georeferenced cluster locations and a Bayesian Multi-level based logistic regression approach was used to model associations and generate predictions for all LMICs at a 6km resolution. A Markov Random Field (MRF) smooth algorithm was employed to improve spatial correlation and continuity of the prediction maps. RESULTS: Model evaluation statistics were mixed, but weighted average recall was 0.89 for monogastric, 0.78 for ruminant and 0.74 for poultry ownership. High prevalence of poultry ownership was predicted across the Tibetan Plateau and in pockets in the Andes, Ethiopia, and Kenya, while ruminant ownership rates were high in parts of Amazonia, Syria and Yemen. CONCLUSIONS: The resulting prediction maps can be used by policymakers and program planners to generate disease burden estimates, target outbreak prevention interventions geographically and identify hotspots of risk for zoonotic spillover.

Keywords: One Health, infectious diseases, geospatial health, zoonoses, tropical health

EP-084[Built environment » General]

Spatial variation in housing construction material in LMICs: a Bayesian prediction model of a key infectious diseases risk

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BACKGROUND AND AIM: Housing quality is a well-recognized social determinant of health. Many infectious diseases of global concern are transmitted within and between households and features of the built peridomestic environment and infrastructure can promote or impede the spread of pathogens and their insect vectors. In tropical and rural regions where vector-borne and neglected tropical diseases circulate, dwellings are often constructed using locally available, natural materials and traditional techniques. Disease-causing insects and microbes are well-adapted to exploit the ecological niches that such buildings provide. This study modeled spatial variation in housing material types using covariates with global coverage to map predicted coverage across LMICs.

METHOD:Data on materials used in construction of dwelling floors, walls and rooves were compiled from 334 nationally representative, population-based household surveys, and classified into natural, rudimentary, and finished types. A novel georeferencing methodology was developed and implemented here for the first time. A suite of time-static environmental and demographic spatial covariates in raster format were compiled based on their hypothesized associations with the outcome variables. Variable values were extracted at the georeferenced cluster locations and a Bayesian Multilevel based logistic regression approach was used to model associations and generate predictions for all LMICs at a 6km resolution. A Markov Random Field (MRF) smooth algorithm was employed to improve spatial correlation and continuity of the prediction maps.

RESULTS: Models for wall and roof material performed better than for floors giving a precision of 0.82 for the finished category and a weighted average precision of 0.7 and 0.73 respectively. Cropland areas, urbanization, and distance to water source were important variables in all models. CONCLUSIONS: Resulting prediction maps enable the identification of areas of low coverage of improved housing material across large areas of Sub-Saharan Africa, South Asia, and Amazonian South America among others, and can be used to prioritize populations for housing improvements.

Keywords: Infectious diseases, social determinants of health, housing, global health

Deciduous teeth from the New Hampshire Birth Cohort Study: Infant feeding and Pb in water predict dentine elements

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BACKGROUND AND AIM: To estimate associations between maternal/child characteristics, along with elements measured in home tap water during pregnancy, and element concentrations in shed deciduous teeth.

METHOD: Our analysis included 152 mother-infant dyads followed from the second trimester through the end of the first postnatal year from the New Hampshire Birth Cohort Study. During pregnancy and early infancy, we collected maternal and infant dietary and sociodemographic information via surveys, measured metals in home tap water, and later collected naturally shed teeth from child participants and measured weekly deposition of elements in dentine using LA-ICPMS. Multivariable linear mixed models were used to estimate associations between predictors and tooth metal concentrations. RESULTS: We measured 12 elements in dentine including those previously found in teeth (Ba, Mn, Pb, Sr, Zn) and other elements potentially derived from environmental, dietary, or drinking water exposures (AI, As, Cd, Cu, Hg, Li, and W). A doubling of Pb concentrations in water was associated with higher prenatal and postnatal dentine Pb [8.9% (95%CI: 3.2, 14.8%); 13% (95%CI: 5.0%, 22%)]. Exclusive formula feeding was associated with higher postnatal dentine element concentrations as compared to exclusive breast feeding at 4 months: Sr: 251% (95%CI: 54%, 699%); Ba: 120% (95%CI: 32%, 268%); Li: 73% (95%CI: 13%, 166%); Al: 136% (95%CI: -6.2%, 498%). A mix of formula and breast feeding was associated with higher elements but to a lesser degree than exclusive formula feeding, suggesting a dose response: dentine Sr: 73% (95%CI: 17%, 155%), Ba: 26% (95%CI: -0.6%, 60%), Li: 46.9% (95%CI: 20%, 79%); Al: 4.8% (-32%, 63%) as compared to exclusive breastfeeding.

CONCLUSIONS: Measurement of elements in deciduous teeth provide retrospective information on individuals exposures. Pb in home tap water and any formula use were predictors of dentine elements.

Keywords: Heavy metals, Biomarkers of exposure, Children's environmental health, Environmental epidemiology

Survival of bronchopulmonary cancers according to radon exposure

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BACKGROUND AND AIM:Radon residential exposure is estimated to be responsible of nearly 10% of lung cancers in France, making it the 2nd risk factor, after tobacco. The Auvergne-Rhône-Alpes region, in the Southwest of France, is particularly affected by this exposure as 30% of the population lives in areas with medium or high radon potential.

The aim of this study was to investigate the impact of radon exposure on the survival of lung cancer patients.

METHOD:In this single-centre study conducted at the Centre Léon Berard (Lyon, France), patients with a histologically confirmed diagnosis of lung cancer, and newly managed, were prospectively included between 2014 and 2020. The assessment of the study participants' radon exposure was based on the geogenic radon potential of their municipality of residence, using the zip code of residence from their electronic medical record. Univariate and multivariate survival analyses were carried out using a nonproportional risk survival model to consider variations in risk over time. Adjustment was made for the main prognostic factors: age at diagnosis, sex, smoking status, histology, tumour stage at diagnosis, and presence of brain metastases.

RESULTS:A total of 1,477 patients were included in the analysis. In the multivariate analysis and after adjustment for covariates, radon exposure was not statistically associated with survival of lung cancer patients (HR=0.82 [0.55-1.22], HR=0.92 [0.72-1.18], HR=0.96 [0. 77-1.20] at 1, 3 and 5 years respectively for patients residing in category 2 municipalities; HR=0.88 [0.66-1.17], HR=0.93 [0.77-1.12], HR=0.89 [0.75-1.05] at 1, 3 and 5 years respectively for patients residing in category 3 municipalities.

CONCLUSIONS: Although radon exposure is known to increase the risk of lung cancer, in the present study no significant association was found between radon exposure and survival of lung cancer patients, in univariate and multivariate studies, at 1, 3 and 5 years.

Keywords: Ionizing radiation, Cancer and cancer precursors, Survival, Environmental epidemiology

EP-087[Exposures » Environmental disparities]

Cardiovascular Health in Miramar Guayama, Puerto Rico: Posible Case of Public Health Justice

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BACKGROUND AND AIM: In 2016 a survey demonstrated that people who live in Miramar, Guayama P.R. had a high probability to suffer from cardiovascular and respiratory diseases. Environmental factors such as air pollution may be associated with these diseases. Our co-created objectives with community leaders were: 1) To assess and categorize cardiovascular diseases in Miramar, and 2) report back the results to the citizens of Miramar.

METHOD: From September-October 2022, a survey was designed with demographic questions and chronic/acute diseases. We collected data in November 2022 using the platform Kobo Toolbox. Afterward, we created frequency tables and graphs using Excel. In December, results were reported back in oral and paper format.

RESULTS:A total of 175 people completed the survey, leading to 20% of the Miramar community. The median age for participants was 50. Most (80%) of the participants have been residents for more than 5 years, and 35% indicated suffering from cardiovascular disease and had been through many cardiovascular-related procedures. Cardiac Arrest and Hypertension were the diseases that had more prevalence.

CONCLUSIONS: Studies of Environmental Health indicate that particulate matter 2.5 could cause cardiovascular and respiratory diseases, especially in elderly people. Reporting results can allow people to advocate for environmental justice and possible behavior change. Future students should include biological markers to assess the relationship between environmental sources and health exposure. Acknowledgments: We appreciate the community leaders of Miramar and Santa Ana and the support of "The Organized Community Guayamesa United for Health". Funding: This project was subsidized by the PR-LSAMP Scholarship.

Keywords: community health, carbon emissions

Multipollutant Associations Between Air Pollution and Autism Spectrum Disorder in California: How Sociodemographics and Region Impact Risk.

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BACKGROUND AND AIM:Autism spectrum disorder (ASD) is a complex neurodevelopmental condition with social, behavioral, and learning challenges, likely caused by a mix of genetic and environmental factors. Its prevalence has surged in the US, causing significant health and economic burdens. This study examines the link between ASD and exposure to environmental toxins like PM25, NO2, and O3, considering sociodemographic and regional factors.

METHOD: This study employed a population-based cohort design (N = 2,376,489), utilizing 2013-2018 birth records from the California (CA) birth registry linked to ASD cases (N = 44,416) reported by the CA Department of Developmental Services up to the end of 2022. Air pollution exposure was ascertained using a land-use regression spatiotemporal model with advanced machine learning. A multipollutant strategy was employed to adjust for co-pollutants.

RESULTS:The prevalence of ASD for 2013-2018 births was 1.88%. This study found that in a multipollutant model including PM2.5, NO2, and O3, a 1 interquartile range (IQR: 2.39 ug/m³) increase in PM2.5 across pregnancy was associated with a 14.7% (95% CI: 1.13, 1.16) increased risk of ASD, while a 1 IQR (4.95 ppb) increase in NO2 was associated with a 3.1% (95% CI: 1.02, 1.05) increased risk of ASD. Overall O3 (IQR: 5.11 ppb) was not associated with an increased risk of ASD. Additionally, we saw interesting differences in the estimated effects of different air pollutants on ASD by race, maternal education, neighborhood socioeconomic status, and region.

CONCLUSIONS: Results indicate that prenatal exposures to PM2.5 and NO2 are associated with ASD incidence in CA, with results varying by key sociodemographic factors and region, suggesting that different pollutant sources or exposure profiles/mixtures may place individuals at greater risk of ASD.

Keywords: Autism Spectrum Disorder, Air Pollution, Neurodevelopment, Pregnancy

Cardiovascular and respiratory effects of longterm exposure to air pollution: A cross sectional study in Greece

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BACKGROUND AND AIM: We investigated the long-term effects of modeled ambient air pollutant exposures on cardiovascular and respiratory health outcomes in the Greek National Morbidity and Risk Factors Survey (EMENO).

METHOD: We used data collected for 5,908 residents in Greece participating in the EMENO survey in Greece, 2015-2016. We used mean arterial pressure (MAP) based on measurements, prevalent hypertension, myocardial, coronary and stroke event as cardiovascular outcomes, asthma, chronic obstructive pulmonary disease, chronic bronchitis and allergic rhinitis as respiratory outcomes. Longterm exposure to nitrogen dioxide (NO2), particulate matter with a diameter equal or less than 10µm (PM10) and ozone (O3) at the participant residential address were estimated by dispersion models for Greece and by spatio-temporal land use regression (LUR) models for the Greater Athens Area and Thessaloniki. Multiple linear and logistic regression was applied adjusting for potential confounders. RESULTS:A 10 µg/m3 increase in long-term exposure of NO2 and PM10 at the participants' residence all over the country, was associated with an increased risk of stroke [Odds Ratio (OR): 1.14 (95% Confidence Interval (CI):1.02, 1.29) and 1.40 (95% C.I.:1.08, 1.82), respectively]. A higher risk of stroke was found for participants living in the 2 largest cities of Greece; for a 10 µg/m3 increase in long-term exposure of NO2 and PM10, estimated ORs were: 1.22 (95% C.I.:1.02, 1.46) and 1.49 (95% C.I.:1.00, 2.21), respectively]. Moreover, in the 2 metropolitan areas, a 10 µg/m3 increase in long-term exposure of NO2 and PM10 was also associated with increased MAP and increased risk of chronic bronchitis, hypertension and asthma.

CONCLUSIONS: In a cross-sectional analysis, using predicted air pollutant concentrations at the residence of the participants of a survey conducted in a representative population sample in Greece, we found adverse associations of long-term exposure to NO2 and PM10 and cardiovascular and respiratory health.

Keywords: long-term air pollution, exposure modeling, cardiovascular, respiratory, cross-sectional

Characterizing social inequalities in health in the Region of the Americas

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BACKGROUND AND AIM: The Region of Americas is characterized by inequalities in demography, socioeconomic conditions, health systems and public policies that play a key role in shaping epidemiological scenarios. Therefore, we aim to study the epidemiological trends of morbidity to identify baseline socio-health scenarios of the region characterizing social inequalities in health. METHOD: A descriptive ecological study of 27 countries in the Americas was developed using the latest data from WHO, PAHO, UN Development Programme, GCO and OurWorldInData. The baseline socio-health scenarios were identified using cluster analysis (Ward's method). The socio-demographic variables studied were the percentage of elderly population, Human Development Index (HDI), coverage of essential services, and health expenditure. Epidemiological variables included the prevalence of obesity, hypertension, and diabetes, and cancer incidence, for the 2014-2019 period. Clusters data and socio-health characteristics were mapped using a GIS.

RESULTS:We identified 3 clusters representing different socio-health scenarios. The first one included the Southern countries (Chile, Brazil, Argentina, Uruguay), together with the Bahamas, Costa Rica, Cuba and Jamaica; the second cluster included North American countries (Canada and USA); and the third included 63% of the rest. Comparative analysis of socio-demographic and epidemiological characteristics between clusters showed that the second cluster has a better socio-health situation (higher average HDI and health expenditure) and an older population, with higher burdens of obesity and cancer. We observed that the first and third clusters had similar epidemiological profiles, but the first one had a higher average HDI and health expenditure, while the third had a less-aged population and the lowest average HDI.

CONCLUSIONS: Most countries in the Americas region (93%) presented a very different socio-health scenario to the countries in the north of the continent, which presented a more favorable socioeconomic situation but higher burdens of obesity and cancer. Grants FONCYT-PICT-2019-04594.

Keywords: socio-economic factors, environmental disparities, obesity and metabolic disorders, cancer and cancer precursors, cardiovascular diseases

Mapping residential air pollution hotspots using freely available Energy Performance Certificates in England and Wales

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BACKGROUND AND AIM: The use of solid fuel appliances (SFAs) for heating homes, particularly wood burning stoves, has increased in recent years across the Global North raising concerns on the impact of airborne emissions on human health. In 2022, SFAs are estimated to account for 25% of all PM2.5 emissions in the United Kingdom (UK) versus 12% for road transport. Identifying potential air pollution hotspots in residential areas is challenging when existing monitoring networks are based around major roads.

METHOD:Since 2008, UK law has required that Energy Performance Certificates (EPCs) are issued whenever a property changes hands. We used data on all 23 million EPCs from England and Wales to identify SFAs hotspots. We also quantified the association between SFA prevalence, Index of Multiple Deprivation (IMD) and Smoke Control Areas established in many towns and cities following the Great London Smog of 1952.

RESULTS:London currently has the highest geographic concentration of SFAs at 3.8 per km2 compared with the second highest, the South East of England, at 1.8 per km2. The prevalence of wood-burning SFAs has remained relatively stable in London at 31-44 per 1000 houses between 2008 and 2022 but increased by 57% outside of London from 71 per 1000 houses (95%CI: 70-72) to 114 (95%CI: 113-114). SFAs were recorded in 12.9% (95%CI: 12.8-12.9%) of houses in the least deprived IMD quintile compared with 2.1% (95%CI: 2.1-2.1%) in the most deprived quintile. For houses in Smoke Control Areas, the odds of an SFA were 52% lower (95%CI: 51-52%) than outside of these areas.

CONCLUSIONS:Our results are consistent with appliance sales trends and smaller surveys suggesting that affluent areas are the major contributors to PM2.5 emissions from SFAs. EPCs could help local decision-makers target awareness campaigns and expand Smoke Control Areas to reduce air pollution and improve population health.

Keywords: Air pollution, Big data, Spatial statistics, Built environment, Socio-economic factors (nonchemical stressors)

Association of ambient PM2.5 mass and its components with ovarian reserve in a northern peninsular province, China: the critical constituent

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BACKGROUND AND AIM: Potential effects of PM2.5 components on ovarian reserve have not been well explored worldwide, especially in northern China where air pollution contamination and women fertility disorders both have been arousing substantial public concerns. Our aim was to examine the associations of PM2.5 components and ovarian reserve in northern China. METHOD: We included 15,102 women with serum AMH measurements between January 2015 and December 2019 from the Center for Reproductive Medicine, Shandong University in China. Concentrations of PM2.5 and its five major components $(0.1^{\circ} \times 0.1^{\circ})$, including sulfate (SO42-), nitrate (NO3-), ammonium (NH4+), organic matter (OM), and black carbon (BC) were assigned to each participant's residential address. Multivariable linear mixed effect models were performed to evaluate the associations between PM2.5 components and ovarian reserve over six exposure periods, with constituent-residual model used to confirm the most responsible component. RESULTS: During the exposure period from primary to small antral follicle, per interguartile range increase in average concentration of PM2.5 mass was associated with -8.7% (95%CI: -12.3%, -4.9%) change in AMH. The association was significant for all five components, with the effect estimate observed largest for SO42-. The associations were more pronounced during the process from primary to small antral follicle and among women with low educational level and living in inland areas. CONCLUSIONS: Our findings suggest that short-term exposure to PM2.5 and its specific chemical components (particularly SO42-) was associated with ovarian reserve decline. Lower educated or inland women were more vulnerable than others.

Keywords: PM2.5 components, ovarian reserve, exposure period, anti-Müllerian hormone

Respiratory and allergic effects associated with pesticide exposure among farmworkers in Costa Rica

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BACKGROUND AND AIM:Growing evidence suggests that pesticide exposures may contribute to respiratory symptoms, asthma, and allergies. We examined the association of exposure to insecticides, fungicides, and herbicides with respiratory and allergic effects among farmworkers in Costa Rica.

METHOD: We measured concentrations of 15 pesticide metabolites in urine samples collected from 299 farmworkers at one or two time points between May and August 2016. We administered participants a computer-based questionnaire to collect information on sociodemographic factors, current pesticide use, medical conditions, and presence of respiratory and allergic symptoms during the last 12 months (short version of the European Community Respiratory Health Survey). We implemented two-stage Bayesian Hierarchical Models (BHM) adjusted for age and smoking status to examine exposure-outcome associations with all urinary pesticide metabolites included simultaneously.

RESULTS:Geometric mean (GSD) specific gravity-corrected urinary concentrations of 2-isopropyl-4methyl-6-hydroxypyrimidine (IMPy; metabolite of the organophosphate insecticide diazinon), boscalid-5-hydroxy (BOS-OH; metabolite of the fungicide boscalid), and 4-hydroxypyrimethanil (OH-P; metabolite of the fungicide pyrimethanil) were 0.48 ng/mL (4.24), 0.33 ng/mL (3.99), and 0.29 ng/mL (6.85), respectively. We found that higher IMPy concentrations were associated with increased odds of asthma symptoms or medication use [adjusted OR per two-fold increase in urinary metabolite concentrations; 95% credible interval = (1.33; 1.10, 1.61)], a higher asthma symptoms score (1.15; 1.04, 1.26), and rhinitis (1.32; 1.14, 1.52). We also observed that higher BOS-OH concentrations were associated with increased odds of asthma symptoms or medication use (1.22; 1.00, 1.50) and that higher OH-P concentrations were associated with increased odds of eczema (1.10; 0.99, 1.23). Null associations of pesticide exposure with chronic bronchitis were observed.

CONCLUSIONS:Our data indicate that occupational exposure to several pesticides may be associated with adverse respiratory and allergic outcomes.

Funding: UNA, SNIS, Swedish Research Council (2018-05841), EAWAG, Fogarty International Center (D43TW011403).

Keywords: pesticides, respiratory outcomes, allergies, occupational epidemiology, mixtures analysis

Investigating associations of exposure to blue spaces with natural and cause-specific mortality in Greece using different exposure assessment methods

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BACKGROUND AND AIM: The potential health benefits of exposure to natural environments, particularly green space, have gained widespread attention, while the effects of exposure to blue spaces is less documented. We investigated the association of exposure to blue spaces with natural and cause-specific mortality in Greece using an ecological study design.

METHOD: We collected socioeconomic and mortality data for 1,035 Municipal Units (MU) from the 2011 Census. To define exposure to "blue" we used the CORINE 2012 map to calculate the rate of land cover categories associated with blue space per 10,000 people in the MU, and proximity to the coast for MUs on the Greek coastline. We applied Poisson regression models, accounting for spatial autocorrelation for the entire country and various geographical definitions. We assessed the sensitivity of our results to co-exposures to the air pollutants and NDVI by two-exposure models. RESULTS: An interquartile range (IQR) increase of blue space per 10,000 was associated with decreased risk in natural mortality (Relative Risk (RR): 0.98 (95% confidence interval (CI): 0.98, 0.99), mortality due to cardiovascular and respiratory causes and diseases of the nervous system (0.98 (95% CI: 0.97, 0.99); 0.97 (95% CI: 0.95, 0.99); 0.94 (95% CI: 0.88, 1.00) respectively). Protective associations were also detected for ischemic heart disease, COPD and cerebrovascular disease mortality. We estimated protective associations for the distance from the coast and mortality from the diseases of the nervous system (RR = 0.75, 95% CI: 0.61, 0.92, \leq 1 km from the coast versus >1 km). Our results were stronger in the islands, the coastline and in the rural areas and

remained robust after co-exposure adjustment.

CONCLUSIONS:Our findings support the beneficial effect of exposure to blue space on mortality. Nonetheless, additional research is required to further investigate and elucidate our results.

Keywords: Blue space, Mortality, Green Space, Air pollution
Association of pesticide exposure with neurobehavioral outcomes among avocado workers in Mexico

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BACKGROUND AND AIM: To date, few studies have focused on the health effects of pesticide exposure among avocado workers. We aimed to examine the association of exposure to insecticides, fungicides, and herbicides with cognitive and mental health outcomes among avocado workers from Michoacan, Mexico.

METHOD: We conducted a cross-sectional study of 105 avocado workers between May and August 2021. We collected data on self-reported pesticide use during the 12 months prior to the baseline survey and estimated annual exposure-intensity scores (EIS) using a semi-quantitative exposure algorithm. We calculated average concentrations of 13 insecticide, fungicide, or herbicide metabolites measured in urine samples collected during two study visits (8-10 weeks apart). We administered tests from the NIH Toolbox Cognition Battery and the Brief Symptom Inventory 18 (BSI-18) to assess participants' cognitive function and psychological distress, respectively. We examined individual associations of EIS and urinary pesticide metabolites with neurobehavioral outcomes using generalized linear regression models. We also implemented Bayesian Weighted Quantile Sum (BWQS) regression to evaluate the association between a pesticide metabolite mixture and neurobehavioral outcomes. RESULTS: In individual models after adjustment for multiple comparisons, higher concentrations of fungicide metabolite hydroxy-tebuconazole (TEB-OH) were associated with higher anxiety (IRR=1.26, 95%CI:1.08, 1.48) and overall BS-18 scores (IRR=1.89, 95%CI:1.36, 2.75). Higher 3,5,6-trichloro-2pyridinol (TCPy) metabolite concentrations were associated with lower overall BSI-18 scores (IRR=0.69, 95%CI: 0.56, 0.85). In BWQS analyses, we found evidence of a mixture association of urinary pesticide metabolites with higher overall BSI-18 (IRR=1.99, 95% CrI: 1.39, 2.79), anxiety (IRR=1.72, 95% CrI: 1.12, 2.55), and depression (IRR=4.60, 95% CrI: 2.19, 9.43) symptom scores. TEB-OH and OH-T combined contributed 54%, 54%, and 40% to the mixture effect in the overall BSI-18, anxiety, and depression symptom models, respectively.

CONCLUSIONS: We found that exposure to fungicides, which has been rarely studied in farmworkers, is associated with adverse neurobehavioral outcomes among avocado workers.

Keywords: Pesticides, Mental health outcomes, Neurodegenerative outcomes, Occupational epidemiology,

Nitrate ingestion from drinking water and dietary sources and risk of brain cancer in the Agricultural Health Study

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BACKGROUND AND AIM:N-nitroso compounds (NOC) formed from ingested nitrate/nitrite cause brain tumors in animals. Nitrate and nitrite intakes from drinking water and diet are associated with brain cancer in limited epidemiologic studies. We evaluated these exposures and brain cancer risk in the Agricultural Health Study (AHS).

METHOD:The AHS is a prospective cohort of licensed pesticide applicators and their spouses in Iowa (IA) and North Carolina (NC). Drinking water source was ascertained at enrollment (1993-1997; N=74,919). For users of public water supplies (PWS, 25%), we linked participants' addresses to monitoring data for nitrate-nitrogen (NO3-N) and computed duration-specific averages. For private well users (71%), we estimated NO3-N using random forest models based on well depth, nitrogen inputs, soil characteristics, and other factors. Among 30,177 participants who completed the NCI Dietary History Questionnaire (1999-2003), we assessed dietary nitrate and nitrite intakes using a database of nitrate/nitrite in foods. Incident brain cancers were assessed from enrollment (drinking water analyses, N=137) or first follow-up (diet analyses, N=61) through 2019 (IA) and 2014 (NC). Adjusted hazard ratios (HRs) and 95%CI were computed using Cox regression for average drinking water nitrate concentrations (quartiles [Q], Q4 split at 90th percentile) and tertiles (T) of dietary intakes. We stratified by median intakes of red meat and vitamin C, factors that increase and decrease NOC, respectively.

RESULTS:Nitrate concentrations in private wells exceeded 10mg/L NO3-N (regulatory limit, PWS) for 12% of IA and <1% of NC participants. Drinking water nitrate concentrations >7.1 mg/L NO3-N (90th percentile) were associated with increased risk (HR=1.7, 95% CI=1.0-3.0; p-trend=0.08). We observed some evidence of effect modification by red meat and vitamin C. There were no significant associations with dietary nitrate and nitrite.

CONCLUSIONS: Drinking water nitrate concentrations were associated with increased risk of brain cancer, supporting endogenously formed NOC as potential risk factors.

Keywords: cancer and cancer precursors, water quality, exposure assessment

Racial and ethnic disparities between short-term increases in ambient PM2.5 concentrations and temperature with stillbirth among Medicaid enrollees

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BACKGROUND AND AIM: Studies examining the association between prenatal exposure to ambient fine particulate matter (PM2.5), temperature and stillbirth risk in the US typically focus on long-term (e.g. trimester) rather than short-term (e.g. days, weeks) exposures. Racial/ethnic heterogeneity in the effect of short-term increases in PM2.5 or temperature on stillbirth have also been understudied. METHOD: Within the Medicaid Analytic eXtract (MAX) dataset, 118,632 stillbirths from 2000-2014 were linked to zip code-level average daily outdoor PM2.5 concentration and temperature. A time-stratified, case-crossover design using a distributed lag non-linear model (0 to 6-day lag) estimated the odds of stillbirth associated with increases in exposures, with an index date set at two days prior to the stillbirth date of diagnosis. Disparities in the association by maternal race/ethnicity (Black, White, Hispanic, Asian, American Indian) and median household income were assessed. RESULTS:A 10 µg/m³ increase in average daily PM2.5 concentration was associated with increased odds of stillbirth on the index date (lag 0) (1.10% (95%CI:[0.22,1.98]) through lag 3 (0.45% 95%CI:[0.01,0.89]) and over the entire lag period (lag 0-6) (3.17% 95%CI:[0.07,6.37]). The temperature-adjusted odds of stillbirth due to PM2.5 from lag 0 to 4 days and lag 0-6 days was higher among Black individuals (lag 0-6: 9.31% 95%CI:[3.45,15.51]) than White individuals (lag 0-6: -2.75% 95%CI:[-8.43,3.29]). Within the lowest income zip codes, a stronger association existed with PM2.5 among Black mothers (e.g. lag 0-6: 14.13% (95%CI:[4.51,24.65]) compared with White mothers (e.g. lag 0-6: 2.88% 95%CI:[-8.26,15.38]). A 1°C temperature increase was not associated with stillbirth risk.

CONCLUSIONS: Short-term increases in PM2.5 exposures were associated with stillbirth among Medicaid recipients, particularly Black enrollees. Racial/ethnic minorities are more vulnerable to environmental exposures exacerbated by climate change.

Keywords: PM2.5, temperature, stillbirth, case-crossover, short-term exposure

Put your money where gas stoves fit: Household air pollution measurements in sub-Saharan Africa to prioritize locations for cooking intervention

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BACKGROUND AND AIM:Cleaner cooking fuels like liquefied petroleum gas (LPG) emit less fine particulate matter (PM2.5) and carbon monoxide (CO) than polluting fuels (e.g. wood, charcoal). Yet, some clean cooking interventions have not achieved substantial exposure reductions. METHOD:The CLEAN-Air(Africa) study measured 24-hour PM2.5 and CO kitchen concentrations (n=262), female cook (n=223) and child (n=119) exposures in peri-urban Kenya, Ghana and Cameroon among households cooking primarily with LPG, wood or charcoal. Stove use monitoring was used to derive mean 'cooking' and 'non-cooking' PM2.5 and CO levels.

RESULTS:The mean 24-hour PM2.5 kitchen concentration among households cooking with charcoal (317 µg/m3) was quintuple that among households using LPG (61 µg/m3) in Kenya, but only 2 µg/m3 higher in Ghana (56 versus 54 µg/m3, respectively). The mean CO kitchen concentration in households cooking with charcoal was twice the WHO guideline (7 ppm) in Kenya (15.81 ppm) but below the guideline in Ghana (1.77 ppm). The mean PM2.5 kitchen concentration among households using wood in Cameroon was four times higher while cooking (811 µg/m3) than not cooking (202 µg/m3). Among households using charcoal in Ghana, the mean PM2.5 kitchen concentration was lower when cooking (42 µg/m3) than not cooking (67 µg/m3). Mean PM2.5 cook exposures only met the WHO interim-1 target (35 µg/m3) among LPG users staying indoors and living >10 minutes from a road.

CONCLUSIONS: Clean cooking interventions should be prioritized in certain sub-Saharan African communities to increase the likelihood of PM2.5 exposure reductions and associated health benefits.

Short-term increases in NO2 and O3 concentrations and odds of stillbirth among U.S. Medicaid enrollees: A time-stratified casecrossover study

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BACKGROUND AND AIM:Few national studies have assessed the relationship between short-term (i.e. day, week) increases in gaseous pollutant (nitrogen dioxide (NO2), ozone (O3)) concentrations and stillbirth risk in the US. National racial and ethnic disparities in the association between short-term increases in gaseous pollutant concentrations and stillbirth have also not been investigated. METHOD:Within the Medicaid Analytic eXtract (MAX) dataset, 114,799 stillbirths from 2000-2014 were linked to zip code-level average daily outdoor NO2 and O3 concentrations. We used a time-stratified, case-crossover design to compare NO2 and O3 exposures on the case day with those the same weekday within the calendar month. A distributed lag non-linear model was used to estimate the distributed (lag0-lag6) and cumulative odds of stillbirth due to short-term increases in NO2 and O3 exposures, controlling for PM2.5 concentrations and temperature (individual-level confounders controlled by design). We explored effect modification by race/ethnicity (Black, White, Hispanic, Asian, American Indian).

RESULTS:Nationally, a short-term, 10 ppb increase in NO2 (lag0-6: -0.88 95%CI:[-2.43%,0.70%]) and 10 ppm increase in O3 concentration (lag0-6: -0.21 95%CI:[-1.35%,0.94%]) were not associated with stillbirth odds. Among American Indians, each 10 ppb increase in lag0-lag6 cumulative average daily NO2 exposure was not statistically significantly associated with odds of stillbirth (7.12% 95%CI:[-9.83%,27.27%]; however, a significant association was found at lag0 (5.66% 95%CI:[0.57%,11.01%]) and lag1 (4.08% 95%CI:[0.22%,8.09%]), with the risk declining from lag0 to lag6 days. No national-level associations were found for NO2 concentrations among other racial and

ethnic groups, nor for short-term increases in O3 concentrations. CONCLUSIONS:No associations between short-term increases in gaseous pollutant concentrations and stillbirth were found at a national level. However, there was suggestive evidence of an association between short-term, single-day increases in NO2 concentrations and stillbirth risk among American Indian Medicaid recipients, highlighting the importance of further evaluating sources of NO2 pollution in this population. **EP-100[Exposures » Microplastics]**

A comprehensive approach to determine routes of human exposures to micro and nanoplastics in water and health effects

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BACKGROUND AND AIM: To present a comprehensive approach for conducting a systematic review (1990-2022) to determine routes of human exposures to micro and nanoplastics (M-NPs) in water and assess the potential health effects.

METHOD: We registered our protocol in PROSPERO. Searching eight databases resulted in 6,472 scientific publications. Using Covidence, we eliminated duplicates, completed screening 6,417 titles and abstracts (stage 1) and reviewing 744 full texts (stage 2), and are finishing data extraction (stage 3) of 253 publications. We developed the inclusion criteria and reasons for exclusion for stages 1 and 2, and templates for data extraction and quality assessment for stage 3. To ensure transparency and produce reliable summaries of scientific knowledge, the inclusion of publications at each stage required that two reviewers, working independently, arrive at the same agreement.

RESULTS:Publications selected for data extraction cover areas showing our comprehensive approach to better understand (1) how M-NPs reach freshwater systems, drinking water treatment plants, tap and bottled water, (2) the potential routes of human exposures to M-NPs in water, and (3) the advances in determining the effects of M-NPs on human cells at laboratory scale. Preliminary findings confirm that methods for sampling, sample preparation, M-NPs isolation, size and shape determination, and characterization are not standardized despite authors recommending this need since mid-2010s.

CONCLUSIONS:Recently, researchers found M-NPs in blood and lungs confirming human exposure to M-NPs, though exposure routes remain unproven. Those findings elevated the importance of human exposures to M-NPs as a public health and environmental epidemiology issue. In the water field, hazard identification, exposure assessment, and dose-response assessment will require the sound determination of human exposures to M-NPs. Thus, standardizing methods for sampling, sample preparation, and full M-NPs characterization remains urgent. We expect that our findings will contribute with efforts researchers are conducting to address this public health challenge.

Keywords: exposures, microplastics, environmental epidemiology, water quality

Association of water arsenic and uranium exposures with incident diabetes in Indigenous US communities: The Strong Heart Study

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BACKGROUND AND AIM: In the United States (US), type 2 diabetes (T2D) affects approximately 37.3 million people (11.3% of the population), with the highest burden in American Indian communities. Toxic metal exposures have been identified as risk factors of T2D. Most studies rely on biomarkers, which could be affected by early disease processes. Studies directly measuring metals in drinking water in US populations have been limited. We examined the association of arsenic and uranium exposures in community water systems (CWS) and private wells with T2D incidence in American Indian communities to address current limitations in direct associations between metal exposures and T2D.

METHOD: We evaluated adults in the Strong Heart Family Study (SHFS) free of T2D at baseline (2001-2004) and followed through 2010, with available water arsenic (N=1,737) and uranium (N=1,559) estimates assigned by residential zip code. We used mixed effects Cox models to account for clustering by family and residential zip code, modeling the association between log-transformed arsenic and uranium per linear and non-linear (restricted cubic splines) interquartile range (IQR) change and the risk of T2D. We also assessed cross-sectional associations between water arsenic and uranium levels and prevalent prediabetes at baseline.

RESULTS:T2D incidence in the SHFS was 13.5% (mean follow-up 5.6 years). After adjustment for sex, education, smoking status, body mass index, and estimated glomerular filtration rate, the hazard ratio (95% CI) of incident diabetes excluding prediabetes was 1.06 (1.02, 1.10) and 1.30 (0.79, 2.14) comparing 75th vs. 25th percentiles of private well and CWS arsenic, respectively. Public water and private well uranium were not associated with incident T2D, however private well uranium was associated with prevalent prediabetes (odds ratio = 1.28 (1.02, 1.59)).

CONCLUSIONS: Water arsenic levels were associated with T2D incidence and prediabetes prevalence. Water uranium was associated with pre-diabetes but not with incident diabetes.

Keywords: environmental epidemiology, water quality, cardiovascular diseases

EP-102[Exposure assessment methods » Exposure assessment-general]

Construction of a scale to assess multidimensional vulnerability to pesticides in horticultural production in the Food Region of Córdoba

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BACKGROUND AND AIM: To identify and validate dimensions for the construction of a Socio-sanitary Vulnerability Scale (SVS) as an input for integrated pesticide surveillance in the horticultural context of the Food Region of Córdoba (FRC).

METHOD:A cross-sectional correlational observational study was carried out. Living conditions, work and exposure to pesticides of horticulturists of the FRC (n=198) in the period 2019-2020 were surveyed. Variables were identified in 4 dimensions (D) to address aspects linked to vulnerability in the horticultural context: D1 occupational exposure to pesticides (use of personal protective equipment); D2 tracer health events (presence of symptoms, diseases and self-reported accidents); D3 housing conditions (availability of basic services -water, electricity, drainage, sanitation-); D4 material conditions of horticultural production (land tenure, type of machinery and agricultural tools). The variables that make up each dimension were selected from the application of principal component factor analysis, including those with loadings greater than 0.40 in the first factor. To evaluate the reliability of the dimensions, Cronbach's a coefficient was applied, considering a score greater than 0.70 to be adequate. Stata 16 was used.

RESULTS: The set of dimensions (D1, D2, D3, D4) obtained a total score of 0.72 on Cronbach's a for the 19 items. The individual score for the constructed scale was at D1 a=0.79; D2 a=0.73; D3, a=0.76 and D4 a=0.71.

CONCLUSIONS: The SVS promises to be a robust method for conducting epidemiological surveillance in the horticultural context, its multidimensional nature will allow addressing the complexity of exposure to pesticides It is planned in later stages the evaluation through a panel of experts in the subject for the confection of the EVS.

Keywords: Pesticides, Vulnerability, Exposure, Horticulture

Realtime personal exposure and dosimetry assessment in susceptible population

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BACKGROUND AND AIM:Personal exposure to fine particle is reported to be determined by the concentration of Micro-environment and time of residence at each location. Therefore, information on time-based places of residence is considered an essential factor in estimating time-weighted exposure to personal pollutants. Exposure at the same concentration and time is an important part of exposure assessment because the intensity of exposure varies according to changes in breathing depending on individual activities. Therefore, a personal exposure assessment is required that considers the correlation between pollutants, micro-environment, exposure period, and activity intensity that can reflect the life style of receptors.

METHOD:In this study, personal exposure assessment was conducted by selecting cohort-based susceptible groups to check the amount of fine particle exposure. A total of 60 personal exposure assessments were conducted with 20 residents living in the industrial complex, 20 people with circulatory diseases, and 20 people with respiratory diseases. We conducted an exposure assessment for 5 days per person to collect environmental exposure information and wrote a daily activity diary by hand whenever the subject moved in space to identify the Micro-environment according to the time. The fine particle measurement used AIR HEART-P21, a light scattering portable device. Individual activity measurements were recommended to wear an accelerometer around the waist and were not worn during showers and bedtime. Based on the measured fine particle concentration(μ g/m³) and activity intensity, the daily exposure amount(μ g/day) was calculated through the correlation of respiration rate(m³/hr) in the Korean exposure factors handbook.

RESULTS: The average fine particle daily exposure for all subjects was 110 μ g/day, and the average fine particle daily exposure for each cohort was 132 μ g/day for industrial complexes, 118 μ g/day for circulatory diseases, and 81 μ g/day for respiratory diseases.

CONCLUSIONS: The results of higher exposure were shown in the order of industrial complex, circulatory, and respiratory system subjects.

Keywords: Air pollution, Particulate matter

EP-104[Exposures » Environmental disparities]

Quality of Place: A Measurement Model

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BACKGROUND AND AIM: Neighborhood social, economic, built, and physical environmental features are often correlated with each other. For example, neighborhoods with lower incomes and higher poverty rates may also have fewer community resources and more exposure to environmental hazards such as air pollution. Similarly, neighborhoods with higher rates of crime may also have poorly maintained buildings and streets, as well as limited access to healthy food options and other amenities. These environmental factors can have negative impacts on physical and mental health, social well-being, and economic outcomes. That said, the relationships among different place features may be complex. On the one hand, poverty is often associated with limited access to green spaces, including parks. On the other hand, access to green spaces is also linked to air pollution because, in many cities, parks are located near major roadways, which can lead to exposure to higher levels of traffic-related air pollutants. And how these structural, physical, and built environmental features related to social and organizational features at the place level are largely unknown. These different aspects of "place quality" have only been studied in fragmentation. The purpose of this study is to 1) compile a fuller list of place-based data in the United States to comprehensively measure place social, built, and physical environmental features; 2) examine their correlations to identify the constituent elements of place quality that are conceptually coherent and empirically clustered; and 3) investigate the associations between the quality of place with racial and economic segregation to test the "environmental justice" framework.

METHOD: We will use data from the 2010 US census and a range of open sources and employ both traditional statistical methods and big data methods to examine our research questions. RESULTS: We haven't completed data analysis here.

CONCLUSIONS: Will add here and finish a complete manuscript before the meeting.

Keywords: concentrated disadvantage, segregation, social capital, air pollution, build environment

EP-105[Air pollution » Particulate matter]

Long-term Exposure to Particulate Matter and Mortality between General Population and Cancer Patients in South Korea

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BACKGROUND AND AIM: Exposure to particulate matter (PM) has been reported as a major environmental hazard to human health. Although many studies found the associations with mortality and its susceptibility in patients with diabetes and heart diseases, few studies paid attention to cancer. The aim of this study is to compare the associations between long-term exposure to PM with all-cause and cause-specific mortality for the general population to those for cancer patients and survivors in the Seoul Metropolitan Area, South Korea, using a population-based cohort.

METHOD:Using the National Health Insurance Services-National Sample cohort, we selected the subjects who received health screening during 2005-2007, had full address information, and were aged 30-80 without severe disability. We defined cause-specific mortality based on the International Classification of Disease, 10th reversion. Individual-level long-term PM concentrations were estimated for the previous 5 years from each year for 2002-2015 by a previously-developed prediction model. We performed time-dependent Cox proportional hazards model to estimate hazard ratios (HRs) and 95% confidence intervals per 10 ug/m3 increase in PM2.5 and PM10 adjusting for sociodemographic characteristics, family history of cancer, and health behaviors.

RESULTS:Our study population of 91,017 adults include 90,092 people without cancer for 2002-2006 and 925 cancer patients and survivors. We observed significant or marginal associations with all-cause and cardiopulmonary mortality for the general population (PM2.5: HR=1.22-1.56; PM10:1.05-1.19), but no associations for cancer patients and survivors (PM2.5: HR=1.11-1.32; PM10: 0.90-1.01). Although HRs for cancer and lung cancer mortality were not statistically significant, cancer patients and survivors showed higher HRs than the general population.

CONCLUSIONS:Our findings for cancer patients and survivals suggest the susceptibility of PM effect for cancer mortality but not for total and cardiopulmonary mortality. Future studies using an extended population should re-examine the association.

Keywords: Particulate matter, Mortality

Receptor-based aggregate exposure estimation for children's personal care and cosmetic products in Korea

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BACKGROUND AND AIM:To manage the risk of consumer chemical exposure, realistic exposure estimation through aggregate exposure from multiple consumer products are considered. Accurate aggregate exposure assessment should be based on individual's exposure factors. Due to children's product usage patterns are strongly related to the demographic characteristics, receptor-based aggregate exposure assessment is required. The aim of this study was to estimate aggregate exposure of parabens in multiple personal care and cosmetic products (PCCPs) by Korean children. METHOD:We collected exposure factors of 11 PCCPs (shampoo, body wash, soap, hand wash, body lotion, body oil, baby powder, sunscreen, lip care, nail makeup, and lip makeup) by face-to-face interviews. The survey was conducted to 20,000 households with children aged 0-12 years in twice, July to October 2017 and February to March 2018. The number of subjects was determined by proportional quota sampling based on the children's gender, age, and region distribution. Aggregate exposures were calculated for methyl-, ethyl-, propyl- and butyl- paraben according to individuals' exposure factor response and simultaneous PCCPs use. Children's

RESULTS:PCCPs use rates were ranged 7.5-98.7% for 11 products. Average number of simultaneous PCCPs use was 5.45 ± 1.43 . A worst-case exposure (0.4% parabens to each PCCPs) estimated aggregate exposures of paraben for 13.3 µg/kg-bw/day to 95th percentile population. Total 0.18% of population (36 users) exceeded 5 mg/kg-bw/day of paraben. Total 0.02% of population exceeded exposure safety level of 10 mg/kg-bw/day for methyl- and ethyl-paraben. The PCCPs with highest contribution was lotion.

CONCLUSIONS: These aggregate exposure data would be useful input data for risk assessment and regulation of parabens in PCCPs for children.

Keywords: aggregate exposure, personal care products, cosmetics, children, paraben

Challenges when estimating the environmental burden of disease for children in Germany

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BACKGROUND AND AIM:In most European countries, children are a comparably healthy population. However, long-term environmental exposures, even at lower levels, starting early in life or even before birth can negatively impact children's health. Our aim was to estimate the environmental burden of disease (EBD) attributable to a selected set of environmental risk factors for children aged 3 to 17 years in Germany.

METHOD:Using the EBD approach we estimated various health indicators such as disability-adjusted life years for the selected environmental risk factors. Current exposure and health data for children were derived from the fifth population-representative German Environmental Survey (GerES V 2014-2017).

RESULTS:Quantifications were performed for 5 out of 18 risk factors: secondhand smoke, Bisphenol A, traffic noise, benzene and particulate matter. One limitation was that we hardly could use the GerES V data for the assessments, because for several risk factors, the measured exposure levels were too low and thus would not result in any quantifiable disease burden. However, it does not mean, that the identified concentrations were generally uncritical. Though, it was challenging to combine exposure-response functions identified by systematic literature searches with the survey data. For traffic noise and particulate matter, we used other exposure data, even though they did not only focus on children but on the general population.

CONCLUSIONS: The EBD method needs several input data, which are not readily available for children in Germany hampering a comprehensive overview of their EBD.

Keywords: Environmental epidemiology, Exposure assessment, Risk assessment

EP-108[Chemical exposures » Pesticides]

The situation of agricultural pesticide use and its human health hazards in Iran, A qualitative study

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BACKGROUND AND AIM: Agricultural pesticide poisoning is a common and serious occupational hazard for farmers in developing countries. In this study we try to explain the pattern of agricultural pesticide use and its hazards in Iran.

METHOD:In this qualitative study, purposeful sampling was performed, and 8 farmers and 2 agriculture engineers participated in this study. Semi-structured in-depth interviews were used to collect information. Then, qualitative theme analysis was performed.

RESULTS: Information collected about the situation of pesticide use in Iran, was categorized in four themes. First, "No supervision on the use and distribution of pesticides". Second, "Farmers' knowledge is inadequate about the hazard of pesticides and no organization is responsible for educating them". Third "Safety instructions are not obeyed and the hazardous effects of pesticides are frequently observed among farmers". Fourth, "The use of pesticides is irrationally high in Iran". CONCLUSIONS: Serious action should be taken to prevent the human health hazards of pesticides in Iran, including comprehensive training programs about proper preparation, storage and use of agricultural pesticides for farmers and pesticide retailers. Also, it is necessary to continuously supervise pesticide sales, distribution and use in the country.

Keywords: Pesticides, Policy and Practice, Occupational Exposures

The ascending trend of Valley Fever in El Paso, TX, and its association with regional climate and atmospheric factors

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BACKGROUND AND AIM: This study aimed to assess the trend of reported human Coccidioidomycosis (Valley Fever -VF) cases and determine the association between weather variables and the incidence of VF in El Paso, Texas, from 2023-2022. Many studies associate the incidence of valley fever in the southwest US with weather and climate variables.

METHOD: We collected incidence data of Coccidioidomycosis cases from the City of El Paso Notifiable Conditions Report from 2013 until 2022. Weather data, including monthly precipitation total, minimum monthly temperature, average monthly temperature, and maximum monthly temperature, was downloaded from the National Weather Services website. The incidence data were summarized in descriptive tables. A trend analysis was performed using a three-month centered moving average method corresponding to the duration of each season, complemented with a linear regression analysis. In addition, correlation tests were performed between the monthly weather variables and the count of Coccidioidomycosis per month, with lags up to 18 months.

RESULTS:During this time, 246 valley fever cases were recorded in the El Paso region. The numbers were higher in July and August and in summer and spring. The disease trend has increased ($R^2 = 0.5497$), with an apparent bi-yearly seasonality effect. The number of positive cases of VF after four months' lag was inversely related to total monthly precipitation (r=-0.204, p=0.028) and directly related to maximum monthly temperature (r=0.184, p=0.046) after one month's lag. No other significant correlation was observed.

CONCLUSIONS: There is a current and significant rising trend in the incidence of VF in the El Paso, TX region. Climate variables such as temperature and precipitation are likely to affect the incidence of VF in the El Paso region; however, more investigation is needed. Moreover, promoting increased community and healthcare provider awareness of this infection remains a crucial responsibility for public health officials.

Keywords: Climate, Infectious diseases, Particulate matter, Temperature

Lead and Mercury untrauterine exposure and Birth weight: Birth cohort in an urban área -PIPA UFRJ

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BACKGROUND AND AIM: This study aimed to evaluate prenatal exposure to lead and mercury and their effects on birth weight.

METHOD: The study population consisted of newborns delivered at the maternity-school of UFRJ between June 2021 and July 2022. A total of 750 newborns were included. Mothers' characteristics were obtained through a questionnaire applied at pregnancy third trimester. Lead and Mercury were mesured at umbilical cord blood samples. Pearson correlation was used to assess the correlation between lead and mercury levels. Birth weight was evaluated based on adequacy for gestational age. The reference values (RV) considered for lead and mercury exposure were 3.5 µg/dL and 5.0 µg/L, respectively. The effects were measured using risk ratio (RR) and hypothesis tests.

RESULTS: The detection rate for lead and Mercury were 98.9% and 94.5%, respectvely. 2.4% (18) of the newborns had lead blood levels above RV, and 2.3% for Hg. Lead and mercury concentrations showed a significant positive correlation (r = 0.16, p = 0.000). Babies with mercury levels above the median for the study population ($0.8 \mu g/dL$) had a 3.5 times higher risk of having lead levels above the reference value for this metal (p = 0.025). Babies with lead levels above the median had a twofold higher risk compared to those with lead levels below the median (RR = 1.9, p = 0.05) of being big for gestational age (BGA). When comparing lead concentrations above the reference value, the risk ratio was 3.9 (p = 0.005). Mercury did not show an association when the cut-off was the reference value; for mercury levels above the median, the risk ratio was 1.55 (p = 0.25). Baby gender, maternal diabetes, and body mass index were considered confounding factors. CONCLUSIONS:Higher lead concentrations were associated with an increased risk of being big for

CONCLUSIONS: Higher lead concentrations were associated with an increased risk of being big for gestational age.

Keywords: Metals exposure, metal mixture, environmental pollutants, birth weight, Birth outcomes

Childhood and Environmental Pollutants Project (PIPA UFRJ): Retention Strategies in a Birth cohort

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BACKGROUND AND AIM:A Birth Cohort is an opportunity of pollutants concentrations measurement at different biological matrix and clinical and subclinical effects follow up at the first cycle of life. The PIPA-UFRJ project is a longitudinal study that follow children from pregnancy to 4 years old to access the environmental pollutants effects on fetal and childhood development. AIM: To describe steps, retention strategies and study progress.

METHOD: The study included babies born at UFRJ-maternity-school, which mothers had >16years old and lived at Rio de Janeiro city. Metals, organochlorine, pyrethroids and PFOAS were analyzed at mother and baby's samples. Outcomes: Birth, weight gain and other anthropometric outcomes, respiratory, allergic and neurodevelopment. The planning and execution stages and strategies used for recruitment and retention at follow-up were described.

RESULTS:The cohort recruited was accomplished from June 2021 to July 2022 and adherence rate was 80%. 907 pregnant and 844 babies were recruited. 865 (94%) blood samples and 824 (89%) urine samples from pregnant, and 792 (94%) umbilical cord blood samples were collected. So far, 86% of the babies have been returned at least one of the following periods (3rd, 6th, or 1st year) and 50% had returned at the 3 moments. 846 Breast milk samples were collected (3rd and 6th month); 1580 baby urine (3rd, 6th, and 1st). Strategies: Involvement of the institution's professionals in sample collection, with prior and ongoing training. With the mothers: welcome visit to the birth in the ward, help with transport and snacks for the day of follow-up, small whatsapp groups of mothers, telephone contact to accompany the baby and simulation of appointments; Active search of families via local health unit; creation of a council of families to define strategies for approaching.

CONCLUSIONS: The study has a good adherence rate >80% and retention >86% at the end of the 1st year of follow-up.

Keywords: Birth Cohort, Environmental pollutants, Birth and pregnancy outcomes, Methodological study design

Bisphenol A and Cancer: A critical review of the epidemiologic literature for hazard assessment

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BACKGROUND AND AIM:Bisphenol A (BPA) is a high production volume chemical with extensive consumer and industrial applications. BPA is detected in the majority of the US general population, despite a short half-life (< 6 hours) and declining exposures. We comprehensively reviewed the epidemiologic literature on the carcinogenicity of BPA and key considerations of exposure characterization needed to interpret these studies.

METHOD: Multiple biomedical databases were searched until March 2023 for peer-reviewed publications on BPA exposure and human cancer. Eighty-three records were identified. All analytical epidemiologic studies were included (38 studies). Study quality evaluation included a detailed bias assessment, using principles of systematic review. PRISMA guidelines were followed. RESULTS: Potential for information bias posed the greatest challenge for interpreting the human cancer studies. Reliably characterizing long-term BPA exposure was limited by use of short-term biomarkers that reflect recent exposure and lack of longitudinal measurements to characterize temporal variation. Urinary BPA was measured at a single time point, post-diagnosis in most studies; limitations were reverse causation and inability to capture the time window of susceptibility. Past BPA exposure estimated via questionnaire or job exposure matrix in few studies were also limited. For most cancers, only one study was available, with the exception of the thyroid, lung, colorectum, prostate (\leq 3 studies each), and breast (13 studies). For breast cancer, the associations with BPA were inconsistent. CONCLUSIONS: The epidemiologic evidence was inadequate to evaluate the carcinogenicity of BPA. Limitations included unreliable estimation of long-term BPA exposure, few studies by cancer site, lack of consistency, and low exposures because all studies were conducted in the general population. Therefore additional studies are warranted, particularly in workers highly exposed to BPA, ideally with prospective and longitudinal collection of quantitative exposure data as well as sufficient follow-up for cancer morbidity or acute endpoints in established mechanisms of carcinogenesis.

Keywords: Cancer and cancer precursors, Phenols, Environmental epidemiology, Biomarkers of exposure, Risk assessment

The association between greenery type and gut microbiome in schizophrenia: Did all greenspaces play the equivalent role?

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BACKGROUND AND AIM: In recent years, attention has been focused on the benefit of greenspace on mental health, and it is suggested this link may vary with the type of greenery. As more and more studies highlighting the influence of the gut microbiome on SCZ, however, the effect of greenspace on SCZ gut microbiome and further the effect of different greenery types on gut microbiome remain unclear. We aim to examine if there were variations in the effects of various greenery types on the gut microbiome in SCZ. Besides, we sink to explore important taxonomic compositions associated with different greenery types.

METHOD: We recruited 243 objects with schizophrenia from Anhui Mental Health Center and collected fecal samples for 16S rRNA sequencing. Three types of greenery coverage were calculated with different circular buffers (800 m, 1500 m, 3000 m) corresponding to individual addresses. The association between greenspace and microbiome composition was analyzed with permutational analysis of variance (PERMANOVA). We conducted the linear regression to capture specific gut microbiome taxa associated with greenery coverage.

RESULTS:Tree coverage was consistently associated with microbial composition in both 1500 m (R2=0.007, P=0.030) and 3000 m (R2=0.007, P=0.039). In contrast, there was no association with grass cover in any of the buffer zones. In the regression analysis, higher tree coverage was significantly correlated with the relative abundance of several taxa. Among them, tree coverage was positively associated with increased Bifidobacterium-longum (β =1.069, 95% CI: 0.419-1.720), which was the dominant composition in the gut microbiota.

CONCLUSIONS: The relationship between greenspace and gut microbiome in schizophrenia patients differed by type. Besides, "tree coverage" may present a dominant effect on the important taxonomic composition. Our findings might provide instructive evidence for the design of urban greenspace to optimize health and well-being in SCZ as well as the whole people.

Keywords: Green space, Microbiome, Biodiversity

Environmental and biological monitoring: Risk assessment for arsenic exposure through groundwater in a rural community of Uruguay

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BACKGROUND AND AIM: Arsenic in drinking water is a major health issue affecting millions of people across the world. Arsenic is a well-known human carcinogen, and dietary exposure has been proven to be the major source's pathway to the human body. General population exposure to inorganic arsenic mostly occurs through the consumption of groundwater. Those sources of drinking water often have measurable arsenic levels and several regions of Uruguay have shown naturally higher levels than the WHO's maximum recommended value.

To assess human health risks, the concentration of toxicologically relevant arsenic species in urine has often served as a biomarker that indicates recent exposure to inorganic arsenic considering that urine is the main route of excretion.

This work aims to assess human exposure to inorganic arsenic through groundwater in a population in a rural area near the town of San Antonio

METHOD: The studied area is a rural region with 1650 inhabitants. 33 local families were visited, and the owners were asked to voluntarily participate in a survey providing groundwater and urine samples. The survey consisted of personal interviews and recorded relevant data such as average liters of water consumption per family, food intake, along with personal.

47 urine and 33 drinking groundwater samples were later refrigerated and brought to the laboratory for arsenic determination using HG- MIP-OES.

RESULTS:Results in drinking water showed more than 97% of analyzed samples with higher levels of arsenic than WHO's guidelines.

Urine toxicologically relevant arsenic species concentrations results ranged from non-detect levels to 70.5μ g/L which were correlated by Spearman's correlation coefficient (r=0.35,p-Value=0.03) and reflect current exposure to this contaminant in groundwater, can be considered of moderately to highly human health risks.

CONCLUSIONS: Consequently, these urinary arsenic levels, should be monitored in this, an others rural areas in future environmental health surveillance programs, which are not yet implemented in Uruguay.

Keywords: Biomarkers of exposure, Exposure assessment, Water quality, Risk assessment, Heavy metals

EP-115[Other » Other (to be specified with keywords in the keywords section)]

A case for perinatal natural photoperiod in the developmental origins of health and disease

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BACKGROUND AND AIM:Light, and in particular daylight, is the key synchronising agent ("zeitgeber") for the temporal organisation of physiology, acting via the circadian timing system. Given the breadth of physiological co-governance by this system (incl. endocrine, metabolic, immunologic, growth and repair, sle

EP-wake, genetic regulation – and in all cells), it is not surprising that perturbation of this system is linked with various chronic diseases. The time-of-year (month/season) of birth has also long been associated with various chronic diseases, in studies all across the globe. The natural daily photoperiod – important for circadian timing systems and health – is a ubiquitous factor that varies by time-of-year and latitude and in a completely predictable manner (resolution to a day). Experiments in animal models demonstrate the impact of different perinatal light-dark zeitgeber paradigms on physiology and health, including on various working parts of the circadian timing system.

METHOD: We assessed perinatal natural photoperiod metric associations with cancer, diabetes, cardiovascular disease, depression, and chronotype (a circadian timing system marker) in later-life in humans. These studies were conducted using the International Childhood Cancer Cohort Consortium (I4C) and the UK Biobank with study participants from across the globe. Perinatal natural photoperiod metrics were determined using time-of-year of birth and latitude.

RESULTS: Signals of association with all outcomes studied were observed for average daily photoperiod in the 3rd trimester of pregnancy and for the range of daily photoperiods experienced in this time window relative to the average daily photoperiod.

CONCLUSIONS: Although size and direction of effects varied by outcome, associations were consistently observed and association with chronotype is compatible with the hypothesized mechanism of action (i.e., via the circadian timing system). Further studies are, of course, needed, but the case for a role of natural photoperiod in the developmental origins of health and disease is growing.

Keywords: Light pollution, Obesity and metabolic disorders, Mental health outcomes, Cancer and cancer precursors, Cardiovascular diseases

Establishing prediction model for psychosocial and environmental risk of postpartum depression

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BACKGROUND AND AIM:Postpartum depression (PPD) is a common and serious mental health problem for postpartum mothers. Although some modeling mechanism of PPD has been developed in recent three years, the impact of environmental exposure factors such as air pollution has not been included. Therefore, the study aims to development machine learning algorithm for predicting PPD including not only social psychological but also environmental exposure factors.

METHOD: Taiwan Birth Cohort Study recruited nationally representative participants, as a result of approximately 12% of all deliveries in 2005 using multistage stratified sampling. PPD was inquired when their child was six months of age by face-to-face interview. Exposure to air pollution of mothers during perinatal periods was estimated using hybrid kriging/land-use regression model based on residential address. Including the possible psychosocial predictors, a framework of data extraction and classification, processing, and machine learning was implemented to enable future PPD risk prediction. RESULTS: The best-performing model uses data from the demographic characteristics, baby's condition, household factors as well as air pollution concentration during perinatal periods. Area under the receiver operating characteristic curve increased from 0.65 by generalized logistic model to 0.97 and 0.81 in the development and validation datasets by bootstrap forest model. In the best performing machine learning algorithm, exposure to PM2.5 during pregnancy remained an important predictor for PPD.

CONCLUSIONS: Machine learning provides the ability to identify women at risk of PPD. In the algorithms, air pollution exhibits non-negligible impact on PPD compared with other risk factors. The results may contribute to scalable prevention and interventions, reducing negative psychological outcomes.

Keywords: postpartum depression, machine learning, air pollution

Increased risk for cancer mortality observed among female hairdressers in Brazil, 1996 -2020

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BACKGROUND AND AIM: Hairdressers are classified by the International Agency for Research on Cancer as occupation exposed to probable carcinogens to humans (Group 2A) for lung and bladder cancer, but evidence is accumulating on associations with other cancers, such as oral cavity, stomach, breast, non-Hodgkin lymphoma (NHL), and leukemia. However, evidence on health effects among Brazilian hairdressers is scarce. To better inform tailored cancer actions, we compared cancer mortality rates among hairdressers and the general population in Brazil.

METHOD: Exploratory and comparative study on sex-specific mortality ratio of cancer and other causes, among hairdressers and 'other workers' (as reference group), aged from 20-70y, with identifiable occupation, and notified on the Brazilian Mortality Information System from 1996-2020. Sociodemographic characteristics and mortality ratio of different types of cancer were compared. Crude Odds Ratio (OR), and adjusted (ORADJ) for age, educational level, and ethnicity are presented with 95% confidence intervals (CI).

RESULTS:From 1996-2020, 23,557 deaths by cancer (as primary cause) among hairdressers, and 13,332,996 among all other workers (excluding hairdressers) were notified in Brazil. Hairdressers' deaths were significantly higher among women, at younger ages, with white skin color, and with completed high school than other workers. Female hairdressers had significantly higher odds of dying from cancer of digestive, respiratory, reproductive, urinary and hematological system, both in crude and adjusted models. We highlight high ORADJ of dying for lung (1.58, 95% CI 1.42-1.75) and bladder cancer (1.74, 95% CI 1.20-2.52), alongside breast cancer (1.51, 95% CI 1.41-1.63) and acute myeloid leukemia (AML) (1.37, 95% CI 1.06-1.77). Odds of dying from liver, lymphoid leukemia, and acute lymphoid leukemia (ALL) lost significance after adjustments.

CONCLUSIONS: Higher mortality from several types of cancer among hairdressers has been observed in the Brazilian mortality system, and causal associations, such as exposures to chemicals, should be investigated by epidemiological studies.

Keywords: Occupational exposures, cancer and cancer-precursors, mortality, chemical exposures

EP-118[Air pollution » Particulate matter]

Outdoor ultrafine particulate matter and risk of lung cancer in the Los Angeles Ultrafine PM Study

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BACKGROUND AND AIM: Fine particulate matter (PM2.5, <2 μ m in diameter) is an established cause of lung cancer, but it is unclear whether ultrafine PM (<0.1 μ m), a key PM2.5 component, contributes to risk. Our objective was to investigate the U

FP-lung cancer association overall and by histologic subtype.

METHOD: The Los Angeles Ultrafine PM Study includes 45,660 participants aged 50+ in Southern California at enrollment (1995-1996) followed through 2011 for incident lung cancer (N=1,285). We estimated historical residential ultrafine PM concentrations via land use regression and backextrapolation. We estimated total and sex-specific associations between 10-year lagged UFP (per 10,000 particles/cm3) and lung cancer overall and by histologic subtype (adenocarcinoma, squamous cell carcinoma, small cell carcinoma) in Cox models adjusted for smoking and other confounders, adjusting for PM2.5 concentrations (Spearman's rho=0.52) as a model covariate and in crossclassified analyses. We evaluated relationships by smoking status, birth cohort, and historical duration at the residence.

RESULTS:Ultrafine PM exposure was associated with a non-significantly increased risk of lung cancer (hazard ratio [HR]=1.02 per 10,000 particles/cm3;95% CI [0.96-1.08]). Risk of adenocarcinoma was significantly elevated among men (HR=1.10 [1.00-1.20]); but not women (p-interaction=0.04). A nonsignificant association for adenocarcinoma was apparent in never-smoking (HR=1.15 [0.92-1.43]) and former smoking (HR=1.10 [0.99-1.23]) men, but weaker in current smoking men (HR=1.05 [0.86-1.28]; p-interaction>0.05). Associations were strongest among men born in 1925-1930 (HR=1.14 [1.01-1.27]; p-interaction=0.03) and with \geq 10 years residential duration (HR=1.14 [1.01-1.30]; p-interaction=0.03). We observed no significant relationships for women or other disease subtypes. Patterns were consistent when adjusting for PM2.5 and ultrafine PM associations were stronger when PM2.5 levels were low (<median) versus high (\geq median).

CONCLUSIONS: Ambient UFP exposure may increase the risk of lung adenocarcinoma among men, with historical exposures contributing more than levels in recent decades. Further investigation of the disparity in findings by sex is warranted.

Keywords: Air pollution, ultrafine particulate matter, long-term exposure, lung cancer

Geographic patterns in wildfire exposures and county-level lung cancer mortality in the United States

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BACKGROUND AND AIM: Emissions from wildland fire plumes are composed of modified biomass combustion by-products, including carcinogens. However, studies of the association between wildland fire exposures and lung cancer are scant. We evaluated geographic patterns in these exposures and lung cancer mortality to explore possible associations.

METHOD: We extracted historical fire (wildfires and prescribed burns) information and satellite imagery for the conterminous U.S. from the Monitoring Trends in Burn Severity program (1984-2001). We derived two county-level fire exposure metrics: 1) ratio between total burned area and county area, and 2) fire density (events/100 km2). Age-adjusted, sex-specific lung cancer mortality rates at the county level for two 5-year periods (2011-2015 and 2016-2020) were obtained from the National Center for Health Statistics. Lee's L statistic for bivariate spatial association was used to identify geographic patterns with significant associations between fire exposures and lung cancer mortality rates.

RESULTS:There were over 6,100 wildland fires (67% were wildfires) and 7,650,000 km2 burned area during the exposure period, with most activity in the Western U.S. states and Florida. Among females, we observed clusters of counties where the areal-based ratio metric and lung cancer mortality rates (2011-2015) were both high across eastern Kentucky (n=17 counties, p-values: 0.009-0.03), southwestern West Virginia (n=9, p-values: 0.009-0.01), and Florida (n=17, p-values: 0.009-0.03). Among western counties, greater fire exposure was associated with lower lung cancer mortality (n=47, p-values: 0.009-0.03). These patterns were consistent among men, by time period, and for fire density. Our findings differed from recently published lung cancer mortality clusters associated with smoking prevalence.

CONCLUSIONS:Our novel analysis identified U.S. counties where wildfires might contribute to lung cancer mortality; the inverse association in some Western counties may be due to chance and requires additional investigation. Studies with individual-level exposure-response assessments are needed to further evaluate this relationship.

Keywords: air pollution, wildfires, cancer and cancer precursors, mortality

Impact of the central London Ultra-Low Emission Zone and toxicity-charge on adult emergency hospital admissions: An interrupted time series analysis

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BACKGROUND AND AIM: The Ultra-Low Emission Zone (ULEZ) was introduced in central London, UK, in April 2019, replacing the less stringent toxicity-charge, dating from October 2017. These interventions have led to substantial air quality improvements, but limited evidence exists on their impact on health. We aimed to assess these interventions' impact on emergency hospital admissions due to cardiovascular disease, respiratory disease, and all non-accidental causes ('all-cause'), using a controlled interrupted time series (cITS) approach.

METHOD: National routine data on emergency hospital admissions for adult (\geq 15 years) residents of the ULEZ and a control area of London were used to identify cause-specific admissions (cardiovascular: primary ICD-10 code I00-I99, respiratory: J00-J99, all-cause: A00-R99) between 6 January 2014 and 1 March 2020. cITS analysis used segmented negative binomial regression, modelling the outcomes as weekly age/sex-standardised rates, adjusting for temperature, relative humidity, month, and public holidays. Temporal autocorrelation was accounted for using Newey-West standard errors. The estimands of interest were trend changes in rates between pre- and postintervention periods, with changes in the intervention area adjusted for those in the control area. The toxicity-charge and ULEZ were modelled both as separate interventions and in combination. RESULTS: There were trend reductions in age and sex-standardised cardiovascular (-0.19% per week, [95%CI: -0.07%, -0.31%]) and all-cause (-0.10% [-0.05%, -0.15%]) emergency admission rates in the ULEZ relative to the control area when a single intervention point was modelled at the toxicitycharge start, and larger reductions for the ULEZ start (cardiovascular: -0.38% [-0.07%, -0.68%], allcause: -0.18% [-0.04%, -0.32%]). Respiratory admissions showed no statistically significant trend change relative to the control area (toxicity-charge: -0.05% [-0.15%, +0.05%]). CONCLUSIONS: These results indicate that the ULEZ/T-charge is associated with reductions in airpollution-related emergency hospital admissions, particularly those due to cardiovascular disease. Further analysis with alternative control areas would be valuable to further test the robustness of these results.

Keywords: Environmental epidemiology, Policy, Respiratory outcomes, Cardiovascular diseases.

Multiple pathways mediate the residential greenspace morphology and triglyceride risk: implications for climate change

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BACKGROUND AND AIM:Long recognized as the link between greenspaces, an essential component of a healthy city, and cardiovascular risk factors, but little is known about how Greenpeace morphology affects triglyceride risk.

METHOD: We included 106238 locals between the ages of 35 and 75 based on the Cardiovascular Disease Screening Cohort in Anhui Province, China. The greenspace morphology was calculated using high-resolution land cover data for 2020 from the World Cover Database, and triglyceride as an outcome. Multiple linear regression model and structural equation model were used to evaluate relationships between greenspace morphology and triglyceride risk and to investigate the potential role of fine particulate matter (PM2.5) and heat waves in the association, respectively.

RESULTS:Overall, in residential environmental characteristic exposure, triglyceride was expected to increase by 0.046% (95% CI: 0.040%, 0.052%) with a 1% increase in the percentage of built-up while decrease by 0.270% (95% CI: 0.202%, 0.337%) in the percentage of greenspace. Furthermore, the shape, connectedness, and aggregation of greenspace were inversely correlated with triglyceride when the total greenspace was maintained, lowering to 0.605% (95% CI: 0.198%, 1.012%), 0.031% (95% CI: 0.022%, 0.039%), and 0.049% (95% CI: 0.039%, 0.058%), respectively. Likewise, the protective effect of the shape index was higher than that of the total amount of greenspace. The stratification results showed that urban residents benefited more from greenspace exposure. Greenspace morphology can minimize triglyceride risk by reducing pollution and heat waves, with aggregation having the greatest effect on reducing pollutants whereas fragmentation is more efficient at reducing heatwaves.

CONCLUSIONS: Exposure to the greenspaces morphology is associated with a reduction in triglyceride risk. The study has important practical and policy implications for early health monitoring and the spatial layout of greenspace, and will provide scientific information for healthy urban planning by reducing unfavorable health consequences.

Keywords: Green space, Environmental epidemiology, Risk assessment, Built environment, Air pollution

Association of arsenic exposure with diabetes and insulin resistance in Chinese adults: China National Human Biomonitoring (CNHBM)

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BACKGROUND AND AIM:Previous findings about the association between low-to-moderate arsenic (As) exposure and diabetes are inconsistent. Population heterogeneity and creatinine adjustment methods may contribute for discrepancies across studies. This study aims to evaluate the associations of low-to-moderate As exposure with diabetes and insulin resistance (IR) in a representative sample of Chinese adults and in different subgroups using the covariate-adjusted standardization method to correct urine dilution.

METHOD: Based on 2017-2018 China National Human Biomonitoring (CNHBM), we conducted a crosssectional analysis and a case-control study. 10,510 participants were included in the cross-sectional analysis and 972 participants were included in the case-control study with 489 with diabetes and 483 controls. Urinary total As (TAs) were analyzed as As exposure and homeostatic model assessment of insulin resistance (HOMA-IR) was calculated. Generalized linear mixed models and RCS models were used to assess the association of TAs levels with diabetes prevalence and HOMA-IR.

RESULTS:Of the cross-sectional population, the weighted median (interquartile range) concentrations of creatinine-corrected TAs was 19.52 μ g/L (11.36-36.61 μ g/L) and the weighted prevalence of diabetes was 10.80%. The fully adjusted OR (95%CI) of diabetes prevalence for an interquartile range increase in the In-transformed TAs was 1.15 (1.06, 1.24) in the cross-sectional analysis and 1.25 (1.06, 1.46) in the case-control study. TAs was positively associated with HOMA-IR. Compared with those in the lowest quartile, HOMA-IR of participants in the fourth quartiles of TAs increased by 2.14 (95% Cis: 0.57, 3.70). RCS models showed a positive and linear association between TAs and diabetes. The association between TAs and diabetes varied by residence area with a greater association in urban residents (P values for the interaction was 0.017).

CONCLUSIONS:TAs was positively associated with diabetes prevalence and HOMA-IR in the Chinese adults. Population residing in urban area may have increased susceptibility to As-related diabetes in China.

Keywords: Biomonitoring, Urinary arsenic, Diabetes, Insulin resistance

Exposure to DDE and BMI among adolescents in the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) Study

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BACKGROUND AND AIM:Dichlorodiphenyldichloroethylene (DDE) is considered an obesogen, as it can alter the individual's susceptibility to develop obesity. Bariatric surgery is effective in reducing weight among adolescents with obesity. However, the mechanisms that lead to variations in the rate of weight loss post-bariatric surgery remain unknown and could be due to environmental exposure to DDE. We aimed to assess the impact of different levels of exposure to 4,4-DDE on body mass index (BMI) and waist circumference in a cohort of adolescents up to 5 years after bariatric surgery. METHOD:We included 63 participants from 5 time points from the prospective multi-center Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) cohort. Exposure was measured in visceral adipose tissue (vAT) collected at the time of surgery and categorized into tertiles (low $\leq 14ng/g$, moderate 14 to 21ng/g, and high $\geq 21ng/g$). We constructed longitudinal linear regression models to assess the interaction between exposure and time since surgery, with a random intercept for participant and a linear spline with a single knot at one year, adjusted for sex, age, race, and parents' income.

RESULTS:We found a dose-response relationship, with the low exposure group having a greater reduction in BMI during the first year after bariatric surgery compared to both the moderate and high exposure groups (6.12 kg/m², 95%CI 0.62 to 12.85, and 4.38 kg/m², 95%CI 2.69 to 11.46, respectively). BMI increased after the first year, with patients exposed to lower levels of DDE showing a smaller increase compared to those in the higher exposure group (9.82 kg/m², 95%CI 3.16 to 16.49 for moderate, and 3.40 kg/m², 95%CI -3.74 to 10.53 for high exposure group). We observed a similar pattern between exposure to 4,4-DDE and waist circumference.
CONCLUSIONS:Our findings suggest that exposure to 4,4-DDE could contribute to differences in weight trajectory following bariatric surgery among adolescents.

Keywords: Obesity and metabolic disorders, Environmental epidemiology, Children's environmental health

Association between Blood Cadmium Concentrations and Dyslipidemia among Older Adults: A Cross-sectional Study

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BACKGROUND AND AIM:Dyslipidemia, defined as abnormal lipid levels, constitutes a significant risk factor for the development of cardiovascular disease (CVD), increasing the likelihood of atherosclerosis and related cardiovascular events. Cadmium, a toxic heavy metal, can enter the human body through various channels such as air, water, and soil, accumulate within bodily tissues, and jeopardize human health. The present study aims to explore the association between blood cadmium concentrations and dyslipidemia in the older population.

METHOD:A cross-sectional study was conducted among 3,326 elderly participants in Zhejiang, China. Whole blood levels of cadmium were measured using inductively coupled plasma mass spectrometry (ICP-MS). Dyslipidemia events were defined based on total cholesterol (TC), triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) levels. Multivariable logistic regression analysis was employed to assess the association between cadmium levels and dyslipidemia.

RESULTS: The prevalence of dyslipidemia among the older population in China was found to be 36.49%. In logistic regression models, blood cadmium levels showed a positive correlation with dyslipidemia. When compared to the lowest quartile of blood cadmium, the odds ratio (OR) of dyslipidemia in the highest quartile was 1.30 (95% confidence interval, CI: 1.04, 1.64) after adjusting for multiple covariates.

CONCLUSIONS: The whole blood level of cadmium exhibited a significant association with the risk of dyslipidemia in the older Chinese population. This finding emphasizes the importance of monitoring and controlling environmental exposure to heavy metals and improve cardiovascular health.

Keywords: Cardiovascular diseases, Epidemiology.

Cancer risk from occupational cosmic radiation exposure in flight attendants: A systematic review and meta-analysis

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BACKGROUND AND AIM:Cosmic radiation is an occupational risk factor for flight attendants (consisting of pilots and cabin crew), and recent studies of flight attendants have reported risk for several individual cancer types. However, the findings of these studies are inconsistent and evidence of risk at low dose radiation which is considered as the exposure level of flight attendants remains unclear. This study aims to establish the risk of cosmic radiation exposure for cancer in flight attendants based on summarizing studies published to date.

METHOD: We conducted a search of articles through PubMed and EMBASE with a predefined search strategy. The search terms included flight attendant terms, cosmic radiation terms, and cancer terms. We selected articles that met our inclusion criteria through a screening of titles and abstracts, as well as full-text reviews. In addition, a meta-analysis was performed to evaluate quantitative synthesis assessment for cancer risks from the articles.

RESULTS:Of the 9,242 articles retrieved (3,466 in PubMed and 5,776 in EMBASE), a total of 50 studies matched our inclusion criteria, excluding 2,935 duplicates. The standardized incidence or mortality ratios (SIR or SMR) were presented in 33 articles, and most of the studies were conducted in Europe (63.6%). The pooled-SIR for all cancers was 0.84 (95% CI 0.81 to 0.87), and the pooled-SMR for all cancers was 0.78 (95% CI 0.75 to 0.80), which was significantly lower than that of the reference groups. In individual sites of cancer, the pooled-estimates of breast cancer (SIR=1.42), melanoma (SIR=1.40, SMR=1.53), and leukemia (SIR=1.37) were significantly higher than that of the reference groups.

CONCLUSIONS: The pooled-estimates for all cancers were significantly decreased, indicating a possible healthy worker effect. For a better understanding of increased pooled-estimates in several cancer sites, an in-depth review is required with consideration of various risk factors (e.g., shift work, socioeconomic status) and cosmic radiation doses.

Keywords: Cosmic radiation, Cancer, Occupational exposure, Flight attendant, Meta-analysis

Children of Conflict - Paired Surveys and Interactive Exercise focused on Violence Against Youth

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BACKGROUND AND AIM: Violence endures as a global problem. This study was designed to evaluate the incidence and experiences of violence involving youth in the Eastern Caribbean federation of St. Kitts-Nevis (SKN)

METHOD:Data was derived via surveys on interpersonal violence (IPV) and Violence Against Young Women and Girls (VAYWG) as well as an interactive exercise where respondents shared perspectives on conflict. Fifty (50) youths were recruited throughout November 2022.

RESULTS:Per the IPV survey, approximately 87.5% of respondents identified as Black and 90% achieved a high school certificate. While most had never had a physical altercation (54%), 9 out of 10 respondents recently witnessed at least one physical fight. Approximately 30% experienced physical abuse by a relative. Anger was perceived as a main driver for physical (42%) and verbal (67%) assaults. Substance use was not a major promulgator of physical (19%) and verbal (25%) conflicts. Many confrontations (44%) were attributed to miscommunication. Only half of the approximately 13% of respondents who reported physical injuries sought medical care. At least 80% of participants expressed feelings of fear, anger, stress, anxiety, or depression. Per the VAYWG survey, parents, friends, classmates, strangers, and bus operators are among the most common perpetrators of various forms of conflict. Young women and girls were reported to be 6.5 and 6.7 times more likely than their male counterparts to be verbally accosted by a bus driver and a stranger, respectively. Participants (n=29) of the interactive exercise reported that trust issues, poverty, excessive corporal punishment, sexism, and homophobia to be major factors driving violent conflicts. All participants agreed that these factors should be addressed.

CONCLUSIONS: Incidents of IPV including VAYWG continue to impact Eastern Caribbean youth. While widely acknowledged and frequently experienced by minors and young adults, sustained solutions are yet to be determined. Resolutions require nuanced, data-driven interventions.

Keywords: Children's environmental health, Community-engaged research, Mental health outcomes, Socio-economic factors, Tropical health

Prenatal heat stress and birth outcomes in predominantly rural central Ghana

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BACKGROUND AND AIM: Climate change is increasing exposures to higher ambient temperatures, particularly in rural developing communities where people have limited access to indoor cooling. We aimed to examine associations between prenatal heat and birth outcomes in rural Ghana. METHOD: We leveraged the Ghana Randomized Air Pollution and Health Study (GRAPHS) prenatal cohort recruited from 35 rural communities in the Bono East Region of Ghana between 2013-2015. We assigned prenatal heat stress from conception to delivery using weekly averages of satellite-derived daily Wet Bulb Globe Temperature (WBGT) estimates corresponding to the community of each participant. We performed multivariable regression with average WBGT over pregnancy and trimester (TM) specific averages included in the same model to understand associations with birth weight, length, head circumference, and small-for-gestational-age (SGA).

RESULTS:1,173 pregnant individuals with delivery > 28 weeks were available for analysis. Weekly prenatal WBGT averages in the cohort ranged from 22.7-30.8°C. Extreme heat events (WBGT >30°C) have been occurring with increasing frequency and 82% of the participants experienced > 1 extreme heat event in pregnancy. Higher average WBGT in the second TM was associated with lower mean birth weight (β = -36.5 g, 95% CI: -72.9, -0.2) and birth length (β = -0.32 cm, 95% CI: -0.61, -0.02) with third TM exposure suggestive of reductions, although not reaching statistical significance. Higher average WBGT across gestation, and in first and third TMs, were associated with increased head circumference, possibly a head sparing effect. No significant associations with SGA or LBW were identified.

CONCLUSIONS:We demonstrate impacts of heat stress on newborn anthropometrics in this rural Ghanaian population where the range of temperatures is relatively narrow. Given the link between size at birth and future disease, it is critical to better understand how rising global temperatures impacts newborn health, and more importantly, identify interventions to mitigate these effects.

EP-128[Air pollution » Particle components]

Spatial variation of PM2.5 component concentrations in 23 Tokyo wards

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BACKGROUND AND AIM:In the general environment, concentrations of particulate matter with an aerodynamic diameter of less than 2.5 μ m (PM2.5) show wide spatial homogeneity. However, we do not have evidence of whether the same pattern applies to the PM2.5 components. In particular, within big cities, such as Tokyo, with diverse pollutant sources, we cannot ignore the possibility that there are spatial variabilities of PM2.5 component concentrations. In this study, we examined the spatial variation of PM2.5 mass and its component concentrations in 23 Tokyo wards.

METHOD:In the fiscal year of 2021 (April 2021 to March 2022), Aerosol Chemical Speciation Analyzer (ACSA-14, Kimoto electric co. Ltd) was set and continuously measured total PM2.5 mass concentrations and its component concentrations at three monitoring sites (Ota-ku in the western part, Chiyoda-ku in the central part, and Koto-ku in the eastern part) within the 23 Tokyo wards. Our measured components included black carbon (BC), water-soluble organic compounds (WSOC), nitrate, and sulphate. We estimated daily mean concentrations of total mass and each component, and summarised the data.

RESULTS:During the study period, daily mean total PM2.5 mass concentrations were 9.9 (standard deviation = 5.0) μ g/m3 at Ota-ku, 9.7 (4.9) μ g/m3 at Chiyoda-ku, and 9.5 (4.8) μ g/m3 at Koto-ku, and the average Pearson's correlation coefficients between two sites were 0.95. Strong correlations were also observed among the each component concentration at three sites (correlation coefficients = 0.86 for OBC, 0.94 for WSOC, 0.95 for nitrate, and 0.95 for sulphate).

CONCLUSIONS: Within 23 Tokyo wards, the spatial homogeneous assumption of PM2.5 components seemed to be generally valid.

Acknowledgements

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Keywords: fine particle, chemical element, spatial variation

EP-129[Omics technologies » Metabolomics]

Revealing the association between metabolic pattern and heat stress exposure in farmers by nuclear magnetic resonance

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BACKGROUND AND AIM:During the global warming era, heat stress exposure becomes a more severe problem for heavy physical labor, especially combined with physical exertion and inadequate hydration. The literature has revealed that heat stress can cause unknown etiology of chronic kidney disease due to the susceptibility of the kidney. This study aims to explore the metabolic effects of heat stress and correlate it with chronic kidney disease in farmers.

METHOD: Farmers were recruited as the heat exposure group based on prolonged physical labor, and non-farmers were recruited as the control group. The participant urine samples were collected and analyzed by nuclear magnetic resonance (NMR) by metabolomics. Then, the multivariate analysis will be conducted after spectral data processing to determine the variation in the metabolome between farmers and non-farmers.

RESULTS: The 114 subjects who were 40 to 65 years old were recruited from Yunlin Christian Hospital in our project. Numerous urinary metabolites were shown in the NMR spectrum. Metabolome variation between farmers and non-farmers is not significant. Later, adjusting for confounders such as job category, dehydration, and age will be conducted in addition to the typical multivariate analysis used in metabolomics studies.

CONCLUSIONS: As global temperatures continue to rise and extreme heat events become more frequent and intense, the adverse health effects of heat stress on farmers are expected to worsen in the coming years. This study intends to discover molecular events of heat stress in the highly exposed population. The information may suggest potential health effects and provide molecular information for early diagnosis.

Keywords: Metabolomics, Environmental epidemiology, Temperature

Air pollution might impede ALT normalization in chronic hepatitis B patients treated with nucleotide/nucleoside analog

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BACKGROUND AND AIM: The biochemical response is an important indicator of prognosis in chronic hepatitis B (CHB) patients receiving nucleotide/nucleoside analogues (NAs). The effects of air pollution in alanine aminotransferase (ALT) normalization were elusive.

METHOD: The longitudinal study recruited 80 CHB patients with hepatitis B e-antigen (HBeAg) negative who received NAs. ALT levels were examined at the first year of anti-HBV therapy. Normal ALT was defined as <19 U/L for females and <30 U/L for males, and the risk factors associated with ALT abnormality were analysed.

RESULTS:Sixteen patients (20.0%) with baseline ALT >40 U/L and 41 patients (51.6%) were ALT abnormal (>19 U/L for females and >30 U/L for males). After 1-year NAs therapy, 75 patients (93.8%) had undetectable HBV DNA. Post-treatment ALT levels significantly decreased, compared to the pre-treatment levels (21.3 U/L vs 30.0 U/L, respectively; P < 0.001). The proportion of patients with normal ALT was also significantly higher after treatment, compared to the pre-treatment status of patients (71.2% vs 51.2%, respectively; P = 0.001). The strongest factor associated with ALT abnormality after first year treatment with NAs was body mass index (BMI) (odds ratio[OR]/95% confidence interval[CI]: 1.28/1.05-1.54; P=0.01). and ozone level (OR/CI: 1.11/1.02-1.22; P=0.02). CONCLUSIONS:Among HBeAg negative CHB patients with relatively low viral load, NAs could improve the ALT level by adjusting the confounding factors. It could also increase the proportion of ALT normalization.

Keywords: NAs, HBV, HBeAg negative, air pollution, ozone

Associations of outdoor air pollution and cancer incidence in a large US prospective cohort

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BACKGROUND AND AIM:Outdoor air pollution and airborne particulate matter (PM) have been classified as Group 1 carcinogens for lung cancer, however evidence for other cancers is limited and the American Cancer Society (ACS) Cancer Prevention Study-II (CPS-II) has focused solely on cancer mortality. This research examined associations of outdoor air pollutants with incidence of a range of cancer subtypes, including less fatal cancers.

METHOD:In the ACS CPS-II Nutrition Cohort, census block-group level annual predictions of PM2.5, PM10, PM10-2.5, NO2, O3, SO2, and CO concentrations were assigned to residential address. Extended Cox regression estimated multivariable-adjusted hazard ratios (HR) and 95% confidence intervals (CI) for associations of pollutant concentrations with risk of any incident cancer and at 21 cancer sites. Air pollution exposure estimates were updated annually during follow-up.

RESULTS:There were 30,959 total cancer cases identified among 108,002 participants followed from 1992-2017. PM2.5 was associated with an increased risk of lung cancer (HR per 4.1 ug/m3=1.05; 95% CI 0.99-1.10). PM10-2.5 (per 5 ug/m3) was associated with higher risks of colon (HR=1.05; 95% CI 1.00-1.11), uterine (HR=1.09; 95% CI 1.01-1.18), and cervical (HR=1.57; 95% CI 1.13-2.16) cancers, as was PM10. Higher NO2 was associated with increased risk of any cancer, but only statistically significantly with lung cancer (HR per 6.3 ppb=1.05; 95% CI 1.01-1.10). SO2 was associated with higher risk of lung and kidney cancer. O3 was associated with increased risk of melanoma. CO was associated with increased risk of any cancer as well as statistically significant associations with melanoma and uterine cancer.

CONCLUSIONS: Consistent with previous literature, multiple outdoor air pollutants were associated with lung cancer. Additionally, we identified novel associations with air pollutants and incidence of several other cancers. These findings suggest a broader impact of air pollutants on cancer risk than has been previously recognized.

Keywords: air pollution, particulate matter, long-term exposure

EP-132[Outcomes » Other (to be specified with keywords in the keywords section)]

Associations Between Maternal Gestational Diabetes and Pubertal Growth in Offspring

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BACKGROUND AND AIM:Maternal gestational diabetes mellitus (GDM) has an adverse impact on children's dysmetabolic trait. Discussion about maternal GDM and children's peripubertal health remains limited. This study aims to determine the association of maternal gestational diabetes mellitus (GDM) and peripubertal growth of offspring.

METHOD: This is a prospective cohort study that enrolled 1,008 mother-infant pairs who received antenatal care at single center from 2010 to 2012. In 2018, children received follow-up study which included bone age, serum sex hormone levels, Tanner stage for breast and testes, and the penile length follow-up. Differences in the outcomes between offspring of mothers with GDM and control subjects were examined using Student's t test and chi-square test. We also used multiple linear and logistic regression models to adjust for maternal pre-gravid BMI, household income, maternal age at delivery, and maternal menarche age.

RESULTS: There were 43 (8.9%) children born from GDM mothers, and 441 (91.1%) in the control group. In girls, there was more advanced bone age in the GDM group (n=19) than the control group (n=205) after adjusting for potential confounding factors (0.48-year, 95% CI=0.005-0.97-year, p=0.048). For boys, the GDM group (n=24) showed no advancement in the bone age compared with the control group (n=236) (-0.13-year, 95% CI= -0.65-0.40). The serum sex hormone levels and secondary sexual characteristics of children in the GDM group were comparable to those in the control group.

CONCLUSIONS: Compared to the control group, girls with mothers diagnosed with GDM showed more advanced bone age at peripubertal stage. We need longer follow-up of consequent health effects during their adolescence.

Keywords: outcomes, Obesity and metabolic disorders

Relationships between urinary uranium and cardiac geometry and left ventricular functioning in the Strong Heart Study

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BACKGROUND AND AIM:Drinking water contaminated with uranium is common in the Western US, particularly in areas near abandoned mines. Uranium is a potentially cardiotoxic non-essential element. Measures of cardiac geometry and function are useful for capturing risk, early-detection, and progression to clinical cardiovascular disease outcomes. We leveraged urinary uranium measures in Strong Heart Study participants from the Great Plains and the Southwest to investigate their association with measures of cardiac geometry and functioning in young adults.

METHOD:Urinary uranium was measured among participants free of diabetes, cardiovascular disease, and <50 years old at baseline (2001-2003). Transthoracic echocardiography and blood pressure was assessed at baseline and follow-up (2006-2009). We estimated mean differences in measures of cardiac geometry and function at baseline and follow-up using linear mixed effect models with random intercept and slope over time, accounting for family clustering.

RESULTS:Participants' mean (SD) age was 30.8 (10.4) years; 39.3% were male. Median (IQR) uranium levels were 0.029 (0.045) µg/g creatinine. At baseline, a 2-fold increase in urinary uranium was positively associated with left ventricular (LV) mass index (mean difference: 0.49, 95% CI: 0.07-0.92), left atrial systolic diameter (0.02, 0.01-0.03), and stroke volume (0.66, 0.25-1.08) after adjustment for age, sex, smoking status, urinary arsenic, body mass index and other cardiovascular risk factors. At follow-up, uranium was associated with increases in left atrial diameter (0.02, 0.01-0.03) and pulse pressure (0.28, 0.05-0.52). Among participants in the highest tertiles of uranium and arsenic, associations were stronger at baseline and follow-up for LV mass (5.23, 2.66-7.81; 4.55, 2.06-7.05), left atrial diameter (0.14, 0.07-0.20; 0.15 0.08-0.21) and stroke volume (5.08, 2.57-7.58; 2.49, 0.12-4.85), respectively.

CONCLUSIONS: Preliminary findings indicate that uranium exposure may be associated with measures of cardiac geometry and left ventricular functioning in the Strong Heart Study. Future analyses should determine the potential long-term clinical cardiovascular effects of uranium exposure.

Keywords: Environmental epidemiology, chemical exposures, cardiovascular diseases

Selenium Status and DNA methylation in the Strong Heart Family Study

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BACKGROUND AND AIM:Selenium (Se) is a naturally occurring metalloid found in rocks and soils throughout the United States and is an essential element for several antioxidant-related pathways. However, Se is potentially linked to elevated diabetes risk at high concentrations. The mechanisms behind these relationships remain unknown and there is a need to identify mechanistic biomarkers of Se exposure to identify individuals at risk. We performed an epigenome wide association study to investigate the relationship between Se exposure and DNA methylation (DNAm) in a population of American Indian participants with high diabetes risk.

METHOD:Urinary Se was measured in the baseline exam (2001-2003) of the Strong Heart Family Study (n=2325), a prospective study of cardiovascular disease among American Indian communities in Arizona, Oklahoma, North Dakota and South Dakota. Se was analyzed by inductively coupled plasma mass spectrometry. Blood DNAm was measured using the Illumina MethylationEPIC BeadChip Array at baseline. Epigenome-wide robust linear regressions (limma) and an elastic net regression approach (glmnet) were performed to select differentially methylated CpG sites associated with Se. Gene ontology enrichment analysis was performed using gometh.

RESULTS: Among 1,357 participants free of diabetes at baseline, the mean (SD) age was 55.4 (8.0) years and 58.2% were female. The median (SD) concentration of Se was 51.81 (25.13) μ g/g creatinine. Across 788,368 CpG sites, 490 sites were retained in the elastic net approach and one site (cg00163554) was significantly associated with Se after accounting for multiple comparisons in linear regression (Bonferroni p-value: 0.0044). This site was annotated to the DIP2C gene. Enrichment analysis did not yield any overrepresented gene ontology terms.

CONCLUSIONS: Preliminary findings indicate that urinary Se may be associated with specific changes in DNAm in a sample of American Indians. Future analyses should replicate these findings in an external cohort and investigate the mediating role of differentially methylated CpG-associated sites with diabetes.

Keywords: Environmental epidemiology, biomarkers of exposure

EP-135[Neurologic and mental health outcomes » Mental health outcomes]

Risk factors associated with transient and persistent anxiety among pregnant women in Shanghai, China

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BACKGROUND AND AIM: Chronic or persistent anxiety (PA) over the course of pregnancy may lead to adverse maternal and infant outcomes. Several studies have investigated the potential contributing factors to transient anxiety (TA) at one point in pregnancy, but little is known about PA. This study aimed to identify the risk factors for TA and PA during pregnancy.

METHOD:Pregnant women with no history of mental illness were recruited from 2016 to 2021 based on a Shanghai sub-cohort of the China National Birth Cohort study (CNBC). Structured survey interviews were conducted in early pregnancy to collect the socio-demographic information, obstetrical and physical health status, and lifestyle factors. The Zung Self-Rating Anxiety Scale (SAS) was used to assess the anxiety status of pregnant women and their partners during each trimester. Separate logistic regression models were performed to identify risk factors for TA (SAS scores \geq 50 for only one trimester) and PA (SAS scores \geq 50 for at least two trimesters).

RESULTS:The prevalence of TA and PA among the total of 3456 pregnant women was 12% (n=421) and 4.2% (n=146), respectively. Logistic regression showed that younger age, poor physical health, low intake of vegetables, and poor sleep quality were the common factors strongly associated with TA and PA in pregnancy. Additionally, a low intake of milk (OR = 1.314, 95% CI: 1.034 - 1.677) was the exclusive predictor of TA. Self-pay medical insurance (OR = 1.757, 95% CI: 1.063 - 2.815) and partner anxiety (OR = 1.053, 95% CI: 1.029 - 1.076) were unique predictor of PA.

CONCLUSIONS: Poor physical health, partner anxiety, and some socio-demographic (e.g. age and medical insurance) and lifestyle (e.g. diet and sleep) factors may play important roles in TA or PA during pregnancy. Identification of these risk factors may guide the development of early intervention strategies.

Keywords: Epidemiology, Socio-economic factors, Food/nutrition

Climate warming and chronic diseases burden: direct gradient between heat wave annual frequency and mortality by cerebrovascular events in Argentina

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BACKGROUND AND AIM: Climate warming is generating new challenges in health, and little is known about its effect on chronic diseases. The aim of this study is to characterize the spatio-temporal pattern of heat waves in the central area of Argentina in the last decades and to assess the association of heat wave frequency with mortality from cerebrovascular disease (CD). METHOD:A longitudinal study with an ecological design (2005-2019; n=26 geographical units) was conducted in Córdoba, Argentina. Data from the European Climate data service were processed to build a 30-year time series of daily Maximum air temperature. Heat waves were identified annually (National Meteorological Service definition). From official mortality data, annual crude mortality rates were estimated for CD (CIE-10 I60-I69). An autoregressive order 2 Poisson regression model was fitted, using CD mortality rates as the outcome, and annual frequency of heat waves (0-7, 8-19, \geq 20), urban scale (big cities/middle-sized or small cities/towns) and socioeconomic stratum, as covariates. RESULTS: Aggregated spatial patterns of heat waves were identified, their frequency ranging from 0 to 25 annually. An increasing trend in the annual number of heat waves was observed over the studied period. The intermediate and higher categories of heat waves showed a direct effect with a clear gradient on CD mortality rates in women (OR 1.01; p<0.047 and OR 1.04; p<0.001, respectively). In males and females, a higher urbanization level (vs. towns) was associated inversely with CD mortality, while an intermediate urbanization level showed increased CD mortality rates. CONCLUSIONS: The spatial and temporal patterns of heat waves were neither homogeneous nor constant. The effect of heat waves on CD mortality is evident only in women, perhaps given their longer life expectancy, considering that age is a vulnerability factor against climatic events. Funding: FONCyT; Grant PICT-2019-04594.

Keywords: Climate, Environmental epidemiology, Temperature variability, Cardiovascular diseases, Mortality

Associations between air pollution exposure and gait speed in older women: partial mediation by structural brain atrophy

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BACKGROUND AND AIM:Decreased physical performance, especially slowed gait speed, is associated with increased risks of disability and mortality. Cortical thickness (CT) of brain regions important for sensory, motor, and cognitive functions is implicated in gait speed. Late-life air pollution exposure is associated with poorer physical functioning and may exert neurotoxic effects on CT. Here we examined whether and how much of the adverse impact of exposure on gait speed was mediated by reduced CT in older adults.

METHOD: We conducted a cohort study of community-dwelling cognitively-unimpaired women (n=484; aged 71-87) from the Women's Health Initiative Memory Study who had a brain MRI scan in 2005-6 and timed walk assessed in 2012-13. We estimated monthly PM_{2.5} and NO₂ exposures at residential locations using regionalized universal kriging models and aggregated to 3-year averages before MRI scan. Gait speed was calculated as the distance (3 or 4 meters) walked divided by the seconds used. Brain scans were processed using FreeSurfer-v.5.3.0 to estimate CT in 34 bilateral regions parcellated with the Desikan-Killiany atlas. Structural Equation Models were constructed to examine mediation effects of each CT on the association between exposure and gait speed, adjusting for sociodemographic, lifestyle, and clinical covariates, and random effects for scanner manufacturers. RESULTS:Women exposed to higher PM_{2.5} and NO₂ had slower gait speed (β PM_{2.5}=-0.072 per

 3.19μ g/m³, p<0.001; β NO₂=-0.058 per 6.64ppb, p=0.001), equivalent to 4.2 and 3.6 years of aging, respectively. The largest mediation effects were observed in precentral, paracentral, superior frontal, and middle temporal gyri (all p<0.01), mediating 13.9-19.3% of total PM_{2.5} effect and 19.8-29.6% of total NO₂ effect. The remaining direct associations between exposure and gait speed remained statistically significant.

CONCLUSIONS: In cognitively-unimpaired older women, higher exposures to PM_{2.5} and NO₂ were associated with slower gait speed - relationships partially mediated by the lower CT in the frontal lobe, especially the motor cortex.

Keywords: environmental epidemiology, gait speed, cortical thickness, partial mediation

Residential Greenness Cover and Risk of Psychiatric Hospital Admission among US residents

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BACKGROUND AND AIM: Earlier evidence has indicated potential mental health benefits from exposure to greenness. However, much evidence was generated from studies of certain age groups as well as in cities. In addition, most of them focused on milder outcome measures, such as mental symptoms. Little is known about whether it also protects more severe outcomes, such as psychiatric hospitalization. In this study, we aimed to estimate the associations between residential greenness exposure and risk of psychiatric hospitalization among US residents.

METHOD:Psychiatric hospital admissions were extracted from the Health Cost and Utilization Project State Inpatient Databases, covering 14 US states (Arizona, Colorado, Delaware, Georgia, Kentucky, Maryland, Michigan, North Carolina, New Jersey, New York, Rhode Islands, Vermont, Washington, and Wisconsin). We applied zero-inflated negative binomial regressions to obtain relative risk (RR) of total psychiatric hospitalization associated with increases in residential exposure to greenness, as measured by Normalized Difference Vegetation Index (NDVI). NDVI was divided into quartiles before modeling with higher quartiles indicating higher greenness cover. The analysis covered all-age residents in the included states over 2000-2019 and a total of 10,801 unique ZIP code areas with population over 100. Models were adjusted for temperature, precipitation, sunlight, admission year and state, and neighborhood contextual backgrounds.

RESULTS:Over the study period and among the covered areas, we identified 7,256,308 admissions due to psychiatric disorders. Using quartile 1 as reference, NDVI quartile 2, 3, 4 were associated with an outcome RR of 0.90 (95% CI, 0.88-0.92), 0.95 (95% CI, 0.93-0.97), 1.09 (95% CI, 1.07-1.12) respectively. The protective associations were stronger among more urbanized areas and certain states.

CONCLUSIONS: The study suggests that living in areas with moderately higher levels of green space may be associated with mental health benefits among US residents, including reduced risk of psychiatric hospital admissions as observed. This work was supported by NIH P30 ES000002.

Keywords: Long-term exposure, Mental health outcomes, Green space

Impact of fine particulate matter on latent tuberculosis infection and active tuberculosis in older adults:a population-based multicentre cohort study

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BACKGROUND AND AIM: Evidence showed that air pollution was associated with an increased risk of tuberculosis (TB), an infectious disease caused by bacillus Mycobacterium tuberculosis (MTB). However, the associations of air pollution with latent TB infection (LTBI) and subsequent active TB development have not yet been investigated to date. This study aimed to study the impact of long-term exposure to ambient particulate matter with an aerodynamic diameter less than 2.5 μ m (PM2.5) on the acquisition of LTBI and on the risk of subsequent active disease development among rural older adults from a multicentre cohort.

METHOD:A total of 4789 older adults were included in a population-based, multicenter, prospective cohort study (LATENTTB-NSTM) from 2013 to 2018. The level of long-term (1- to 3-year) exposure to PM2.5 for each participant was assessed by aggregating satellite-based estimates at a daily time scale and 1 km resolution. Logistic regression and time-varying Cox proportional hazards models with province-level random intercepts were employed to assess associations of long-term exposures to PM2.5 with the risk of LTBI and subsequent development of active TB, respectively.

RESULTS:Out of 4789 participants, 3283 were LTBI-free at baseline, among whom 2805 completed the one-year follow-up and 127 of them developed newly identified LTBI. No significant associations were identified between long-term exposure to PM2.5 and the risk of LTBI. And among 1506 participants with LTBI at baseline, 30 active TB cases were recorded during the 5-year follow-up. Particularly, an increment of 5 μ g/m3 in 2-year moving averaged PM2.5 was associated with a 42.7% increased risk of active TB (HR = 1.427, 95% CI: 1.073-1.897).

CONCLUSIONS:Our findings suggest that long-term air pollution might be considered as a neglected risk factor for active TB development from LTBI, especially for those living in developing or less-developed areas where the air quality is poor.

Keywords: air pollution, particulate matter, infectious diseases, respiratory outcomes, environmental epidemiology

Association of fine particulate matter constituents and ozone with immunotherapy outcomes among Non-small cell lung cancer patients

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BACKGROUND AND AIM:Short-term or long-term evidence for associations between pollutants and immunotherapy outcomes of non-small cell lung cancer (NSCLC) patients was extensively sparse. We aimed to comprehensively understand the impacts of air pollutants on the progress-free survival (PFS) of the patients, and to explore the key exposure windows of the pollutants.

METHOD: We selected 364 patients who diagnosed with NSCLC and treated with PD-L1 immunotherapy at Beijing Chest Hospital from 2019 to 2022. Concentrations of main PM2.5 constituents (organic matter (OC), black carbon (BC), nitrate (NO3–), sulfate (SO42–), and ammonium (NH4+)) and O3 were estimated using the Tracking Air Pollution in China (TAP) dataset. Multivariate Cox regression models was adopted to estimate the effects of exposure to PM2.5, PM2.5 constituents and O3 across moving-average lags on immunotherapy outcomes for NSCLC. Restricted cubic spline models were used to evaluate potential nonlinear relationships between statistically significant pollutants and outcomes. Stratification analyses were done by sex, age, and PD-L1.

RESULTS:The concentrations of PM2.5, SO42–, NO3–, NH4+, OM, BC, O3 on lag-1y were averaged at 39.7, 6.4, 8.8, 5.5, 9.3, 1.7 and 96.6 µg/m3, respectively. As for BC, OM and O3, significant associations were identified at different exposure time windows. Long-term exposure to BC and OM were associated with a higher risk, with corresponding HRs of 2.31 (1.35, 3.97), 2.66 (1.49, 4.74) observed at lag-1y. The difference is that exposures to O3 significantly elevated risks of adverse outcome of immunotherapy for NSCLC, with HRs of 1.47 (1.01, 2.14) at lag-21d, 1.52 (1.03, 2.26) at lag-1m, and 1.66 (1.08, 2.55) at lag-3m. Monotonic increasing dose-response relationships were observed for the associations of all pollutants with risks of outcomes of immunotherapy for NSCLC. CONCLUSIONS:Our findings suggest that long-term exposures to PM2.5, PM2.5 constituents and Short-term exposure to O3 were positively associated with increased risks of adverse outcome of immunotherapy.

Keywords: Particulate matter, Ozone, cancer and cancer-precursors, survival

Interactive effects of ambient temperature and nitrogen dioxide on childhood asthma in Shanghai - a megacity in China

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BACKGROUND AND AIM: While strong evidence supports adverse effects of non-optimum ambient temperature and nitrogen dioxide (NO₂) on childhood asthma, previous studies rarely considered their interactions or even the potential role of offspring sex. Therefore, we aimed to assess the overall and sex-specific interactive effects of ambient temperature and NO₂ on childhood asthma in Shanghai under the context of climate crisis.

METHOD: This study relied on 16,605 mother-child pairs from the Shanghai Children's Allergy Study. Self-reported questionnaires were used to obtain data on the prevalence of pediatric asthma and covariates such as demographic, socioeconomic, and behavioral characteristics. Environmental data including ambient temperature and NO2 were satellite derived. Binomial generalized linear models with a logit link were carried out to evaluate the association between environmental exposure and children's asthma adjusted for potential confounders, and then stratified by sex.

RESULTS:Mean exposure to ambient temperature and NO2 during three years prior the study was 17.65 °C and 41.27 μ g/m3, respectively. Per unit increment of temperature was associated with an increased odds ratio (OR) of childhood asthma prevalence (1.13, 95% confidence intervals, CI: 1.05, 1.21 in overall; 1.15, 95% CI: 1.05, 1.27 for males) after controlling potential confounders. There was no such association in females. In addition, the NO2-asthma association was only found in the low temperature group (< median value) where an interquartile range increase of NO2 was associated with 22% increased OR (95% CI: 1.06, 1.40) for children's asthma.

CONCLUSIONS:Both ambient temperature and NO2 seemed to be triggers of childhood asthma, together with their interactive effects. Children were more sensitive to NO2 in cold conditions, and males were more venerable to higher temperatures. Further research are warranted, and tailored preventive strategies shall be proposed to protect children's respiratory health.

Keywords: Asthma, children, interactions, nitrogen dioxide, temperature

Ten-year exposures to PM2.5 and NO2 and cancer incidence in American older adults

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BACKGROUND AND AIM: Epidemiologic evidence on air pollution and major cancers other than lung cancer remains largely lacking. We aim to examine simultaneous effects of 10-year exposures to fine particulate matter (PM2.5) and nitrogen dioxide (NO2) on the risks of breast, prostate, colorectal, and endometrial cancer.

METHOD:For each cancer, we constructed a separate cohort among the national Medicare beneficiaries during 2000–2016. For each participant, we required a follow-up of at least 10 years, during which there was no cancer diagnosis. After that, participants were censored at first occurrence of cancer diagnosis, death, or end of study, whichever occurred earliest. We examined additive effects of moving average exposures to PM2.5 and NO2 over the year of diagnosis and previous 2 years, previous 3 to 5 years, and previous 6 to 10 years, predicted using high-resolution spatio-temporal models, on the risk of first cancer diagnosis after 10 years of "cancer-free" follow-up. We used an inverse probability weighting-based additive model to perform analysis, accounting for competing risk of death.

RESULTS: The cohorts included 2.2–6.5 million subjects for different cancers. PM2.5 and NO2 exposures increased absolute risks of colorectal and prostate cancer across the 10-year exposure window: a unit reduction in PM2.5 and NO2 would respectively prevent 705 and 95 colorectal cancers, representing 6.2% and 0.8% of new cases per year within the cohort; a unit reduction in PM2.5 and NO2 would respectively prevent 3.4% and 1.7% of new cases per year within the cohort. Effects were considerably larger at low exposure levels. PM2.5 and NO2 wore not associated with endometrial cancer risk. Evidence supported adverse effects of NO2 on breast cancer risk but was unclear for PM2.5.

CONCLUSIONS:Long-term PM2.5 and NO2 exposures increased colorectal and prostate cancer risks. Substantial benefits of air quality management exist through cancer prevention.

Keywords: Air pollution, Long-term exposure, Cancer and cancer-precursors, Incidence, Methodological study design

Mixture effects of air pollutants and seasonal temperature anomalies on cardiovascular hospitalizations

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BACKGROUND AND AIM:Although emerging evidence suggests that climate change negatively impacts cardiovascular disease (CVD) through pathways involving worsening air quality and abnormal temperature patterns, the joint impacts and relative importance of related exposures are largely lacking. Our goal is to assess mixture effects of chronic exposures to air pollutants and seasonal temperature anomalies on hospitalization risk for CVD among all-age residents in 15 U.S. states during 2000–2016.

METHOD: Using the Health Cost and Utilization Project State Inpatient Databases, we investigated associations between annual exposures to mixtures of major PM2.5 components (sulfate, nitrate, ammonium, organic carbon, and elemental carbon), ozone, nitrogen dioxide (NO2), and fluctuations of seasonal temperature averages and standard deviations on the hospitalization risks for ischemic heart disease, cerebrovascular disease, heart failure, cardiomyopathy, arrhythmia, valvular heart disease, and all of these CVDs combined. For each outcome, we used a generalized weighted guantile sum regression with guasi-Poisson link to examine the cumulative association between the mixture of exposures and hospitalization risk and the contribution of each single exposure to the cumulative association, adjusting for individual- and community-level characteristics as confounders. RESULTS: For the combined CVD, we found that each decile increase in the levels of the mixtures increased hospitalization risk by 7.8% (95% confidence interval: 7.3%, 8.2%). Sulfate, NO2, and nitrate contributed the most to the cumulative association. For individual CVDs, a decile increase in the mixtures was significantly associated with increased hospitalization risks, with point estimates ranging between 6.7%-10.0%. In addition to sulfate, NO2, and nitrate, warmer-than-average summer temperature was another important contributor for most individual CVDs. CONCLUSIONS: Our findings suggested that air pollution and warmer climate jointly increased the risk of cardiovascular hospitalization. Identified air pollutants suggested that combustion of fossil fuels, traffic, and agriculture were the most detrimental sources to cardiovascular health.

Keywords: Air pollution, Mixtures, Climate, Cardiovascular diseases

Exposure to monocyclic aromatic hydrocarbons -BTEX is associated with cardiovascular disease, dyslipidemia and leukocytosis in national US population

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BACKGROUND AND AIM: The evidence of blood benzene, toluene, ethylbenzene, and xylenes (BTEX) on cardiovascular diseases (CVD) from epidemiological studies is insufficient. To investigate the effects of blood BTEX on total CVD and individual CVD outcomes, as well as that on lipid profiles and white blood cell (WBC) count.

METHOD: We investigated the associations of blood combined and individual BTEX with CVD and its subtypes in 17007 participants from the U.S. National Health and Nutrition Examination Survey 1999–2018 by survey-weighted multivariate logistic regression. Weighted quantile sum model and its extension quantile g-computation were conducted to estimate the combined effect of BTEX mixture on CVD. Weighted multivariate linear regression was used to estimate the effects of BTEX on lipid profiles and WBC and its five-part differential count.

RESULTS:Compared to reference quartile of BTEX mixture, adjusted odds ratio of CVD risk for people in the highest quartile was 1.64 (95% CI: 1.23 to 2.19) with P for trend = 0.008. Positive associations were also found for benzene, toluene, ethylbenzene, and m-/p-xylene but not for o-xylene. The above associations demonstrated monotonically increasing exposure-response relationship. Furthermore, combined BTEX exposure was associated with congestive heart failure (CHF), angina pectoris, and heart attack; individual benzene, toluene, and ethylbenzene were associated with CHF; toluene, ethylbenzene, and all xylene isomers were associated with angina pectoris; benzene, toluene, and oxylene were associated with heart attack. Combined and individual BTEX was positively associated with triglycerides, cholesterol, low density lipoprotein, and WBC and its five-part differential count, but negatively associated with high density lipoprotein. Subgroup analyses identified modifying effects of smoking, drinking, exercise, BMI, hypertension, and diabetes on the associations between specific VOCs and CVD risk.

CONCLUSIONS: Exposure to higher levels of combined and individual BTEX were associated with increased CVD risk through dyslipidemia and leukocytosis.

Keywords: biomarkers of exposure, cardiovascular diseases, mixtures analysis, environmental epidemiology

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Interaction between air pollution and risk factors for cognitive decline: a comparison study in China and the UK cohorts

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BACKGROUND AND AIM: The Lancet Commission's review of risk factors for dementia and cognitive decline in 2020 identified twelve factors, among which air pollution was recognized as a significant contributor. However, little is known about the potential interaction effects of air pollution with other risk factors for cognitive decline, and their differences between countries.

METHOD:In the study, 13,186 participants aged over 45 from the China Health and Retirement Longitudinal Study (CHARLS, 2015 wave) and 461,020 UK Biobank participants aged 37-73 (enrolled between 2006 to 2010) were compared. The study assessed cognitive function using standardized tests that measured specific cognitive domains. Air pollution exposure, including annual averages of PM2.5, PM10, and NO2, was measured in both cohorts. The study utilized multivariable regression models to analyze the direct and interaction effects of air pollutants and 11 other risk factors on cognitive function, while adjusting for key covariates.

RESULTS:Both cohorts demonstrated a significant interaction effect between air pollution and smoking status across most cognitive tests, but there were differences in the nature, extent, and direction of the interaction effects observed. The CHARLS cohort revealed that the interaction between PM10 and hearing loss had a significant effect on immediate learning ability (0.21 [95%CI 0.04, 0.38]), while NO2 had significant interaction effects with obesity on delayed learning ability (-0.22 [-0.40, -0.05]). Conversely, the UK Biobank cohort showed that the interaction between PM2.5 and physical inactivity had a significant effect on numeric memory (-0.04 [-0.07, -0.01]) and reaction time (0.003 [0.001,0.006]). Furthermore, the magnitude of interaction effects was generally more substantial in the CHARLS cohort compared to the UK Biobank cohort.

CONCLUSIONS:Our findings in China and the UK emphasize the need for tailored interventions that target multiple risk factors and address the unique risk factors and environmental exposures in specific populations to promote healthy cognitive aging.

Keywords: Air pollution, Cognitive decline, Interaction effect, China, United Kingdom

Associations between long-term and short-term air pollution and postpartum depression, and interaction with temperature

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BACKGROUND AND AIM: Few studies have examined the relationship between air pollution and postpartum depression (PPD). The joint impact of air pollution and temperature on PPD remains unexplored. We aimed to investigate the relationships between PPD and maternal exposure to long-and short-term air pollution, and the interaction of air pollution and temperature.

METHOD:Clinical data were obtained from Kaiser Permanente Southern California electronic health records (2008-2016). PPD ascertainment was done using ICD-codes and prescribed medications. Monthly ambient air pollution concentrations (PM2.5, PM10, NO2, and O3) were assessed using kriging interpolation of monitoring station data. PM2.5 constituents (sulfate, nitrate, ammonium, organic matter, and black carbon) were estimated using outputs from a fine-resolution geoscience-derived model. Multilevel Cox proportional hazard models were applied; non-PPDs were censored at the end of follow-up (one-year after delivery). Long-term exposure was defined as exposure from conception to the date of PPD diagnosis or censoring; short-term exposure was defined as exposure during the past month of the PPD diagnosis or censoring. Relative excess risks due to interactions were calculated to quantify the interactions between air pollution and temperature.

RESULTS:A total of 342,241 singleton births with 43,399 (10.5%) PPD cases were included. We observed increased PPD risk associated with both long- and short-term air pollution, including PM_{2.5}, PM10, NO₂ and PM_{2.5} constituents. The associations were most pronounced for long-term PM10 [adjusted hazard ratio(HR) per interquartile range: 1.18, 95% confidence interval(CI):1.16–1.20] and short-term NO₂ (HR=1.06,95%CI:1.50–1.07) among krigged pollutants, and PM_{2.5} black carbon (long-term: HR=1.34,95%CI:1.29–1.38; short-term: HR=1.24,95%CI:1.21–1.26) among PM_{2.5} constituents. We identified positive additive interactions between air pollution and maximum temperature, suggesting that increasing maximum temperature could aggravate the increased PPD risks associated with air pollution.

CONCLUSIONS: Exposure to long- and short-term air pollution was associated with an increased risk of PPD. There is a synergistic effect between air pollution and high temperature on PPD.

Keywords: Pregnancy outcomes, mental health outcomes, air pollution, temperature

PFAS exposure and changes in the extracellular microRNA profile in a cohort of adolescents undergoing bariatric surgery

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) are synthetic chemicals that persist in the environment and accumulate in humans, leading to adverse health effects, such as hepatotoxicity. Little is known about the modes of action of PFAS toxicity, but one likely mechanism is alteration of microRNA (miRNA) profiles that regulate post-transcription gene expression. This study aims to investigate associations between plasma PFAS concentrations and plasma miRNA expression in adolescents with severe obesity undergoing bariatric surgery.

METHOD:PFAS concentrations (PFOS, PFOA, PFHxS, PFNA, PFUdA, PFHpA) were assessed in plasma samples from 175 participants of the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) cohort. 843 plasma miRNA were profiled using the established HTG EdgeSeq platform. We examined associations of individual PFAS with miRNA using linear regression after adjusting for sex, BMI, age,

race, parental income, pre-surgery weight loss and geographic clinical site of surgery. We additionally assessed PFAS mixture effects using quantile g-computation. Ingenuity Pathways Analysis (IPA) was used to identify putative biological functions of PFAS-associated miRNA (p < 0.05). RESULTS:In the single PFAS analysis, PFHpA exhibited the highest numbers of significant associations with miRNA (22 upregulated, 192 downregulated, p < 0.05). Moreover, PFOS, PFOA, PFNA, PFHxS and PFUNdA were associated with 6, 25, 3, 29 and 33 miRNA (p < 0.05), respectively. PFAS mixture was significantly associated with alteration in 239 miRNA levels (52 downregulated, 187 upregulated, p < 0.05), but none overlapped with individual PFAS-associated miRNA. Putative targets of dysregulated miRNA associated with PFAS mixture included pathways involved in hepatotoxicity (e.g. liver inflammation, cirrhosis and hepatocellular carcinoma), cardiotoxicity (e.g. organismal injury and abnormalities and reproductive system disease) and nephrotoxicity (e.g renal inflammation and nephritis).

CONCLUSIONS: Altered miRNA expression could be an indicator of PFAS toxicity and a mechanistic link between PFAS exposure and disease risk.

Keywords: Children's environmental health, Mixtures analysis, Epidemiology

Long-term Exposure of Ambient PM2.5, Particulate Constituents and Hospital Admissions from Non-respiratory Infection among Older Adults in the US

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BACKGROUND AND AIM:PM2.5 is known to have high immunotoxicity. Previous studies have found that PM2.5 was associated with increased risk of respiratory infections. Less is known about the association between PM2.5 and non-respiratory Infections. We investigated the association between total PM2.5, PM2.5 constituents, source-specific PM2.5 and hospital admission from non-respiratory infection.

METHOD: Annual ZIP code level concentration of PM2.5 and its constituents across the US between 2000-2016 were estimated from validated ensemble machine learning models. Non-negative matrix factorization was used to obtain the concentration of source-specific PM2.5 from constituent data. Quasi-Poisson regression models were used to investigated the association between annual ZIP code-level total and source-specific PM2.5 and rate of hospital admission of Medicare participants from non-respiratory infections. Using weighted-quantile-sum regression, we estimated the association between PM2.5 mixture index and the outcome while identified the PM2.5 constituents which contributed the most in the association. All the associations were adjusted for demographics, socioeconomic status, access to healthcare and meteorological factors.

RESULTS:Each 1ug/m3 increase is PM2.5 was associated with a 2.8% (95%CI 2.8-2.9%) increase in rate of hospital admission from non-respiratory infections. Sulfates (30.8%), Nickel (22.5%) and Copper (15.3%) contributed the highest weights in the associations between PM2.5 mixture index and the outcome across the 15 constituents. Each one standard error increase in PM2.5 sourced from oil combustion, coal burning, traffic, dirt and regionally transported nitrates were associated with 14.5% (95%CI 7.7-21.9%), 18.2% (95%CI 7.2-30.3%), 20.7% (95%CI 5.6-37.9%), 9.1% (95%CI 0.3-18.6%) and 7.9% (95%CI 0.6-15.7%) increases in hospital admission from non-respiratory infections. CONCLUSIONS:Long-term ZIP code level PM2.5 is associated with increased hospital admission from non-respiratory infection among older adults, with sulfates, nickel and copper playing the most important roles. This study highlighted the need for concern about the impact of air pollution on non-respiratory infections.

Keywords: Particle components, Mixtures, Long-term exposure, Infectious diseases

Influence of gender and age on overwork-related adverse effects among employees: a crosssectional study in Taiwan

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BACKGROUND AND AIM: The aim of the present study was to evaluate the risk of overwork related adverse effects (OrAEs) between women and men among different age groups in Taiwan workplaces. METHOD: Data from employees of the companies providing occupational health services were analyzed. The study population consisted of 4920 employees, and the anonymous data analyzed included employment duration, working hours, work schedules and health examination results. The risk for OrAEs was assessed by an index, the Karo index, which is composed of the cerebrocardiovascular risk score (0-2) and the occupational risk score(0-2), with scores of 3 and 4 being categorized as at high risk for OrAEs (h-OrAEs).

RESULTS: The 4920 employees had a mean employment duration of 8.5 years and a mean age of 38.6 years. The ratio of female to male labor force participation changed with increasing age. The prevalence rates for h-OrAEs in women and men were 9.8% and 23.3%, respectively. The peak prevalence rates for h-OrAEs were in the 40s and 50s for women and in the ages of 40s for men. Multivariate analysis results showed that men had a 2.9-fold higher risk of h-OrAEs than women, and the workers in their 40s had the significantly highest risk of h-OrAEs for both women and men. CONCLUSIONS: There are significant gender differences in the risk of overwork-related adverse effects among Taiwanese workers. The late middle-aged workers have the highest risk of overwork-related adverse effects in both women and men.

Keywords: Overwork related adverse effects, Gender differences, Age, Cardiovascular diseases, Risk assessment

Serum Concentrations of Per and Polyfluoroalkyl Substances and Thyroid Function Biomarkers Among Females Presenting to a Fertility Clinic

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BACKGROUND AND AIM: This study aimed to examine the associations between serum per and polyfluoroalkyl substances (PFAS) concentrations and their mixture with thyroid biomarkers among females presenting for fertility investigation.

METHOD: Our study included 287 females seeking medically assisted reproduction at a fertility center in Massachusetts, United States (U.S.). Non-fasting blood samples were collected at recruitment and quantified for serum concentrations of six long-alkyl chain PFAS compounds, thyroid hormones [thyroid stimulating hormones (TSH), free triiodothyronine (FT3), free thyroxine (FT4), total triiodothyronine (TT3), total thyroxine (TT4)], and two autoimmune antibodies [peroxidase antibody (TPOAb) and thyroglobulin antibody (TgAb)]. The ratio of FT4 to FT3 was calculated. We used multivariable linear regressions and quantile-based g-computation to evaluate associations of individual PFAS and their total mixture with thyroid biomarkers, adjusting for confounders. RESULTS: The mean (SD) age of the study participants was 34.5 (4.1) years. Most were White females (82.7%) and had graduate degrees (57.8%), and nearly half had unexplained infertility (45.9%). We found that higher serum concentrations of four PFAS compounds, namely perfluorooctanoate (PFOA), perfluorononanoate (PFNA), perfluorodecanoate (PFDA), perfluoroundecanoate (PFUnDA), and the total PFAS mixture were associated with lower TT3 levels. Specifically, each quartile increase in serum concentrations of the total PFAS mixture was associated with a 4.45% (95% CI: -7.15%, -1.67%) decrease in TT3. Further, we found higher serum concentrations of PFNA, PFDA, PFUnDA, and the total PFAS mixture to be associated with a higher FT4/FT3 ratio. No associations were found for TT4, TSH, or autoimmune antibodies.

CONCLUSIONS: In this study of females attending a fertility clinic, we found that select PFAS compounds and the total PFAS mixture were associated with lower TT3 levels and higher FT4/FT3 ratios. Our findings suggest that PFAS induces thyroid disruption among a vulnerable population of subfertile females, especially among those with unexplained infertility.

Keywords: PFAS, Mixtures, Thyroid function, Female

EP-151[Chemical exposures » Heavy metals]

Age- and sex-specific inverse associations between blood lead levels and serum levels of α-Klotho in US adult participants

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BACKGROUND AND AIM:Prolonged exposure to low levels of lead, a non-essential toxic metal, has been associated with aging-related disorders, such as cardiovascular disease, in the general adult population. The aim of the present study was to examine the relation between lead exposure and serum levels of soluble a-Klotho, an anti-aging hormone, in US adults.

METHOD:A nationally representative subsample of 2259 adults from ages 40-79 in the 2013-2016 National Health and Nutrition Examination Survey was analyzed for the association between blood lead levels and serum a-Klotho levels using multiple general linear models, adjusting for potential confounders. Age- and sex-specific analyses were further conducted. We also evaluated two other toxic metals, cadmium and mercury, in association with a-Klotho levels for sensitivity analyses. RESULTS: The weighted geometric mean of blood lead was 1.10 µg/dL and the weighted mean of serum a-Klotho was 819.48 pg/mL in the study participants during 2013-2016. After adjusting for potential confounders, lead was significantly associated with decreased serum levels of a-Klotho (regression coefficient β =-33.75; p=0.0011) in the total study population. Age- and sex-specific analyses revealed a significant inverse association between lead and g-Klotho levels in middle-aged adults (40-59 years) with a β of -48.20 (p=0.0013) and in males with a β =-43.94 (p=0.0003). However, no significant association was observed in older adults (60-79 years) and in females. The age- and sex-specific associations were stronger as compared to the total population. No statistically significant associations with a-Klotho levels were observed for blood cadmium or mercury. CONCLUSIONS: This study demonstrates an inverse relationship between blood lead levels and a-Klotho in middle-aged adults and in males. Additional studies would further explore these age- and sex- specific interactions and elucidate the potential role of a-Klotho in mediating the effect of lead exposure on aging-related disorders.

Keywords: adults, a-Klotho, blood lead levels, lead exposure, NHANES
EP-152[Air pollution » General]

Air quality in Bulgaria and policies to improve it

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BACKGROUND AND AIM: To study the atmospheric air pollution in Bulgaria during the last ten years. METHOD: Data from the Environment Executive Agency, Ministry of Health and National Institute of Statistics were used.

RESULTS: Atmospheric air pollution is extremely relevant globally, with a risk to the health and life of people and the environment. In Bulgaria, the legislation on its monitoring is harmonized with the European one. According to the requirements, 6 regions for assessment and management of atmospheric air quality with 48 stationary points have been approved. The biggest problem is air pollution with fine particulate matter (PM10 and PM2.5). In 2019, the percentage of the population, living at levels of PM10 pollution was very high – 60.8%. Excessive concentrations were found for NO2 (exceeding the average day-night norm in one region), SO2 (10 exceedances were registered in one of the points near the thermal power plant), benz(o)pyrene (exceedance in 7 out of 16 points of the average annual rate). The main sources of pollution are motor transport, heat energy production, domestic heating with solid fuel, metallurgy and oil refining.

CONCLUSIONS:For a 10-year period, in recent years, a decrease in the emissions of the main pollutants has been registered in Bulgaria. This was achieved as a result of the measures taken to reduce national emissions, regulated in the National Program for the Improvement of Ambient Air Quality for the period 2018-2024 and the National Program for Air Pollution Control (2020-2030). In the period 1990-2019, the emissions of the main pollutants decreased, with the exception of PM2.5, due to an increase in the emissions of the household. SO2 emissions decreased by 93% (mainly from TPP). NOx emissions decreased by 66.5%, due to reduced emissions from thermal power plants and motor transport.

Keywords: air pollution, environmental epidemiology, particulate matter

Driving forces of PM2.5 concentrations in megacity Lahore: application of geographically and temporally weighted regression model to city-level

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BACKGROUND AND AIM: Fine particulate matter (PM <2.5 μ m) is the main indicator for air pollution which is closely linked to human health and much wider impact on environment and considered an important impact pathway of global climate change. Accurately identifying the main drivers of PM2.5 in megacities is of great significance, as cities are the main hub of air pollution.

OBJECTIVE: The temporal and spatial heterogeneity of PM2.5 and its drivers, considering both climate change and socioeconomic developmental conditions, has not been explored in the previous studies especially at the city-level.

METHOD: We adopted a geographically and temporally weighted regression model (GTWR) to explore the direction and strength of the influences of climate change and socioeconomic variables on the concentration of PM2.5 in one of the highest polluted megacity Lahore, covering the period 1998 to 2020.

RESULTS:PM2.5 concentration steadily increased from an average of 53 to 88µg/m3 during last 20 years in Lahore city. Windspeed, relative humidity, temperature and precipitation reduce PM2.5 concentrations, with strongest to weakest influence in that order. Eastern part of the city more strongly favorably influenced than western part of the city by the climate variables leading to higher PM2.5 concentrations in eastern part of the city. Foreign direct investment (FDI) very strongly and GDP moderately intensified PM2.5 concentrations. Population density strongly intensifies PM2.5 throughout the city, while road density and land use intensify the concentrations at specific locations within the city. Less dense areas of road and land use inversely favorably influence PM2.5 in the city. CONCLUSIONS:In the city of Lahore, PM2.5 concentrations showed strong spatial variances and correspond to a series of phases. Both the sources of PM2.5 and its concentration are spatially heterogeneous. This information at the sub-districts scale within a city may help in formulating targeted interventions for air pollution mitigation.

Keywords: PM2.5 concentrations, Geographically and temporally weighted regression, climatic conditions, socioeconomic determinants, spatial heterogeneity.

The association of prenatal ambient air pollution with placenta epigenetic age at birth

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BACKGROUND AND AIM:Prenatal exposures to air pollutants (AP) are well-established risk factors for preterm birth, yet evidence on implicated tissues and underlying biological mechanisms remain inconclusive. DNA methylation (DNAm) is involved in AP-induced placental alterations. DNAm-based epigenetic age estimators are emerging biomarkers for biological age and can reflect early-life exposures in children. We assessed associations of prenatal ambient AP with placental epigenetic age at birth.

METHOD:Prenatal AP concentrations (NO2, O3, PM2.5, PM10) were assigned by spatial interpolations on weekly AP data from monitoring stations proximal to maternal residence, and calculated for exposure periods: preconception, pregnancy, which was further divided into three trimesters. Fetalside placenta DNAm data measured on Illumina Infinium HumanMethylation450 BeadChip was available for 104 mother-child pairs from Early Autism Risk Longitudinal Investigation cohort. Epigenetic age was computed using Lee's robust placenta clock algorithm. Intrinsic epigenetic age accelerations (IEAAs) were defined as residuals from a linear regression of epigenetic age on chronological gestational age, adjusting for cell type proportions. We used multivariable linear regressions to examine associations between average AP and IEAAs for each exposure period, adjusting for study site, maternal, and child characteristics. We used weekly distributed lag models (DLMs) to examine vulnerable exposure windows.

RESULTS: Average O3 and PM10 levels during pregnancy were associated with lower IEAA at birth (β =-0.58, 95% CI: -1.11, -0.06; β =-0.80, 95% CI: -1.43, -0.18; per 10-unit AP, respectively). Trimester-specific analyses revealed associations between average O3 and PM10 in trimester 2 with

slower IEAA (β =-0.28, 95% CI: -0.54, -0.03; β =-0.63, 95% CI: -1.10, -0.17; per 10-unit AP, respectively). Weekly DLMs suggested associations with lower IEAA for O3 and PM10 in pregnancy week 16-32 and 18-32, respectively.

CONCLUSIONS: Prenatal ambient AP, especially during middle to late pregnancy, was associated with decelerated epigenetic age at birth, suggesting lower biological maturity. Findings reinforce importance of AP exposure prevention during pregnancy.

Keywords: air pollution, epigenetic age, DNA methylation, placenta

EP-155[Air pollution » Long-term exposure]

Long-term exposure to air pollution and Parkinson's disease: A causal analysis based on a large prospective cohort study

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BACKGROUND AND AIM: Current epidemiological evidence on long-term air pollution exposure and Parkinson's disease is inconsistent, and assessment of causality is particularly lacking. We aimed to investigate the associations between long-term air pollution exposure and Parkinson's disease with causal modelling approaches.

METHOD: We studied 314,482 participants from a large prospective cohort study, the UK Biobank Study, from 2006 to 2019. Long-term exposure to ambient fine particulate matter (PM2.5) and ozone (O3) was estimated using high-resolution spatial-temporal models at each participant's residence. Incidence of Parkinson's disease was identified using health administrative datasets. We used instrumental variable models, with wind speed as the instrument, to examine the causal effects of PM2.5 and O3 exposure on Parkinson's disease. In addition, we used accidental death as a negative control outcome to evaluate the potential bias due to unmeasured confounding.

RESULTS:During an average follow-up of 11.6 years, 1,924 individuals developed Parkinson's disease. In instrumental variable analysis, we found significant associations between PM2.5 exposure and Parkinson's disease, with a hazard ratio of 1.35 (95% confidence interval: 1.05,1.74) for one-unit increment in the instrument. No significant associations were observed for O3 exposure. As expected, no significant associations were found between air pollution exposure and the negative control outcome.

CONCLUSIONS:Our findings suggest that there might be a causal association between long-term exposure to air pollution, particularly PM2.5, and Parkinson's disease.

Keywords: Air pollution, Parkinson's disease, prospective cohort, causal inference

Factors that Influence Risk Perception of Wildfires: A Systematic Review

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BACKGROUND AND AIM:Risk perception plays an important role in developing response actions to wildfires and can be influenced by a variety of factors. We aimed to conduct a systematic review to compile a comprehensive list of factors that affect the public's wildfire risk perception. METHOD:We performed an online search for PubMed, ProQuest, and Web of Science databases to identify research published between January 2000 and August 2022. Studies reporting factors related to risk perception based on surveys were included in the review.

RESULTS: From 3,466 papers retrieved, 20 studies met our screening criteria, and 16 were conducted in the United States. Several major factors were identified as influential factors for the risk perception of wildfires: sociodemographic characteristics, property ownership, living environment, prior wildfirerelated experience, and wildfire-related information resources. The most common factors studied were age, income, education, dense vegetation around the residence, and prior wildfire experience. The associations of age and prior experience with wildfire risk perception were largely inconsistent across papers, with some papers associating older age and having prior wildfire experience with lower risk perception, while others concluded the opposite or no association at all. Other factors, such as owning a property and being able to receive wildfire-related information from different resources were associated with higher risk perception in most of the studies.

CONCLUSIONS: To our knowledge, this is the first review to summarize associations of factors with wildfire-related risk perception. Future studies can provide further investigations and theories to explain inconsistent results for certain variables.

Keywords: air pollution, built environment, natural disasters, socio-economic factors, wildfires

A Comparison between Short-Term Respiratory Effects of Wildfire-Related Particulate Matter and Non-Wildfire Particulate Matter: A Systematic Review

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BACKGROUND AND AIM: The frequency and severity of wildfires have been sharply increasing due to climate change and largely contribute to ambient particulate matter (PM) pollution. We conducted a systematic literature review on the short-term relationships between wildfire-related PM and a variety of respiratory endpoints and compared the effects of wildfire-related PM and non-wildfire PM. METHOD: A comprehensive online search for the literature published from January 2000 to August 2022 was conducted for databases of PubMed, Web of Sciences, Scopus, and EMBASE. We applied search terms related to wildfire smoke and respiratory health outcomes, such as lung conditions, asthma, and wheeze.

RESULTS:In total, 3,397 articles were retrieved, and 37 articles were included in this review. The majority of studies focused on associations of wildfire-related PM less than 2.5 μ m or 10 μ m with hospital admissions, emergency department visits/ambulance dispatches, or mortality, with a time-series or case-crossover study design. Studies were concentrated in the continent of the United States and Australia. Asthma/wheeze was the most studied specific respiratory outcome. Positive

associations of wildfire PM with various respiratory outcomes were observed in most studies, with few studies showing non-significant or mixed associations. Some age groups (e.g., children or elders aged > 65 years) and females were more vulnerable to wildfire smoke impacts. Most studies concluded that wildfire-specific PM was associated with higher risks of adverse respiratory outcomes than non-wildfire PM or stronger associations of PM pollution were observed during the wildfire period or on smoke days related to wildfires.

CONCLUSIONS:To our knowledge, this is the first systematic review to summarize the comparison between the short-term respiratory health effects of wildfire vs. non-wildfire PM. Further investigations are needed to better understand the mechanisms of adverse respiratory effects of wildfire-specific PM pollution.

Keywords: air pollution, particulate matter, respiratory outcomes, short-term exposure, wildfires

Maternal Exposure to Ambient Air Pollution Mixture and Premature Rupture of Membranes: Evidence from A Large Cohort in Southern California

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BACKGROUND AND AIM: There is minimal evidence of relationships between maternal air pollution exposure and spontaneous premature rupture of membranes (SPROM), a critical obstetrical problem that can significantly increase maternal and fetal mortality and morbidity. No prior study has explored the PROM risk related to specific components of particulate matter with aerodynamic diameters of \leq 2.5 µm (PM_{2.5}). We examined associations between maternal exposure to nitrogen dioxide (NO₂), ozone (O₃), PM_{2.5}, PM10, and PM_{2.5} constituents and SPROM.

METHOD:A large retrospective cohort study was conducted and included 427,870 singleton live births from Kaiser Permanente Southern California during 2008-2018. Monthly averages of NO₂, O₃ (8-h daily maximum), PM_{2.5}, and PM10 were measured using empirical Bayesian kriging based on measurements from monitoring stations. Data on PM_{2.5} sulfate, nitrate, ammonium, organic matter, and black carbon were obtained from a fine-resolution model. A discrete time approach with pooled logistic regressions was used to estimate associations throughout the pregnancy and based on trimesters and gestational months. The quantile-based g-computation models were fitted to examine the effects of 1) the air pollution mixture of four pollutants of interest and 2) the mixture of PM_{2.5} components.

RESULTS: There were 37,857 SPROM cases (8.8%) in our study population. We observed relationships between maternal exposure to all four pollutants and SPROM. PM_{2.5} sulfate, nitrate, ammonium, and organic matter were associated with higher SPROM risks in the single-pollutant model. Mixture analyses demonstrated that the overall effects of the air pollution mixture and PM_{2.5} mixture in this study were mainly driven by O₃ and PM_{2.5} nitrate, respectively. Underweight mothers had a

significantly higher risk of SPROM associated with NO₂. CONCLUSIONS:Our findings add to the literature on associations between air pollution exposure and SPROM. This is the first study reporting the impact of PM_{2.5} constituents on SPROM.

Keywords: air pollution, environmental epidemiology, mixtures analysis, multi-pollutant, pregnancy outcomes

The association between carbon monoxide and cardiovascular diseases: a systematic review and meta-analysis

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BACKGROUND AND AIM: The leading cause of death worldwide is cardiovascular diseases (CVDs). Many studies have demonstrated the associations between short-term carbon monoxide (CO) exposure and the occurrence of CVDs in terms of hospital admissions and mortality. However, the findings are still inconsistent, and the risk may vary across diseases. The objective of this study was to quantify the associations between ambient short-term CO exposure and mobility and mortality CVDs, including cerebrovascular diseases.

METHOD: We used Embase, PubMed, and Web of Science to perform a systematic review of the literature to identify studies that reported quantitative data on the connection between CO exposure and CVDs and were published before August 2022. Two researchers independently searched for and selected studies, extracted data, and assessed the quality. Using random-effects models, we calculated the relative risks (RRs) and their 95% confidence intervals (CIs) for various CVDs associated with each 1 mg/m³ increase in CO.

RESULTS:This meta-analysis included 58 articles. We found significant associations between CO exposure and mobility of CVDs (RR = 1.080; 95% CI: 1.016-1.148; I² = 99.9%), mortality of CVDs (RR = 1.021; 95% CI: 1.009-1.033; I² = 92.6%), mobility of stroke (RR = 1.020; 95% CI: 1.002-1.038; I² = 48.5%), mortality of stroke (RR 1.017; 95% CI: 1.010-1.025; I² = 0.0%), mobility of arrhythmia (RR 1.012; 95% CI: 1.007-1.017, I² = 0.0%), mobility of ischemic heart disease (RR 1.007; 95% CI: 1.004-1.010; I² = 40.1%), mobility of heart failure (RR 1.017; 95% CI: 1.011-1.023; I² = 42.2%), and mortality of heart failure (RR 1.019; 95% CI: 1.013-1.026; I² = 19.2%). CONCLUSIONS:Our analyses showed associations between CO exposure and CVDs, but the pooled risk estimates varied across different disease outcomes.

Keywords: carbon monoxide, cardiovascular diseases, mortality, mobility, meta-analysis

Impact of Influenza Infection and Environmental Factors on Sepsis

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BACKGROUND AND AIM: The influences of influenza infections and environmental factors on sepsis have been examined. However, no previous studies have attempted to simultaneously quantify their impact on sepsis. In this study, we aimed to evaluate the time-varying relationships between influenza infection, meteorological factors, air pollutants, and sepsis using Hong Kong's surveillance data over 14 years.

METHOD: Weekly total numbers of hospitalizations due to sepsis were obtained from all public hospitals in Hong Kong during 1998-2011. The numbers were matched with local meteorological records and outdoor air pollutant concentrations. To describe influenza activity, type-specific and all-type influenza-like illness positive (ILI+) rates were used as proxies. Quasi-Poisson generalized additive models were used in conjunction with distributed lag non-linear models to estimate the associations of interest.

RESULTS:A total of 169,830 hospital admissions due to sepsis were notified in public settings during 1998-2011 in Hong Kong. The cumulative adjusted relative risk (ARR) of hospital admission due to sepsis reached 1.10 (95% CI, 1.06-1.15) when the ILI+ total rate increased from zero to 21.68 per 1000 consultations, the 95th percentile. The cumulative ARR of sepsis admission was elevated to 1.19 (95% CI, 1.07-1.32) when the mean ambient temperature decreased from 24.4 °C (median) to 14.9 °C (the 5th percentile). The relationship between short-term exposure to air pollutants and sepsis hospitalization was not found to be statistically significant.

CONCLUSIONS: Influenza activity and cold weather are risk factors of sepsis. This implies that climate change may exacerbate the sepsis burden. Promotion of influenza vaccination may lower the risk of sepsis, especially before the winter season.

Keywords: Infectious diseases, Environmental epidemiology, Modeling

The Washington State Emergency Rule to Protect Workers from Wildfire Smoke: Assessing Stakeholder Engagement and Sentiment in Labor Policy

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BACKGROUND AND AIM:Rulemaking across the Western USA is being enacted to increase protections for outdoor workers during wildfire events. Success of such efforts are dependent on adoption by workers and employers. The Washington State Department of Labor and Industries (LNI) adopted its first seasonal emergency occupational wildfire smoke rule in July 2021.

METHOD: We used qualitative methods to analyze the sentiments expressed about this rulemaking effort from three primary sources. 1) Public comments collected during a series of Statewide rulemaking forums held between April and June 2021. 2) Responses to key informant interviews of outdoor worker representatives from different industries and labor organizations. 3) Responses to an online survey distributed to outdoor supervisors and workers' to capture their experience with wildfire smoke and the emergency rule (n=30).

RESULTS:Cross-cutting themes that emerged were a) appreciation for the worker health impacts of wildfire smoke; b) debate on air quality action levels, monitoring, and data; c) challenges due to inconsistencies between different rules in adjacent states; d) issues with the practicality and feasibility of exposure reduction strategies, including respiratory protection; e) the need to manage co-exposures and cumulative risks involving COVID-19 and heat exposure; and f) concerns on rule compliance, worker rights, and enforcement. We also observed a significant shift (p < 0.001) from negative to positive sentiment between the April (prior to wildfire) and June (post wildfire) meetings suggesting recent exposure to wildfire smoke may impact rulemaking sentiment.

CONCLUSIONS: These findings highlight important common themes and concerns that impact wildfire smoke preparedness and compliance with worker protections. Responding to these themes is likely to improve stakeholder engagement for future permanent rulemaking efforts.

Keywords: Wildfires, Occupational exposures, Policy research, Community outreach, Research translation to affect policy and practice

Extreme Heat and Severe Maternal Morbidity in Southern California: Evidence of Health Disparities from a Large Pregnancy Cohort

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BACKGROUND AND AIM: The rate of severe maternal morbidity (SMM) has continued to increase in the United States. We aimed to examine if maternal exposure to extreme heat is associated with the risk of SMM.

METHOD: We conducted a retrospective cohort study and included 425,722 singleton pregnancies from Kaiser Permanente Southern California in 2008-2018. Daily maximum temperature data at a 4 km resolution were obtained. An extreme heat day was defined as a day with the daily maximum temperature exceeding a certain threshold. Four percentiles (i.e., 75th, 90th, 95th, and 98th) of daily maximum temperature during the warm season (May-September) in 2007-2018 in Southern California were selected to define the extreme heat day. Long-term exposures included the proportions of extreme heat days during the entire pregnancy and by trimester. Short-term exposures were measured by 12 different heatwave exposures (combining the four thresholds with three durations, i.e., ≥ 2 , ≥ 3 , and ≥ 4 consecutive days) during the last gestational week. The discrete-time approach and Cox proportional hazards model were used to estimate the long- and short-term associations between heat exposure and SMM, respectively. Stratified analyses were conducted to examine vulnerable subpopulations and the effectiveness of mitigation measures.

RESULTS:There were 7,767 (1.8%) SMM cases during delivery hospitalization in this study. Long-term associations with extreme heat were detected in the entire pregnancy and each trimester. Heatwave exposures during the last gestational week were associated with higher risks of SMM. Stronger associations were observed in mothers who were Hispanic, with lower education or incomes, or smokers. More green space may attenuate heat effects.

CONCLUSIONS:Long- and short-term maternal exposure to extreme heat can be associated with an increased risk of SMM. More residential green space can be a potential mitigation strategy.

Keywords: environmental epidemiology, green space, pregnancy outcomes, socio-economic factors, temperature extremes

A population-based analysis on the relationship between air pollutants, influenza infection, and acute otitis media in children

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BACKGROUND AND AIM:Acute otitis media (AOM) is the most common diagnosis for childhood acute illness, accounting for 13.6 million pediatric office visits annually. It is currently acknowledged as a bacterial complication of viral upper respiratory tract infection (URI). Other potential risk factors of AOM aside from URI, involve exposure to environmental air pollution and cold seasons. Herein, we used territory-wide hospitalization data to investigate the relationships between meteorological factors, air pollutants, influenza infection, and AOM for children observed from 1998 to 2019 in Hong Kong.

METHOD:Quasi-Poisson generalized additive model in conjunction with distributed-lag non-linear model was used to elucidate the association of interest, with weekly AOM admissions for children as the response variable and weekly influenza-like illness-positive (ILI+) rates and air pollutants (i.e., oxidant gases, sulfur dioxide, and fine particulate matter) as predictors, while controlling for meteorological variations.

RESULTS:According to our results, there were 21,224 hospital admissions due to AOM for children aged \leq 15 years throughout a 22-year period. The cumulative adjusted relative risks (ARR) of AOM were 1.15 (95% CI, 1.04-1.28) and 1.07 (95% CI, 0.97-1.18) at the 95th percentile concentration of oxidant gases (65.9 ppm) and fine particulate matter (62.2 µg/m³) respectively, with reference set to their medians of concentration. The ARRs exhibited a monotone increasing trend for all-type and type-specific ILI+ rates, indicating ILI+ Total, A/H1N1, A/H3N2, and B were all statistically significantly associated with an increased risk of AOM.

CONCLUSIONS:Our findings suggested that policy on air pollution control and influenza vaccination for children need to be implemented, which might have significant implications for averting AOM in children.

Keywords: Environmental epidemiology, Children's environmental health

Short-, Mid-, and Long-term Ambient Exposure of Ozone, Physical Activity, and Dyslipidemia: Korea National Health and Nutrition Examination Survey

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BACKGROUND AND AIM: Evidence for the adverse health effects of ambient ozone which is one of the elevating air pollutants in Korea was limited. This study was aimed to evaluate the association of ozone exposure with dyslipidemia and examine whether the association was modified by level of physical activity.

METHOD:Adults enrolled in the Korea National Health and Nutrition Examination Survey (KNHANES) 2007–2020 were included in this study (n=49,684). Short- (24-hour average), mid- (6-month average), and long-term (1-year average) exposure levels of ambient ozone (ppm) were estimated using the Community Multiscale Air Quality models. Participants were categorized into physically inactive, minimally active, and active groups based on the metabolic equivalent-min/week. Multiple logistic regression models were conducted to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS:Geometric means of ambient ozone levels were 0.0225 ppm, 0.0257 ppm, and 0.0258 ppm for short-, mid-, and long-term exposure, respectively. Of the total participants, 15,240 (30.7%) met the diagnosis criteria for dyslipidemia. The prevalence of dyslipidemia increased by 20% among participants with the highest quintile of mid-term ozone exposure compared to those with the lowest quintile (OR=1.20; 95% CI=1.05–1.36). It showed a higher prevalence of dyslipidemia only in men (OR=1.34; 95% CI=1.13–1.59 for 5th vs. 1st quintile). Notably, when stratified by level of physical activity, the positive association between mid-term ozone exposure and dyslipidemia was more pronounced among minimally active and active participants [ORs (95% CIs) for 5th vs. 1st quintile: 1.72 (1.23–2.41) for minimally active and 1.33 (1.04–1.72) for active; ""p"" for interaction=0.02]. No significant association between short- and long-term exposure to ambient ozone and dyslipidemia was observed.

CONCLUSIONS: Findings of this study demonstrate that 6-month average ozone exposure may be linked to dyslipidemia, and to prevent this, the additive effects of ambient ozone exposure and physical activity should be considered.

Keywords: Air pollution, ozone, dyslipidemia, physical activity, Korea

EP-58[Outcomes » Other (to be specified with keywords in the keywords section)]

Medication adherence of hypertensive and diabetic patients registered in the Family Health Strategy in Acre, Brazil

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BACKGROUND AND AIM: Therapeutic adherence of patients with chronic diseases favors the protection of target organs, reduces cardiovascular risks and improves their quality of life. But despite the therapeutic options and health promotion actions, adherence to long-term therapy for them is still low, especially in developing countries. The aim of this study is analyzing the medication adherence of hypertensive and diabetic patients registered in the Family Health Strategy in the city of Rio Branco, Acre.

METHOD:Population-based survey in adults aged 18 years or over, with arterial hypertension (AH) and/or diabetes mellitus (DM), of both sexes, followed up by the Family Health Strategy in Rio Branco. Adherence was assessed by the Batalla test and the potentially associated variables by logistic regression, with a significance level of 5%.

RESULTS:According to the Batalla test, the prevalence of adherence was 14.7% (HA) and 16.3% (DM) (p<0.001). Most participants were aware of the chronicity of the disease (HA: 71.3%; DM: 79.0%) and understood that it can be controlled with diet and medication (HA: 96.6%; DM: 95.5%), but in relation to affected organs, only 20.0% of hypertensive patients and 22.7% of diabetics achieved two or more correct answers. In the bivariate analyses, a statistically significant association was observed between drug non-adherence and several variables for both diseases. In the multiple logistic regression, only having health insurance (OR: 2.44) and having obesity (OR: 0.53) remained significant for HA, while for DM the age group \geq 65 years (OR: 3.30), having a health plan (OR: 4.03) and being hypertensive (OR: 2.90) remained significant.

CONCLUSIONS: Medication adherence in hypertensive and diabetic patients is low, requiring actions and health policies aimed at increasing adherence.

Funding: Research Support Foundation of the State of Acre (FAPAC), PPSUS – Agreement No. 837567/2016, Process No. 6068-18-0000299, Grant Term No. 032/2018.

Keywords: Cardiovascular diseases, Outcomes, Epidemiology.

FREE POSTERS

FP-001[Chemical exposures » Pesticides]

Health Risk Characterization due to Organochlorine Pesticide Exposure, in Women from Northern Mexico

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BACKGROUND AND AIM: To characterize the health risk from exposure to organochlorine pesticides (OCPs) in a sample of women from northern Mexico.

METHOD:Hazard quotients (HQ) for non-cancer and cancer events were determined in a sample of 908 women from five states in northern Mexico (Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, and Durango), calculating the relationship between the serum concentrations of OCPs and their respective bioequivalents reference risk values. Likewise, the percentage of cases of cardiometabolic, reproductive, and respiratory diseases and cancers attributable to detectable concentrations of OCPs was estimated.

RESULTS:At least 45% of the women in the study were at risk of developing a non-cancer disease because of exposure to total hexachlorobenzene (HCB) and/or dichlorodiphenyltrichloroethane (DDT). In addition, exposure levels to HCB and dichlorodiphenyltrichloroethane (DDE) may cause an increased risk of developing cancer in at least 25% and 50% of women, respectively. It is estimated that HCB and p,p'-DDE are the POCs that may explain the proportion of cases of type II diabetes mellitus (26.65% and 48.47%) and non-Hodgkin lymphoma (19.9% and 27.34%).

CONCLUSIONS: The levels of exposure to HCB, DDT, and chlordane might have deleterious effects on the health of women in the north of Mexico.

Keywords: pesticides, long-term exposure, risk assessment

Wildfires and the changing landscape of air pollution-related health burden in California

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BACKGROUND AND AIM: Wildfires are a growing source of fine particulate (PM2.5) pollution, but associated trends in health burden are not well characterized.

We investigated trends and disparities in PM2.5-related cardiorespiratory health burden (asthma, chronic obstructive pulmonary disease, and all-cause respiratory and cardiovascular emergency department (ED) visits and hospital admissions) for all days and wildfire smoke-impacted days across California, 2008-2016.

METHOD:Using residential ZIP code and daily PM2.5 exposures, we estimated overall- and subgroupspecific (age, gender, race/ethnicity) associations with cardiorespiratory outcomes. Health burden trends and disparities were evaluated based on relative risk, attributable number, and attributable fraction by demographic and geographic factors and over time.

RESULTS:PM2.5-attributed burden steadily decreased, whereas the fraction attributed to wildfire smoke varied by fire season intensity, comprising up to 15% of the annual PM2.5-burden. The highest relative risk and PM2.5-attributed burden (92 per 100,000 people) was observed for respiratory ED visits, accounting for 2.2% of the respiratory annual burden. Disparities in overall morbidity in the oldest age, Black, and "Other" race groups were also reflected in PM2.5-attributed burden, whereas Asian populations had the highest risk rate in respiratory outcomes and thus the largest fraction of the total burden attributed to the exposure. In contrast, high wildfire-attributed burden rates in rural, central, and northern California populations occurred due to differential exposure.

CONCLUSIONS: In California, wildfires' impact on air quality offset the public health gains achieved through reductions in non-smoke PM. Disproportionate effects could be attributed to differences in subpopulation susceptibility, relative risk, and differential exposure.

Keywords: wildfire smoke, cardiopulmonary health, exposure trends, health burden

FP-005[Chemical exposures » Heavy metals]

The Association of Children's Blood Lead Levels and Prevalence of Stunting in Tin Mining Area in Indonesia

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BACKGROUND AND AIM: Metal mining and smelting activities are regarded as major sources of heavy metals such as lead, mercury, arsenic and cadmium in the environment and humans living at surrounding area. Among others, lead can enter and accumulate in the human body and very influential in children's growth and development. This study aims to assess the association between children's blood lead levels and stunting in a mining area in Indonesia

METHOD:A cross-sectional design was implemented by involving 193 children living surrounding Tin Mining in Bangka Island, Indonesia. Venous blood was drawn, and blood lead level was measured by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Stunting status was measured by anthropometry standing height and converted to sex- and age-specific Z-scores based on World Health Organization (WHO) growth reference. Children's dietary was assessed using 24-hour dietary recall method. Statistics of chi-square test and multiple-logistic regression were performed for the analyses.

RESULTS:The geometric mean of Blood Lead Levels (BLLs) was 5.5 μ g/dl (± 2.6 μ g/dl; 95% CI: 5.1 - 5.9). The interquartile range of BLLs and height for age Z-score (HAZ) were 3.0 μ g/dl and -1.5, respectively. The data revealed that 23.3% children were stunted (HAZ < -2). The multiple logistic regression models suggest that elevated BLLs was an independent predictor of the stunting. The odds stunted if blood lead concentration elevated was about ten times higher [adjusted odd ration (AOR) = 9.75 (95% Confidence interval (CI): 3.1 – 30.7); p<0.001] in comparison to the odds of normal BLLs. The BLLs of children at age 2 - 9 years were found associated with stunting after controlling of mother's education, residence, and the intake of energy, protein, zinc, vitamin A, calcium, and phosphorus.

CONCLUSIONS: The study suggested that living at surrounding Tin Mining was dangerous for children health and their development_

Keywords: Children, Blood Lead Levels, Stunting, Tin Mining

The Environmental Surveillance in Medical Center During the SARS-CoV-2 Omicron Variant Pandemic

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BACKGROUND AND AIM:Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing coronavirus disease 2019 (COVID-19) has spread globally. Current epidemiological evidence illustrates SARS-CoV-2 is spread among people by two main routes of transmission: (a) primarily through droplets and may be spread by fomites and contact transmission to the respiratory tract and mucous membranes. (b) inhalation of smaller aerosol particles containing the virus. Previous studies have shown that wards of patients with COVID-19 present the potential risk for medical care associated transmission through aerosols containing SARS-CoV-2. However, there is still limited information on the characteristics of aerosols containing SARS-CoV-2 and the concentration of virus-containing aerosols in and outside of wards. In this study, we aim to investigate whether virus-containing aerosols are present in various areas of the medical center.

METHOD: We use cyclonic sampling devices: a two-stage cyclonic bioaerosol sampler developed by United States' National Institute for Occupational Safety & Health (NIOSH) to collect air samples. Samplers are set up in isolation wards of COVID-19 patients, nursing stations, and corridors of the semi-contaminated areas. Air samples were continuously collected and RNA extracted from samples underwent reverse transcription polymerase chain reaction (PCR) for SARS-CoV-2 analysis. Moreover, we use EAQ-T17 to continuously monitor indoor air quality (IAQ) parameters during our sample collection period, including carbon dioxide, temperature, and relative humidity.

RESULTS: Preliminary result showed that 35 of the 93 air samples in nursing station and 138 of the 342 air samples in corridor tested positive for SARS-CoV-2 RNA, while in isolation rooms, all of air samples tested negative.

CONCLUSIONS: Based on our research, airborne is a possible route for SARS-CoV-2 transmission.

Keywords: Exposure assessment, environmental epidemiology

Characterizing Winter Weather Patterns and Pollution Sources of PM2.5 in Taipei City

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BACKGROUND AND AIM:Air quality is intricately linked to weather patterns. Regional factors such as wind direction, wind speed, and dispersion conditions directly impact PM2.5 concentrations. Therefore, categorizing weather patterns aid in studying their corresponding contributions of pollution sources. METHOD:This study employed three online instruments to conduct monitoring of chemical species of elements, ions, organic carbon, and elemental carbon in PM2.5 during the winter season of 2020-2021. The measured data were then analyzed using the Positive Matrix Factorization (PMF) model to identify pollution sources and their contributions in Taipei City. Additionally, weather patterns with PM2.5 concentrations exceeding 25 μ g/m3 were classified using clustering techniques to investigate the relationship between weather patterns and pollution sources.

RESULTS: The results revealed that weather patterns during periods with high PM2.5 concentrations could be classified into three groups, each showing distinct associations with pollution sources: (1) During periods of low wind speed and poor dispersion, traffic-related pollution was significantly higher compared to other weather patterns, with an average increase of 4.5 μ g/m3; (2) Strong northeast monsoon patterns exhibited relatively lower averaged PM2.5 concentration due to limited pollutant accumulation within the basin compared to the other two weather patterns; (3) Weather patterns predominantly influenced by northwest winds showed significant contributions from pollution sources related to fuel combustion, coal combustion, and industry mixed with secondary aerosols. The PM2.5 concentration level in northwest winds pattern could reach as high as 56 μ g/m3. CONCLUSIONS:The pollution source analysis corresponding to weather patterns can serve as a valuable reference for policymakers in formulating effective PM2.5 control strategies.

Keywords: Particulate matter, Traffic-related, Particle components

Health Risk Analysis of Air Pollution and Related Risk Factors on Residents Living near a Power Plant in Central Taiwan

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BACKGROUND AND AIM: Based on the rise of environmental protection awareness and the establishment of relevant laws and regulations, the overall air pollution has shown a downward trend in Taiwan. However, the incidence and mortality of certain diseases in certain area remains an important public health task. This study has focused on coastal county and city near an important power plant in central Taiwan.

METHOD: We collect the incidence and mortality of diseases from public information, as well as race, occupation, education, economic income and living habits (smoking, drinking, and betel nut chewing), combined with air pollution data. Generalized estimating formula (generalized estimating equations, GEE) was used to explore the impact of various air pollutants and risk factors on health among residents.

RESULTS: Ambient air pollution potentially related to the incidence and mortality of respiratory, cardiovascular and cerebrovascular disease, especially O3. The study showed that gender, education, occupational exposure and alcohol drinking may interact with the effects.

CONCLUSIONS: Multiple exposure scenario consideration including air pollution and related risk factors is important to assess the health effect on residents near power plant. Further study is suggested.

Keywords: Air pollution, respiratory disease, cardiovascular disease, cerebrovascular disease

The association between dietary intake, indoor environmental status, and urinary cadmium levels in a nationwide representative sample in Taiwan

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BACKGROUND AND AIM:Cadmium (Cd) is a toxic heavy metal that can accumulate in the human body through various environmental exposures, including dietary intake. In Taiwan, higher urinary cadmium concentrations among the general population compared with the Human Biomonitoring Guidance value (HBM-GVs) for Cd have been observed, but the primary source has not been identified. This study aimed to investigate the association between dietary intake, indoor environmental status, and urinary cadmium levels in a nationwide representative sample in Taiwan.

METHOD: This study collected 1,566 human urine samples from the Taiwan Human Biomonitoring program in 2019. Individual urinary cadmium concentrations were measured and adjusted by urinary creatinine levels. The study also used questionnaires to collect information on individuals' dietary habits (e.g., vegetarian, lacto-o

VO-vegetarian, and general population), dietary frequency, and indoor environmental conditions (e.g., household incense burning and use of air purifiers).

RESULTS: The results showed that 35.82% of participants (n=561) had urinary Cd concentrations exceeding the HBM-GVs. Additionally, 4.21% of participants (n=66) were vegetarians, and 64.43% (n=1009) burned incense at home, while 23.40% (n=365) used air purifiers at home. Logistic regression analysis, adjusted for gender, age, BMI, and other confounding factors, revealed that the odds ratio (OR) for elevated urinary Cd concentrations was 1.80 (95% CI: $1.02\sim3.19$) for participants who were vegetarian or lacto-o

VO-vegetarian.

CONCLUSIONS: These findings suggest that the consumption of certain foods may increase the risk of heavy metal exposure and toxicity. The results also highlight the need for public health interventions to raise awareness of the potential health risks associated with certain dietary habits and to promote healthy and balanced diets

Keywords: dietary intake, indoor environmental status, urinary cadmium, human biomonitoring

Epidemiology of Sudden Unexplained Death Syndrome among Southeast Asian Labor in Taiwan

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BACKGROUND AND AIM:Sudden unexplained death syndrome (SUDS), also called as sudden unexpected nocturnal death syndrome or Asian sudden death syndrome, is a mysterious illness that mainly attacks young healthy males from Southeast Asian countries. The cause of SUDS remains unknown. Taiwan has started recruiting foreign workers from Southeast Asian countries since 1989, and SUDS was found then. The purpose of this study is to determine the epidemiological characteristics of SUDS in Taiwan.

METHOD: In this case-control study, the case group (totaling 32 individuals with confirmed SUDS symptoms) and the control group (totaling 57 individuals unaffected by SUDS but familiar with the deceased) were collected through the Foreign Labor Death Promulgation System and in-person interview with the controls in a three-year study period in Taiwan. Demographic information (job status, period of residence in Taiwan, lifestyle, and family history of SUDS) was compiled for both groups. Forensic reports and toxicological examinations were included as research data. RESULTS: The majority of deceased individuals were Thai nationals (71.9%), followed by Filipinos (25%). All were males, with an average mean age of 33.3 ± 6.7 years (87.5%) and were employed in Taiwan as foreign laborers. Highest rate of SUDS (87.5) occurred during sleep, significant rate (about 40.0%) were discovered during early morning hours, and a few succumbed during hospitalization. Postmortem forensic and toxicological examinations showed nothing remarkable. Comparative data from case and control groups indicated that alcohol and food consumption prior to sleep appeared a relatively important factor; risk associated with food intake was of particular significance when measured by multiple logistic regression analysis (adjusted odds ratio=8.80/95% CI=2.26-34.97) CONCLUSIONS: Food consumption prior to sleep may be a significant risk factor of SUDS. Such findings can be applied to prevention strategies; however, further investigation is required for complete verification.

Keywords: mortality, sudden unexplained death syndrome, southeast Asian labor, food, sleep

Aristolochic Acid and the Risk of Female Lung Cancer: Population-Based Case-Control Study

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BACKGROUND AND AIM: Aristolochic acid (AA) is a known human carcinogen that induces DNA adducts and lung tumors in rodents exposed to it. As there are relatively few female smokers in Taiwan, the objective of this study is to examine the potential risk of lung cancer in women who consume herbs containing AA.

METHOD: A case-control study based on the population was conducted, where cases were individuals newly diagnosed with lung cancer (ICD-9 162) between January 1, 1999, and December 31, 2013. Logistic regression was utilized to evaluate the risk of lung cancer in relation to the total dose of AA-containing herbs and the estimated cumulative dose of aristolochic acid.

RESULTS: The analysis revealed that certain factors significantly increased the risk of lung cancer, including chronic obstructive pulmonary disease (OR: 1.31, 95% CI: 1.24 to 1.37), tuberculosis (OR: 1.44, 95% CI: 1.26 to 1.64), pneumococcal pneumonia (OR: 2.51, 95% CI: 1.35 to 4.64), human papillomavirus infection (OR: 1.14, 95% CI: 1.03 to 1.26), alcohol-related disease (OR: 1.37, 95% CI: 1.05 to 1.79), hyperlipidemia (OR: 1.05, 95% CI: 1.01 to 1.10), and hormone replacement therapy (OR: 1.15, 95% CI: 1.10 to 1.20). The study also found a slightly elevated risk of lung cancer (OR: 1.08, 95% CI: 1.04 to 1.12) in women taking AA-containing herbs. However, there was no significant dose-response relationship between the estimated AA dose or herbs containing AA and female lung cancer.

CONCLUSIONS: The study found that consuming herbs containing aristolochic acid (AA) is associated with a slightly higher risk of developing lung cancer in women. However, the risk does not seem to be strongly related to the amount of AA consumed. This suggests that even a small amount of AA-containing herbs may pose a risk to women.

Keywords: Exposures, Female, Epidemiology

Evaluation of sinonasal outcome test (SNOT-22) domains in the assessment of the quality of life in patients with nasopharyngeal carcinoma

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BACKGROUND AND AIM: Few instruments are available for assessing the otorhinologic-related quality of life (QOL) in nasopharyngeal carcinoma (NPC) patients. Therefore, we evaluated whether the 22-item Sinonasal Outcome Test (SNOT-22) could be applied to these patients.

METHOD:Patients diagnosed with NPC, who had been treated with standard protocol and followed up in our institute between 2019 and 2022, were invited to join the cross-sectional study during their clinic visits. All participants completed the SNOT-22 and Eustachian Tube Dysfunction Questionnaire-7 once they were recruited. Confirmatory factor analysis (CFA) was performed to decide the most suitable model for the underlying SNOT-22 subdomains, along with various validity and reliability tests.

RESULTS:We identified a total of 275 patients, with 84 (30.5%) women and 191 (69.5%) men. The mean age was 54.1 years (standard deviation: 11.2). Among these patients, 171 (62.1%) were in late stages, and 260 (94.5%) received chemoradiotherapy as treatment. The median interval between primary RT treatment and questionnaire completion was 50 months (interquartile range: 29-93). CFA supported a five-factor model for the SNOT-22 for NPC patients, including nasal, ear/facial, sleep, function, and emotion domains. The internal consistency and test-retest reliability of the SNOT-22 domain score were good. In addition, known-group validity was good for the SNOT-22 total score and domain scores according to the disease recurrence status.

CONCLUSIONS: Psychometric analyses supported the reliability and validity of a five-domain SNOT-22 for assessing otorhinologic-related QOL in NPC patients.

Keywords: Cancer and cancer precursors, Modeling

Early-life exposure to residential black carbon and childhood cardiometabolic health

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BACKGROUND AND AIM: Early life exposure to air pollution, such as particulate matter ≤ 2.5 micrometers (PM_{2.5}), may be associated with obesity and adverse cardiometabolic health outcomes in childhood. However, the toxicity of PM_{2.5} varies according to its chemical composition. Black carbon (BC) is a constituent of PM_{2.5}, but few studies have examined its impact on childhood cardiometabolic health. Therefore, we examined relationships between prenatal and early childhood exposure to BC and markers of adiposity and cardiometabolic health in early childhood.

METHOD: This study included 578 mother-child pairs enrolled in the Healthy Start study (2009-2014) living in the Denver-metro area. Using a spatiotemporal prediction model, we assessed average residential black carbon levels during pregnancy and in the year prior to the early childhood follow-up visit at approximately 5 years old. We estimated associations between prenatal and early childhood BC and indicators of adiposity and cardiometabolic biomarkers in early childhood (mean 4.8; range, 4.0, 8.3), using linear regression.

RESULTS:We found higher early childhood BC was associated with higher percent fat mass, fat mass index, insulin, and homeostatic model of assessment-insulin resistance (HOMA-IR), and lower leptin and waist circumference at approximately 5 years old, after adjusting for covariates. For example, per interquartile range (IQR) increase in early childhood BC (IQR, 0.48 µg/m³) there was 3.24% higher fat mass (95% CI; 2.00, 4.48). Generally, we did not find consistent evidence of associations between prenatal BC and cardiometabolic health outcomes in early childhood, except for an inverse association between prenatal BC and adiponectin, an adipocyte-secreted hormone typically inversely associated

with adiposity.

CONCLUSIONS: Higher early childhood, but not in utero, ambient concentrations of black carbon, a component of air pollution, were associated with greater adiposity and altered insulin homeostasis at approximately 5 years old. Future studies should examine whether these changes persist later in life.

Keywords: Air pollution, Children's environmental health, Particulate matter, Obesity and metabolic disorders

Burden of cardiovascular disease attributable to long-term exposure to ambient PM2.5 concentration and interim target for regulation level

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BACKGROUND AND AIM: Environmental exposure to fine particulate matter PM2.5 is known to be associated with many hazardous health effects, including cardiovascular diseases (CVDs). To reduce the related health burden, it is crucial that policy-makers worldwide set regulation levels according to their own evidence-based study outcomes.

METHOD:In this study, 117,882 CVD-free participants (\geq 30 years) of the MJ Health Database were followed-up (median 9 years) between 2007 and 2017. We used a weight-transformation Cox regression model for the concentration-response function (CRF) between (5-year average) exposure to PM2.5 and CVD incidence. A cost-benefit analysis was proposed by the ratio of avoidable years of life in disability (YLDs) over the mitigation cost for an optimal regulation level.

RESULTS: The CRF was heterogeneous across different areas with dissimilar PM2.5 exposure ranges. Women and older participants were more susceptible. The avoided town/district-specific YLDs in CVD incidence ranged from 0 to 3000 person-years due to improvement in PM2.5 concentrations between 2011 and 2019.

CONCLUSIONS: An annual PM2.5 concentration of 13 μ g/m³ would be optimal, rather than the current level of 15 μ g/m³. The method may be applied to other countries for regulation levels that are most suitable for their air pollution status and population health.

Keywords: Cardiovascular diseases, Environmental epidemiology, Long term exposure, Particulate matter, Research translation to affect policy and practice

Visualizing the Invisible: How Digital Images Reveal the Impact of Surface Mold on Airborne Fungal Levels

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BACKGROUND AND AIM: Rapid monitoring of human exposure to total fungi, including air and surface fungal profiling, is an important issue.

METHOD:In this study, we applied air and surface sampling combined with digital image quantification of surface mold spots to evaluate the contribution of surface fungi to airborne fungal concentrations. RESULTS:Cladosporium, Penicillium, Aspergillus, Geotrichum, and yeast often appeared in the air or on wall surfaces during sampling. These commonly found fungal genera tend to have higher concentrations outdoors than indoors, except for Penicillium and yeast. In addition, the surface density (fungal concentration/area) of individual fungi had no significant correlation with the airborne concentration except for Geotrichum. However, if Aspergillus and Geotrichum presented a higher surface ratio (>0.00035) in the total area of an indoor environment, then the concentration of these two fungi in the air would increase significantly.

CONCLUSIONS:Our results demonstrated that the airborne concentration of indoor fungi is mainly derived from the outdoor concentration. The higher density of surface fungi does not necessarily contribute to a high fungal concentration in the air. Different from fungal density, the quantification of surface fungal area is recommended to assess the risk of surface fungi propelling into the air.

Keywords: bioaerosol, fungi, surface, indoor air

Risk of death from liver cancer in relation to long-term exposure to fine particulate air pollution in Taiwan

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BACKGROUND AND AIM:According to the International Agency for Research on Cancer (IARC), airborne fine particulate matter (PM2.5), which is categorized as a Group I carcinogen, was found to lead to lung cancer in humans. Hepatocellular carcinoma (HCC) is endemic in Taiwan where it is the second and fourth foremost cause of cancer deaths in men and women, respectively. Taiwan's mortality rates for liver cancer vary considerably from one region to another, suggesting that the environment may exert some influence on deaths attributed to liver cancer. The aim of this investigation was to perform an ecologic study to examine the possible link between ambient PM2.5 levels and liver cancer risk in 66 in Taiwan municipalities.

METHOD:To undertake this investigation, annual PM2.5 levels and age-standardized liver cancer mortality rates were calculated for male and female residents of these areas from 2010 to 2019. Data were tested using weighted-multiple regression analyses to compute adjusted risk ratio (RR) controlling for urbanization level and physician density. Annual PM2.5 levels of each municipality were divided into tertiles.

RESULTS: The adjusted RRs for males residing in those areas with intermediate tertile levels (21.85 to 28.21 ug/m3) and the highest tertiles levels (28.22-31.23 ug/m3) of PM2.5 were 1.29 (95% CI=1.25-1.46) and 1.41 (95% CI=1.36-1.46), respectively. Women in these locations shared a similar risk, 1.32 (1.25-1.40) and 1.41 (1.34-1.49), respectively.

CONCLUSIONS: Evidence indicated that PM2.5 increased risk of enhanced mortality rates with liver cancer in both men and women in Taiwan.

Keywords: air pollution, PM2.5, liver cancer, mortality
Citywide wastewater SARS-CoV-2 concentration predicts the epidemic curve in Taipei City, Taiwan

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BACKGROUND AND AIM:During the pandemic, over 70 countries have incorporated wastewater surveillance as a novel public health tool to detect unidentified cases and monitor epidemic curves. However, it remains unresolved whether the surveillance serves as a leading, lagging, or concurrent indicator. The aim of this study was to establish a citywide wastewater surveillance system and a COVID-19 epidemic prediction model in Taiwan.

METHOD:Over a period of 90 days from May to August 2022, wastewater sampling, preparation, and qRT-PCR analysis were carried out daily in the Xinyi and Neihu districts and twice a week in the other 10 districts in Taipei City. Epidemic statistics were obtained from the Taiwan Centers for Disease Control database, and daily epidemiological indicators were computed, including new case rates and last and future x-days moving averages. Simple linear regression analysis, with and without logarithmic transformation, was performed based on daily wastewater surveillance data in the two districts to predict the epidemic curve. The prediction model was validated by comparing reported epidemic indicators and model estimates for the other 10 districts with a paired sample t-test. RESULTS:All wastewater samples from all districts were positive, with an average viral concentration of 1,829.0±2,237.7 copies/L and an average relative signal of 17.1±16.7. Wastewater virus could be well identified when new case rates exceeded 59.08 new cases per 100,000 population. The best-fitting model, with an R-squared value of 0.43, was a log-log model predicting future 5-day moving average new cases with relative signals of the E gene. An increase of 1% in the latter was associated with an increase of about 0.53% in the former. There was no significant difference between reported and predicted epidemic indicators for the other 10 districts.

CONCLUSIONS: Modelling with wastewater viral surveillance data is a useful supplement to forecast epidemic trends.

Keywords: Infectious diseases, Modeling, Policy and practice, Risk assessment, Science communication

FP-018[Air pollution » Long-term exposure]

Spatial-temporal distribution of Alzheimer's diseases and dementia and the risk factors: A global Study

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BACKGROUND AND AIM: Previous studies showed that air pollution has been linked to neurological diseases, but most of them focused on specific populations. Few studies examined the effects at a global scale. This study aims to investigate the associations between long-term exposure to main air pollution and the mortality of Alzheimer's diseases (AD) and dementias worldwide. METHOD: Age-standardised mortality and disability adjusted life years (DALY) of AD and dementias in 149 countries regions were collected from the Institute for Health Metrics and Evaluation in 1990-2019. Ambient PM2.5, NO2, and ozone were collected from different resources, including literature review and satellite-based data. The exposure data were then aggregated into annual average values at a country/region level. Information on covariates, including household air pollution, annual temperature, Gross Domestic Product, prevalence of cigarette smoking, volume of alcohol drinking, prevalence of physical inactivity, mean value of vegetable and fruit intake, mean total cholesterol and prevalence of chronic diseases (i.e., hypertension and diabetes) were collected from different sources. A linear mixed model was used to examine the associations between air pollution and AD mortality and DALYs. Stratified analyses by age groups, sex, continents, and human development index (HDI) were performed to assess the inequity of health effects.

RESULTS: The study found that long-term exposure to air pollution was associated with a higher risk of AD mortality and DALYs after adjusting for various of covariates. Non-linear concentration-response associations between air pollution and AD mortality were observed. Generally, higher risk of AD mortality and DALYs were observed in those with older age and in countries/regions with lower level of HDI.

CONCLUSIONS: Ambient PM2.5, NO2, and ozone are all contributed to the burden of AD and dementia worldwide, even adjusting for household air pollution. This study highlights the urgent need to mitigate the inequity in the health effects.

Keywords: Particulate matter, Oxides of nitrogen, Ozone, Long-term exposure

FP-019[Exposure assessment methods » Exposure assessment-general]

Challenges for the exposure assessment of ambient temperature in longitudinal cohort studies

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BACKGROUND AND AIM: Biomonitoring of ambient temperature exposure in longitudinal cohort studies is a difficult task, since the behavior of the person can be very dynamic across the day. Additionally, temperature can be influenced by different factors such as construction materials of the ambient. This variations should be considered when designing an appropriate method to assess the exposure. For this reason, the present study aimed to evaluate temperature variation assessment in a two day-span using wearable ambient temperature monitors.

METHOD:Longitudinal descriptive study in which the ambient temperature difference between two ambient monitors data loggers was evaluated. For this, one adult male was asked to wear one of the data loggers which was place as a lanyard, resting at the height of the breastbone (this data logger will be referred as Monitor 1). The other data logger was placed on a surface close to the person position, and transported everywhere the person went (Monitor 2). The temperature was recorded every minute. The data logger was not worn only during sleep.

RESULTS:There was a difference in the temperature recorded between the two monitors, being higher in Monitor 1. The difference was heterogeneous, being as low as 1°C and as high as 5.5°C. Abrupt changes were observed in both monitors when the person moved from one ambient to another. CONCLUSIONS:Ambient temperature is a complex exposure to measure since it can be affected by several components, meaning that there are multiple exposed temperatures and temperature changes across a day-span, even at short time-intervals such as minutes. On the other hand, it is important to note that humans are radiation-emitting systems, and the heat released may influence in the ambient temperature felt by the person. If so, this should be evaluated across lifetimes and sexes given the metabolic differences in these groups.

Keywords: Exposure assessment, Temperature, Temperature variability, Methodological study design

Development and Application of Health Measurement Tools and Protocols for Forest Therapy Program through Pilot Test and Qualitative Analysis

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BACKGROUND AND AIM:Research to verify the health promotion effect of forest healing programs is increasing. However, since various health indicators are currently used, it is necessary to establish standardized health measurement tools and protocols related to forest healing to investigate the health promotion effect continuously.

METHOD:Data were collected through about an hour of interviews with 40 interview participants and three forest healing program operators out of 99 pilot participants using Focused Group Interviews and in-depth Interviews. Qualitative analysis was performed using MAXQDA. Three researchers conducted data coding and classification; the first Author and Corresponding Author conducted the final code classification work.

RESULTS: According to the opinions of the program participants, the terms used in mental health measurement tools were not used in daily life. Still, they were difficult to respond to, or it was challenging to answer sincerely to the repeatability of the question. In addition, the length of the mental health measurement tool was not longer than expected, and the answer to the type of exercise was complicated because the example was unclear. There were opinions that it was necessary to introduce a health measurement tool for blood circulation and a health measurement tool that could examine short-term health changes. In addition, it was challenging to measure group customers due to a large number of people, and there was an opinion that it was necessary to introduce a measurement protocol for group customers.

CONCLUSIONS: It is thought that the following research results can be referred to for the standardization of health indicators and protocols used in forest healing programs. In addition, it is believed that medical-based forest healing programs can be applied through long-term health change measurement.

Keywords: Forest bathing, forest healing, physiological effect, psychological effect, Qualitative Research

Comparison of malnutrition levels among adolescents in urban slums of Mumbai in pre and post-COVID-19 times

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BACKGROUND AND AIM: Adolescents have second fastest growth velocity after infancy. Children gain up to 50% of their adult weight and skeletal mass and >20% of their adult height during adolescence. Malnutrition among adolescents is a matter of serious concern as it is associated with immediate impact on their learning and productivity and has transgenerational effects

AIM: To compare levels of malnutrition among adolescents in slums of Mumbai during pre and post-COVID-19 periods.

METHOD: The current study is a part of the APEAL (Longitudinal Effects of Air Pollution Exposure on Adolescents Lungs) study a multi-centric environmental health study in India. Anthropometric parameters are measured for 571 urban slum adolescents in Mumbai in post-covid period (2022-23). Adolescents were classified in to subgroups – stunting (height < -2SD WHO reference 2007), severe-stunting (< -3SD), wasting (weight for height < -2SD), severe-wasting (< -3SD), overweight (> +1 SD), obese (> +2SD).

RESULTS:In urban Mumbai, 14.9% of the adolescent children are stunted with no significant difference in between gender males (p>>0.05). This is found similar to other studies in slum of Mumbai in pre-COVID-19 period (p>0.05). Adolescents have mean weight-for-height of 36.6 (±9.6) kg with no significant difference between the genders (p>>0.05). One-fifth of the adolescents are wasted, of which 6.8% are severely-wasted. 10.9% of adolescents are overweight and 3.5% are obese. Male adolescents have higher percentage of severe-wasting (p=0.04) and obesity (p<0.01) than females. Compared to pre-COVID-19 period, there is no significant difference in over-weight (p>0.05) and obese children (p>>0.05), but wasting and severe-wasting have significantly reduced (p<0.05). Body impedance analysis shows significantly higher total body, subcutaneous whole body and subcutaneous trunk fat among stunted adolescent than normal (p<<0.01).

CONCLUSIONS:Our data shows that COVID-19 times did not affect the malnutrition in urban adolescents, however, higher body fat in stunted children poses risk of development of obesity.

Keywords: Adolescent malnutrition, Stunting, Wasting, Over-weight, Obese

Public behavior and awareness of mask litter as microplastic source in KOREA

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BACKGROUND AND AIM: Masks are commonly used products made of plastic, and their usage has increased rapidly since the COVID-19 pandemic. To solve the problem of plastic and microplastic pollution caused by masks, it is necessary to raise public awareness of mask use and disposal. In this study, a survey was conducted on 1,000 adults in Korea to find out the public's perception of MP emission and mask disposal.

METHOD: By age group, people in their 20s spent the longest time wearing masks, and wearing time decreased as they got older. Among the occupational groups, the occupation with the longest average daily mask wearing time was 12.0 hours for station workers. Children wear masks for an average of 4.5 hours a day, compared to 6.1 hours for adults. On the other hand, the average number of masks used by children per year is 468.2, which is higher than the average of adults (430.6 masks/year). RESULTS:As a result of the survey on the experience of losing a mask, 38.1% of respondents had lost a mask, and the average number of lost masks per year was about 33 regardless of gender. The experience of mask loss was generally higher among younger people.

It was confirmed that the level of risk perception about the microplastics was high compared to low understanding. Also, 55.6% of respondents said they did not know that microplastics could be released from masks.

CONCLUSIONS: The results of mask wearing time and usage according to occupation and age group can be used as basic information for designing management policies for each exposure risk group. The experience of mask loss and the results of the awareness survey on microplastics suggest the need for policy promotion and education for the public.

Keywords: mask litter, microplastics, public awareness, public behavior

Validity of a Low-cost Particle Sensor to Assess Real-time Indoor PM2.5 Exposure

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BACKGROUND AND AIM:Prenatal exposure to indoor fine particulate air pollution (PM_{2.5}) has been linked to numerous adverse birth outcomes. While prior studies have validated the performance of low-cost sensors in laboratory or outdoor settings, only a few have examined their performance within the context of real-world exposures. Therefore, we conducted a pilot in an ongoing pregnancy cohort to assess the validity of low-cost particle sensors to estimate PM_{2.5} in urban indoor settings and evaluate factors contributing to discrepancies when compared with research grade PM_{2.5} monitors. METHOD:Pregnant women in New York City were recruited early in gestation. Real-time indoor PM_{2.5} concentrations were assessed simultaneously with both DustTrak (DT) (TSI-USA, model:8530EP) and PurpleAir (PA) (model:PA-II, Plantower-CF1 algorithm) by co-locating monitors within the home over 7 days. Temperature, humidity, and instrument-run-time were also collected via PA-II sensors. Data was aggregated into hourly averages. We used multivariate linear models with 10-fold cross-validation using PA measured PM_{2.5} (PA-PM_{2.5}) to predict DT measured PM_{2.5} (DT-PM_{2.5}). Models accounting for temperature, relative humidity, instrument run-time, as well as potential interactions between these affecting factors were compared.

RESULTS:Nine houses completed 1-2 distinct periods of indoor sampling. Mean PM_{2.5} concentration ranged from 14-471 μ g/m³ (SD:12-883 μ g/m³). The model that included temperature, humidity, instrument-run-time, and interaction between PA-PM_{2.5} and humidity yielded the lowest RMSE (R²=0.93, MAE=0.2), with all adjusting covariates significantly predicting DT-PM_{2.5}. Significant interactions were also found between PA-PM_{2.5} and humidity (p<0.001). Higher runtime was also significant (p<0.001) but did not interact with other variables.

CONCLUSIONS: This pilot suggests that low-cost indoor air quality sensors such as Purple Air are adequate to estimate indoor PM_{2.5} exposure levels, especially if environmental conditions such as temperature and humidity are measured. Low-cost PM_{2.5} sensors may improve the surveillance of health risks associated with indoor PM_{2.5} exposures, especially in future studies conducted in low-resource settings.

Keywords: Air pollution, Particulate matter, Exposure assessment, Exposures, Temperature

Developing Screening Tools for Work-related Cases: Taking Lumbar Disc Herniation for Example

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BACKGROUND AND AIM:To determine the work-relatedness of a certain disease highly relies on occupational physicians' judgement. Therefore, the referral mechanism from general practitioners to occupational physicians is crucial to diagnosis of occupational diseases. Taking lumbar disc herniation (LDH) for example, this study aimed to develop a screening tool for clinical referral, which could assist general practitioners to differentiate work-related LDH cases from non-work-related.

METHOD:Network of Occupational Diseases and Injuries Service (NODIS) was an important surveillance system of occupational diseases in Taiwan. From 2010 to 2018, a total of 1,421 patients diagnosed with LDH were reported to NODIS, and their diseases were classified as with higher or lower probability of work-relatedness by reviewers. Demographic factors and information of patients' occupation were also recorded. Logistic regression models were used to investigate the effect of each factor and to develop screening tools.

RESULTS: Among 1,421 confirmed LDH cases, 824 were classified as with higher probability of workrelatedness, while 597 were lower. The odds ratios for five factors in favored of higher probability of work-relatedness were statistically significant, including female, tenure over ten years, never stopped working after symptoms onset, currently working part-time, and working in manufacturing or construction industry. In our proposed screening tool, the sensitivity and positive predictive value were 0.90 and 0.60, respectively.

CONCLUSIONS: Demographic factors indicating work-related LDH were identified. We proposed a screening tool for work-related LDH to assist general practitioners in clinic for referral.

Keywords: Occupational exposures, Modeling

Using the Health Belief Model to Explore the Influencing Factors of Occupational Hazard Prevention of Indigenous Laborers in Taiwan

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BACKGROUND AND AIM: The purpose of this study was to use the Health Belief Model (HBM) to identify factors influencing occupational hazard prevention among Indigenous workers and the reasons for not receiving occupational hazard prevention courses.

METHOD: The main research objects are indigenous ethnic group laborers aged 15 and over. Participants will fill in the questionnaire before the promotion activities for occupational hazard prevention. Data collection is carried out by using a structured questionnaire designed based on the HBM. The content includes: demographic information, labor status, healthy life behavior and status, occupational safety and health measures, intention to receive education and training, as well as six dimensions of the health belief model (perceived susceptibility, perceived seriousness, perceived benefits, perceived barriers, action cues, and self-efficacy).

RESULTS: A total of 354 samples was collected in this study. The results of the study found that the failure of indigenous workers to participate in relevant courses was affected by perceived barriers, action cues and self-efficacy, especially perceived barriers. Other factors include: older age, lower education level, shorter seniority, less physical aches and pains, non-fixed job, low income, or perception that the workplace will not encounter hazards. Those in agriculture, forestry, fishery, animal husbandry, manufacturing, construction engineering, accommodation and catering services are relatively untouched.

CONCLUSIONS: From the result based on the HBM, it is recommended that the occupational hazard prevention training courses for indigenous laborers need to be continuously strengthened, and appropriate arrangements should be made in accordance with the characteristics of indigenous groups. According to the time and occasion, try to go deep into the tribe to hold promotional activities, in order to reduce the occurrence of occupational accidents.

Keywords: Indigenous workers, Health Belief Model, Occupational hazard prevention

Temporal variability of nickel levels using repeated biomonitoring data

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BACKGROUND AND AIM: The toxicity of nickel to humans is well known, but studies on exposure levels related to metabolism in the human body are insufficient. We studied the distribution of nickel in three biological tissues in the body.

METHOD: We recruited 50 healthy participants living in Busan, South Korea. Biological tissues were collected four times in March 2020, August 2020, June 2021, and November 2021. Nickel concentrations were analyzed using inductively coupled plasma-mass spectrometry (ICP-MS) at Dong-A University Environmental Health Center.

RESULTS:The results showed that the accuracy and precision of all three tissues were within $\pm 15\%$, and the geometric mean (GM) of nickel concentration in blood was high in November (blood: 1.197 µg/L), and the GM of nickel concentration in serum and urine was high in March (serum: 1.146 µg/L, urine: 1. 893 µg/L). Temporal variation had a significantly affected nickel levels in blood (p-value: 0.004), serum (p-value: <0.001), and urine (p-value: 0.001). The intraclass correlations of blood and urinary nickel were 8.05% and 6.4%, respectively. The GM of blood nickel in Italy (0.89 µg/L) was comparable to this study (1.03 µg/L), but serum nickel in Italy (0.35 µg/L) was about a-half of this study (0.69 µg/L). Urinary nickel was compared to international reference values (RV95), and no participants exceeded the RV95 values for Canada, France, or Germany. The correlation coefficient of nickel concentration in the three tissues was low. This study shows that nickel levels in the body vary depending on the time of sampling and that the intra-individual correlation is greater than the inter-individual correlation.

CONCLUSIONS: Therefore, future research is needed on biomarkers that can adequately reflect the level of nickel in the body by considering the source and route of exposure.

Keywords: Biomarkers of exposure, Environmental epidemiology, Multi-media, Risk assessment

sleep hours and changes in cognitive function considering the morningness-eveningness type

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BACKGROUND AND AIM: Many previous studies have investigated the association between sleep hours and cognitive function, but few studies have considered morningness-eveningness type even though the effect of sleep hours could be different by morningness type.

METHOD: The Korean Community health survey was used in this study. it is a cross-sectional study and assessed sleep hours and sleep quality using PSQI. The participants were categorized into four groups (morningness, intermediate, eveningness, none group). The change in cognitive function was assessed using a questionnaire.

RESULTS: More than half participants (55.6%) were classified into morningness group and 5% of participants were eveningness group. The risk of cognitive decline was different by sleep hours. The sleep hours showing the lowest risk was different between the morningness and the eveningness groups.

CONCLUSIONS: The result of this study showed that the proper sleep hours to lower risk of cognitive decline might be different by individual's morningness type. Further studies investigating the association between sleep hours and health should consider people's morningness type.

Keywords: sleep, cognitive, morningness, chronotype, memory

Air pollution exposure and longitudinal changes in pulmonary function in adults: A communitybased cohort study in Korea

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BACKGROUND AND AIM: The effect of exposure to air pollutants on human health is a global public health concern. They adversely affect lung development and aggravate lung function. This study investigated the effects of exposure to PM, NO2, SO2, and CO on longitudinal change in pulmonary function in Korean adults.

METHOD: The longitudinal associations between air pollutant concentrations and pulmonary function were analyzed by a linear mixed-effect model with an unstructured covariance matrix. A linear mixed model included a subject-specific random intercept and random slope for time.

RESULTS:A total of 5,021 participants were included in this longitudinal study. The mean age was 55.3 years and 45.6% was male. The mean FEV1/FVC ratio, FEV1 liter, FEV1 predicted, and FVC predicted were 79.6 (4.2) %, 2.8 (0.6) L, 113.2 (14.3) %, and 105.0 (12.1) %, respectively. The mean (SD) concentrations of PM10, PM2.5, SO2, NO2, and CO were 6.4 (0.4) μ g/m3, 3.2 (0.3) μ g/m3, 5.5 (0.8) ppb, 2.6 (0.5) ppb, and 59.4 (3.9) ppb, respectively. Men had higher mean values of FEV1/FVC ratio, FEV1 predicted, and FVC predicted than women. Men had a lower mean value of FEV1 liters compared to women.

A 10-µg/m3 increase in PM10 was significantly associated with decreased FEV1/FVC ratios (β = -0.969 %, p <.001), FEV1 liters (β = -0.064, p <.001), FEV1 predicted (β = -1.981 %, p <.001), and FVC predicted (β = -0.537 %, p= 0.008). A 10-µg/m3 increase in PM2.5 was significantly associated with decreased FEV1/FVC ratios (β = -1.791 %, p <.001), FEV1 liters (β = -0.115, p <.001), FEV1 predicted (β = -3.768 %, p <.001), and FVC predicted (β = -1.009 %, p <.001). SO2, NO2, and CO were also significantly associated with reductions in pulmonary function, except the association between SO2 and FEV1.

CONCLUSIONS: Air pollution exposure was associated with accelerated longitudinal change in pulmonary function in Korean adults.

Keywords: air pollutants, lung function, longitudinal

The improvement of indoor air in households of asthma patients through air purifier in industrial city

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BACKGROUND AND AIM:Xiaogang District in Kaohsiung City, Republic of China, was close to both the Linhai Industrial Park and Kaohsiung International Airport. Households indoor air may be impacted by outdoor pollutants emitted from industrial development. The aim of this study was to evaluate how two different mechanisms of air purifiers improved indoor air in households of asthma patients, including particulate matter (PM), ultrafine particles (UFPs), carbon monoxide (CO), carbon dioxide (CO2), nitrogen dioxide (NO2), sulfur dioxide (SO2), and total volatile organic compounds (TVOCs). METHOD:We conducted a randomized, double-blind crossover study among 48 asthma patients in Kaohsiung City, Taiwan. Asthma patients were randomized divided into 2 groups. One group was asked to use air purifier with both Titanium dioxide Photocatalyst (PCO) and filter (including pre-filter, activated carbon, and High-Efficiency Particulate Air) for 2 weeks, followed by 2-week washout period, and then use PCO for additional 2 weeks. Another group was received the same intervention but in reverse order. We measured indoor air pollutants using real-time monitoring equipment, including PM1, PM2.5, PM4, PM10, UFPs, CO, CO2, SO2, NO2, TVOCs, UFPs.

RESULTS: We observed that the concentrations of TVOCs and SO2 were significantly decreased after using air purifiers with PCO. For the intervention of PCO and filter, the concentrations of PM1, PM2.5, PM4, PM10, UFPs, TVOCs, NO2, and CO were significantly decreased. In addition, air purifiers with PCO and filter resulted in a range of 42~45% reduction in PM1, PM2.5, PM4, PM10, and 3% reduction in NO2, respectively.

CONCLUSIONS: We revealed that air purifiers with two different mechanisms improved indoor air pollutants including particulate and gaseous pollutants. Air purifiers with both PCO and filter efficiently reduce the particulate and gaseous pollutants. Therefore, air purifiers could be an effective control method for improving indoor air quality, especially in high-polluted area.

Keywords: industry, household, air purifier, particulate matter, Titanium dioxide Photocatalyst

A high-throughput LC-MS Method for Urinary Transportation- and Petrochemical-Related VOC Metabolites as Biomarkers for Exposure Assessment

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BACKGROUND AND AIM:Many transportation and petrochemical industries Volatile organic compounds (VOCs) are IARC group I carcinogens. Urinary VOC metabolites are valuable biomarkers for assessing VOC exposure. This study aimed to develop and validate a method for quantitatively analyzing 12 urinary VOC metabolites as biomarkers for environmental and occupational exposure assessment. The method was applied to urine samples from primary school students in an urban town in southern Taiwan to evaluate the VOC exposure levels.

METHOD:An isotope-dilution electrospray ionization tandem mass spectrometry (ESI–MS/MS) with online sample cleanup was developed to analyze 12 urinary VOC metabolites quantitatively. The method was validated for accuracy, sensitivity, and precision using spiked standards. In addition, the urinary VOC levels in 255 primary school students in an urban town in Tainan, Taiwan, were evaluated.

RESULTS:The LC-MS method developed in this study demonstrated high accuracy (mean error for spiked standards 0.1 to 17%), sensitivity (limit of detection 0.03 to 1.16 ng/mL), and precision (within- and between-run relative standard deviations 0.5 to 12.9%) for the quantitative analysis of 12 VOC metabolites in human urine samples. Application of the method to urine samples from primary school students in southern Taiwan revealed potentially elevated transportation- and petrochemical-related VOC exposure levels compared to the USA, warranting further investigation and exposure reduction measures.

CONCLUSIONS: A high-throughput, sensitive, and accurate LC-MS method was developed and validated for quantitatively analyzing 12 transportation- and petrochemical-related VOC metabolites in human urine samples. The method was applied to urine samples from primary school students in southern Taiwan, revealing higher VOC exposure levels compared to the USA. These results indicate a need for further investigation and suggest that the developed method can accurately determine VOC metabolite levels in human urine samples as biomarkers for transportation- and petrochemical-related VOC exposure assessment.

Keywords: exposure marker, human biomonitoring, LC-MS/MS, VOCs

FP-031[Exposures » Occupational exposures]

Night-shift work and prostate cancer: a twostage dose-response meta-analysis for the correct risk definition

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BACKGROUND AND AIM: The hypothesis of this study is night shift work exposure can increase the risk of prostate cancer. To validate this hypothesis, the author conducted a two-stage dose-response meta-analysis with improved quality on this topic.

METHOD: The medical librarian searched PubMed, EMBASE, and the Cochrane Library on 30th December 2022. The 7 inclusion criteria were determined and strictly applied to the selection process. RESULTS: Finally, 11 cohort studies (12 cohort reports, total cases: 9366, and total person-years: 88238009) were included. The pooled RR of prostate cancer for 1, 10, 20, and 30 years of night shift work exposure was 1.0126 (95% CI 1.0003-1.0251), 1.1336 (95% CI 1.0033-1.2808), 1.2850 (95% CI 1.0066-1.6404), and 1.4566 (95% CI 1.0099-1.0251), respectively.

CONCLUSIONS: This study (i) strictly applied 7 transparent inclusion criteria, and (ii) thoroughly separated RRs from cohort studies and ORs from case-control studies and synthesized each type of effect estimates separately, even though the ORs from case-control studies were all excluded because of a high possibility of publication bias. In addition, (iii) exposure dose (years of night shift work) was clearly defined in evidence synthesis based on the years of night shift work reported in individual studies. Finally, (iv) the author applied a new two-stage dose-response meta-analysis method reported in recent literature. Therefore, this study will be the best evidence regarding this topic, and the results reported in this study will be the most accurate and up-to-date risk definition for prostate cancer, along with the years of night shift work exposure.

Keywords: Night shift work, Prostate cancer, Two-stage dose-response meta-analysis, Light exposure at night, Cohort studies

Night shift work and colorectal cancer: a twostage dose-response meta-analysis for the correct risk definition

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BACKGROUND AND AIM: The hypothesis of this study is night shift work exposure can increase the risk of colon/rectal cancer. To validate this hypothesis, the author conducted a two-stage dose-response meta-analysis with improved quality on this topic.

METHOD:The medical librarian searched PubMed, EMBASE, and the Cochrane Library on 30th December 2022. The 7 inclusion criteria were determined and strictly applied to the selection process. RESULTS:Finally, 4 cohort studies (9 cohort reports, total cases: 4368.77, and total person-years: 253074380) and 3 case-control studies (5 case-control reports, total cases: 2517, and total controls: 4919) were included. The pooled RR of colorectal cancer for 1, 10, 20, and 30 years of night shift work exposure was 1.0023 (95% CI 0.9992-1.0055), 1.0234 (95% CI 0.9916-1.0562), 1.0473 (95% CI 0.9832-1.1155), and 1.0717 (95% CI 0.9749-1.1782), respectively. The pooled OR of colorectal cancer for 1, 10, 20, and 30 years of night shift work exposure was 1.0268 (95% CI 0.9968-1.0578), 1.3031 (95% CI 0.9685-1.7532), 1.6980 (95% CI 0.9381-3.0737), and 2.2127 (95% CI 0.9085-5.3888), respectively.

CONCLUSIONS: This study (i) strictly applied 7 transparent inclusion criteria, and (ii) thoroughly separated RRs from cohort studies and ORs from case-control studies and synthesized each type of effect estimates separately. In addition, (iii) exposure dose (years of night shift work) was clearly defined in evidence synthesis based on the years of night shift work reported in individual studies. Finally, (iv) the author applied a new two-stage dose-response meta-analysis method reported in recent literature. Therefore, this study will be the best evidence regarding this topic, and the results reported in this study will be the most accurate and up-to-date risk definition for colon/rectal cancer according to years of night shift work exposure.

Keywords: Night shift work, Colorectal cancer, Dose-response meta-analysis, Cohort studies, Casecontrol studies

Heat Related Mortality Burden during the Record-Breaking Summer 2022 in Europe: An Integrated Continental Analysis

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BACKGROUND AND AIM: The record-breaking temperatures in the summer of 2003 caused over 70,000 excess deaths in Europe. The resulting societal awareness led to the design and implementation of adaptation strategies to protect vulnerable populations across the continent. We here aimed to quantify the heat related mortality burden of the summer of 2022, the now hottest season on record in Europe, and analyse it within the context of accelerated warming temperatures. METHOD: We analysed a mortality database including 45,184,044 counts of death from 823 contiguous regions in 35 European countries, representing their whole population of over 543 million people. We used quasi-Poisson regression models to calculate the location-specific temperature-lag-mortality relation in each European region, and a multivariate multilevel meta-regression analysis to pool the location-specific coefficients.

RESULTS: We estimate that 61,405 (95% CI 59,131-63,719) Europeans died due to the observed heat between May 30th and September 4th. Italy (18,091 deaths; 17,375-18,703), Spain (11,234; 10,462-12,009) and Germany (8,209; 7,033-9,430) were the countries with the largest heat related mortality burden. In relative terms, the largest heat related mortality rates were found in the Mediterranean arch, i.e. Italy (296 deaths per million, 285-306), Greece (281, 261-301), Spain (235, 219-251) and Portugal (217, 198-235). 64% more women than men died prematurely due to heat. CONCLUSIONS: In the context of global warming, with European temperatures rising at a faster rate than the global average, and taking into account the magnitude of heat related mortality in the continent, our results call for a substantial re-evaluation and strengthening of existing heat surveillance platforms, prevention plans and long-term adaptation strategies in Europe.

Keywords: Global warming, heat related mortality, summer temperatures, heat waves, climate change adaptation

DNA methylation associated with Cadmium exposure among the residents near vulnerable area

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BACKGROUND AND AIM: Cadmium (Cd) can cause various diseases and cancers in addition to kidney damage. Additionally, several candidate genes have been reported based on research findings that suggest that cadmium exposure affects DNA methylation. Therefore, we conducted biomonitoring survey and identified the association between DNA methylation markers and cadmium exposure among those who lived in vulnerable area.

METHOD: From July to October 2021, blood and urine samples were collected from a total of 290 participants. Cadmium levels were determined using inductively coupled plasma-mass spectrometer. In addition, the locations of differentially methylated regions were identified using reduced representation bisulfite sequencing (RRBS) method. We used STATA for the general statistical analysis and R for DNA methylation adjusting sex, age, regions, smoking and the distance from the exposure source.

RESULTS:The geometric mean concentrations (95% CI) of blood and urinary cadmium in study participants were 1.72 (1.59, 1.85) μ g/L and 2.65 (2.44, 2.88) μ g/g creatinine, respectively. And we found a methylated region of BRD8 in blood cadmium that is associated with regulation of cancer cell proliferation and the response to chemotherapeutic compounds that destabilize the cytoskeleton or impede proteasomal function. The significance was remained after adjusting the age effect. For urinary cadmium, six significant methylation regions were found in all participants, corresponding to the LMX1A, IGKV3D-7, DYSF, DNASE1L3, ADARB2, and GATA5 genes. And the significance of IGKV3D-7 was remained after controlling the age over 60.

CONCLUSIONS: There were significant methylation regions according to the WHO guidance level for Cd, the association between the genes and the level of cadmium will be investigated for the further research.

Keywords: Environmental epidemiology, Epigenomics, Exposure assessment, Heavy metals

FP-035[Air pollution » Particulate matter]

Neighbourhood and household level socioeconomic status and its association with air pollution exposure in Indian cities

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BACKGROUND AND AIM:Although recent studies indicate that the inequities in air pollution exposure negatively affects lower socioeconomic groups, there is relatively limited evidence on how both household and neighbourhood level socioeconomic status (SES) may influence air pollution exposures in lower and middle income settings.We evaluated the associations between household and area-level SES metrics and exposure to particulate matter (PM2.5) in two contrasting Indian cities – Delhi and Chennai.

METHOD: We used baseline data from the Centre for cArdiometabolic Risk Reduction in South-Asiasurveillance (CARRS) study. The household level SES indicators viz. household income, education level and wealth index score were obtained from the CAARS survey. The neighbourhood level SES was calculated based on the ward level socio-demographic variables from the 2011 Census of India. The daily mean PM2.5 estimates for the year 2010-2016 at a spatial resolution of 1 km x 1 km were obtained from a hybrid exposure model. Multilevel mixed-effects models were used to understand the association between air pollution and SES.

RESULTS:Neighbourhoods with lower SES score were exposed to higher PM2.5 concentrations in both the cities. An interquartile range increase in neighbourhood SES score was found to be associated with 0.54µg/m3 and 2.47µg/m3 lower annual average PM2.5 concentrations in Delhi and Chennai respectively. The analysis indicated that in Delhi, people living in densely populated areas and socially disadvantaged groups were exposed to higher pollution as compared to others. In Chennai, heavily populated areas are located closer to the coast where the pollutants are dispersed by the sea-land breeze hence, a negative association was observed between PM2.5 levels and household density. CONCLUSIONS:As compared to household-level SES, neighbourhood factors were observed to have a stronger association with ambient PM2.5 concentrations. This signifies the importance of controlling for neighborhood level SES factors while studying the effects of ambient air pollution on health.

Keywords: Socio-economic factors, Environmental justice, Environmental disparities

Exposure to inorganic arsenic and hypertension among non-diabetic Mexican women

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BACKGROUND AND AIM:Arsenic exposure is a serious public health problem around the world. Ingested inorganic arsenic (iAs) is eliminated through urine as monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA), which are associated with several health outcomes, for example, hypertension (HTA); however, the epidemiological evidence is still inconclusive. Therefore, the objective of this report is to evaluate the association between iAs exposure and metabolism with hypertension in a study sample of women without T2DM.

METHOD: We identified 150 HTA cases and 572 controls from healthy controls of a case-control study for female breast cancer in northern Mexico, after excluding participants with diabetes diagnostic and biological implausible values of urinary creatinine. Women were interviewed about their clinical, reproductive, sociodemographic and lifestyle characteristics. Urinary iAs metabolites were determined by High Performance Liquid Chromatography coupled with mass spectrometry and iAs metabolism was assessed by metabolite percentages and ratios. Unconditional logistic regression models were used to evaluate associations.

RESULTS:Urinary total arsenic minus arsenobetaine (TAs-AsB) concentrations varied from 0.57 to 303.29 µg/L. HTA cases had significantly lower iAs and MMA concentrations (µg/L) than control women. Cases had significantly lower %iAs and %MMA, while %DMA and second methylation index (SMI) were significantly higher than in control women. After adjusting for age, smoking and state of residence, HTA was significantly negative associated with %MMA, as well as significantly positive associated with SMI. No significant associations were observed between HTA prevalence, TAs-AsB levels and its metabolites.

CONCLUSIONS:Our findings support an association between iAs metabolism and HTA but not with TAs-AsB concentrations. These results confirm the complex relationship between iAs metabolism and several diseases.

Keywords: Epidemiology, Heavy metals, Female

Gender and geographical representation in editorial boards publishing in environmental sciences and public health: challenging the "old boys club"

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BACKGROUND AND AIM: Journal editors play a critical role in coordinating and shaping what is accepted as scientific knowledge. This study aimed to explore the diversity of journal editorial boards (EB) publishing in environmental science and public health.

METHOD:Clarivate Journal Citation Reports were used to identify journals classified as Public, Environmental, and Occupational (PEO) Health, Environmental Studies, or Environmental Sciences. Current EB members were identified from each journal's publicly available website between 1 March and 31 May 2021. Individuals' names, EB roles, institutional affiliations, geographic locations (city, country), and inferred gender were collected. Linear and logistic regression models were fitted to further assess the relationship between gender presence, low- and middle-income country (LMIC) presence, and several journal and editor-based indicators.

RESULTS:After identifying 628 unique journals and excluding discontinued or unavailable journals, 615 journal EBs were included. In-depth analysis was conducted on 591 journals (27,772 editors) with complete gender and geographic data. Overall, most editors were men (65.9%), followed by women (32.9%) and non-binary/other gender minorities (0.05%). 75.5% of EBs (n=446) were composed of a majority of men (>55% men), whilst only 13.2% (n=78) demonstrated gender parity (45–55% women/gender minorities [WGM]). 84% of editors (n = 23,280) were based in high-income countries and only 2.5% of journals (n=15) demonstrated economic parity in their editorial boards (45–55% editors from LMICs). None of the editors-in-chief and only 27 editors in total were women based in low-income countries. Having WGM and LMIC-based editors-in-chief are both positively correlated to the overall percentage of WGM (R=0.42) and overall percentage of LMIC-based (R=0.57) editors respectively.

CONCLUSIONS: This study exposes the glaring lack of diversity in EBs in environmental science and public health, and discusses the power dynamics affecting the creation and dissemination of knowledge.

Keywords: editorial boards, environmental sciences, public health, diversity, knowlege generation

FP-038[Exposures » Occupational exposures]

Coal Production Trends and Black Lung Disease Incidence Rate In Indonesia, 2013-2021

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BACKGROUND AND AIM: The use of coal in the world continues to increase, resulting in countries supplying coal products continuing to increase their production. Indonesia as the world's largest coal supplier also seeks to increase coal production every year. The aim of this study is to see the other perspective on occupational health of increasing coal production and its impact on black lung disease in Indonesia.

METHOD: This research is a retrospective longitudinal study conducted on 3 coal mines in Indonesia. The research focused on 2013-2021. Data is taken from Indonesia's national coal production data and black lung disease data is taken based on the annual medical check-up program for coal miners in 3 coal companies in Indonesia. Rate ratios were examined for differences in rates between men and women workers, and annual percent change was calculated to quantify changes in incidence rates over time.

RESULTS:Trends analysis shows that coal production in Indonesia has continued to increase at least 24,49% in the last decade from 490 million tons in 2013 and gradually increased to 610 million tons in 2021. Based on the results of X-Ray every years of coal mine workers in Indonesia, the new cases of Black lung disease in coal miners was found 112 (13,88%) these years, bigger than worldwide incidence rate (8%). Male workers have a greater ratio of black lung disease in coal mining companies. The age of workers over 40 years have an incidence rate twice (69,64%; 78 cases) that of workers under 40 years.

CONCLUSIONS: Increasing coal production in Indonesia results in increasing new cases of black lung disease in Indonesia. The increase in new cases of black lung disease in Indonesia is mainly experienced by male coal mine workers and workers over the age of 40 years.

Keywords: long-term exposure, respiratory outcomes, occupational epidemiology, occupational exposures

Decoding the Impact of Particulate Matter on Metabolic Pathways: A Systematic Review of Toxicological and Epidemiological Studies

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BACKGROUND AND AIM: The global demographic is undergoing an unprecedented shift with the population aged 65 and over surpassing the number of children under five for the first time. This demographic change emphasizes the health risks related to environmental exposures, particularly PM2.5 air pollution, which has been shown to disproportionately impact older individuals. PM2.5 particles can enter the bloodstream through the respiratory system, leading to oxidative stress and systemic inflammation. Metabolomics, the comprehensive analysis of biological metabolites, can provide valuable insights into the effects of these changes and clarify the relationship between air pollution, metabolic changes, and age-related diseases.

METHOD:In this review, we synthesized findings from both epidemiological and toxicological studies using metabolomics to examine the molecular effects of PM2.5 exposure on aging populations. We conducted a thorough examination of studies published on PubMed and Europe PMC from 2012 to 2022. From an initial assessment of 484 abstracts, we selected 70 primary papers that met our selection criteria.

RESULTS: The evidence from the selected studies suggests that exposure to PM2.5 pollution results in cardiovascular-related metabolic disruptions and activates the sphingolipid metabolism pathway. Furthermore, PM2.5 exposure appears to induce metabolic changes associated with oxidative stress, inflammation, and mitochondrial dysfunction, affecting pathways such as amino acid metabolism, lipid metabolism, energy metabolism, and nucleic acid damage/repair.

CONCLUSIONS: This review underscores the urgent need to mitigate the detrimental effects of PM2.5 air pollution on the aging population. Given the escalating environmental challenges, it is paramount to develop and apply targeted interventions and evidence-based strategies to protect the health of older individuals.

Keywords: Untargeted metabolomics, targeted metabolomics, PM2.5, PM10, black carbon

Inventory in ABCD mode Community Assets of Sanmin District, Kaohsiung City for Google Maps

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BACKGROUND AND AIM:According to the National Development Commission (2023) "Republic of China Population Estimates", by 2025, we will enter a "Super Aged Society". According to Hao Guangzhong et al.'s (2019) research, it was found that all elderly people aged 65-85 have experience in using mobile phones, and Lin et al.'s (2009) research found that the elderly want easier and clearer media operation interfaces. In response to the needs of the elderly's daily activities and health care. METHOD:Since October 2018, the ABCD (asset-based community development) model has been used to classify and build community assets. The data is built on Google Maps, which reduces the memory space of mobile phones and tablets, and can be used on various media. In addition, with the Information Office of Zhonghe Hospital affiliated to Kaohsiung Medical University, the "Social Participation Map" was embedded in the hospital's medical information system, and the patient's address was linked to the "Social Participation Map" to present the community assets near the patient's home (source), and through the doctor's simple Explain and introduce to patients and their families.

RESULTS: Users feel that it is convenient and easy to use, and it is easy to find the resources they want to use.

CONCLUSIONS:Recording community resources on multi-media shared by many people is easy for the public to use, and it is helpful for them to promote healthy behaviors. In addition, using google earth multimedia, it is clear at a glance the proportion of resources in each region, which is conducive to the balance of community distribution.

Keywords: ABCD (asset-based community development), community assets (source), Google Map, Google earth

Estimation of Burden of Abestos Related Cancers in Taiwan

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BACKGROUND AND AIM:Occupational and environmental exposure to asbestos is a crucial risk factor for asbestos-related cancers (ARCs), including malignant mesothelioma (MM), lung cancer, laryngeal cancer and ovarian cancer. Because of the relatively long latency period of ARCs, and a general lack of public awareness, there are barriers and difficulties in recognition, and their underestimation could be a public health challenge. Few studies analyzed the trend of ARCs or evaluated their extent of underestimation in Taiwan. This study aimed to estimate the disease burden of ARCs during 2005-2017. METHOD:Cancer cases were obtained from the Taiwan Cancer Registry, and incident case number of MM, lung cancer, laryngeal cancer, ovarian cancer, pharyngeal cancer, gastric cancer, and colorectal cancer were retrieved from 2005 to 2017. Healthcare utilization data were based on the National Health Insurance (NHI) databases. The cases of ARDs attributable to asbestos were estimated using population attributable fraction (PAF). The prevalence of asbestos exposure was estimated through retrospective exposure assessment using worker population in various industries, and CARcinogen EXposure (CAREX). Relative risks of the ARCs of interest were drawn from epidemiological literature searched in the PubMed databases.

RESULTS:PAF of MM was assumed to be 100%, and PAF of the other ARCs ranged from 0.14% (colorectal cancer) to 2.31% (lung cancer) in 2015. Estimated incident case numbers of asbestos-related malignancies were summarized. There were about 400 cancer cases annually may be attributable to asbestos exposure in Taiwan.

CONCLUSIONS:ARCs would impose a substantial burden on Taiwanese workers. We observed obvious underestimation of ARCs in comparison with real-world statistics of worker's compensation. Collaborative efforts to increase awareness of work-related ARCs in the general public and among clinicians are urgently needed. Appropriate health exam programs with cancer screening should be designed considering cost-effectiveness for workers even after retirement for early detection of ARCs.

Keywords: Cancer and cancer precursors, Incidence

Predictability assessment of the first continental heat-cold-health early warning system: new avenues for human health forecasting

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BACKGROUND AND AIM: The increasing number of extreme climate events due to global warming highlights the urgent need for the implementation of early warning systems directly targeting the effects of weather phenomena on human health. Here we build the first continental heat-cold-health early warning system, and compare its predictability with the original weather forecasts. METHOD: We did so by considering almost 60 million counts of all-cause mortality in 147 contiguous NUTS regions from 16 European countries. We calculated state-of-the-art temperature-lag-mortality models, which account for the delayed effects of daily temperatures on mortality counts. These epidemiological associations were used to transform the daily bias-corrected forecasts of 2-meter temperature into daily predictions of temperature related mortality. We compared the predictive skill of temperature forecasts and temperature related mortality predictions by using predictability assessment techniques widely used in weather and climate forecasting.

RESULTS:We found that temperature forecasts can be used to issue skillful predictions of heat and cold related mortality accounting for the real impacts of temperature on human health, although the window of predictability was differently reduced by season and location. We also showed that the predictability of the early warnings is to a very large extent constrained by the original weather forecasts, and not by the epidemiological models, which means that further advancements in weather forecasting would automatically turn into an increase in the predictability window of health early warning systems.

CONCLUSIONS: Therefore there is a pressing need to develop new interdisciplinary research combining weather and climate forecasting with epidemiology and social sciences, which systematically validates the predictability of any derived early warning system. Overall, we proved that a rigorous assessment of the predictability of early warning systems is an unavoidable requisite to generate trust among public health authorities, and in this way, increase resilience and strengthen our early adaptation response to climate change.

Keywords: Temperature, Mortality, Short-term exposure, Climate

Linking the health of women and non-binary residents during Covid-19 pandemic to public spaces with natural elements, gentrification and touristificat

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BACKGROUND AND AIM:Our main goal was to understand if and how – in the context of the Covid-19 pandemic – changes in use and perception of public space which have natural elements (PSNE) have impacted the health of women and non-binary residents of Barcelona. Also, to explore how changes in processes such as gentrification and touristification may have impacted the use of and health benefits from PSNE during the pandemic.

METHOD: We employed a comparative mixed methods case-study with two parts (one quantitative and one qualitative) in two neighborhoods of the city of Barcelona (Spain). For the quantitative part we collected data from 907 residents using a questionnaire. For the qualitative part we performed two participate workshop, two exploratory walks and semi-structured interviews. We interpreted the results jointly to obtain statistically solid and context-relevant results.

RESULTS: We found that in general participants maintained or increased their use of PSNE nearby their residence. But in neighborhoods with low access to PSNE, spaces located outside the neighborhood emerged as relevant.

Participants who maintained or increased their use of nearby PSNE during the Covid-19 pandemic had around 50% lower odds of self-reported poor general and mental health. Those who maintained or increased their use of PSNE further away also had around 55% lower odds of reporting poor general health. Interviewees explained that walking and meeting friends and family in PSNE helped them relax, disconnect, and decrease their stress levels. Among participants, we found that increased perceptions of touristification during the Covid-19 pandemic were associated with a 7% (1%, 14%) higher odds of reporting poor general health.

CONCLUSIONS: Our results add to other existing evidence indicating that contact with PSNE should be promoted during health emergencies like the Covid-19, while paying attention to the detrimental impacts of perceived changes to touristification.

FP-044[Built environment » Green space]

Perceived urban ecosystem services and disservices in gentrifying neighborhoods: Contrasting views between community members and state informants

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METHOD: We performed 153 interviews (105 to community representatives and 48 to state informants). We analyze the ecosystem services and disservices identified by community and state informants in seven cities with gentrifying neighborhoods, pronounced social inequalities, and where NOE were created or improved: Amsterdam, Bristol, Cleveland, Lyon, Montreal, Philadelphia, and San Francisco.

RESULTS:Our study shows that informants report a wide array of ecosystem disservices (and services) in relation to new and improved NOE located in cities undergoing gentrification and identified some disservices previously under-studied (i.e. physical tiredness, low attractiveness and forced displacement). Generally, community informants were able to identify ecosystem disservices more clearly and richly. Our study illustrates how differences in decision making positions can impact perceptions of ecosystem services and disservices.

CONCLUSIONS:Our study has implications for urban environmental planning decisions that will help maximize the ecosystem services provided by urban NOE. Only if all perceived ecosystem services and disservices are considered, will it be possible to design green just healthy cities.

Keywords: Green space, Particulate matter, Environmental disparities, Environmental justice

Spatial distribution of arsenic in environmental matrices and its relationship with the urinary arsenic concentration in pregnant women from Arica

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BACKGROUND AND AIM: The soils of Arica, northern Chile, contain arsenic of natural and anthropogenic origin. Here, we explore the relationship between the arsenic concentration in two environmental matrices and the urinary arsenic concentration in pregnant women. METHOD: Data analysis of 1,559 pregnant women from Arica city with urine arsenic concentration, information on seafood intake, and drinking water supply sources between 2013 and 2016. For the same years, information on urban drinking water samples' arsenic concentration (n=40) was obtained through public reports from the local health authority. Information on soil arsenic concentration (n=394) was obtained from a study of the soil chemical quality in 2008 available on the web. RStudio software was used to geocode and assign to each pregnant woman the arsenic concentration of both matrices according to the residence place (n=68 neighborhood units for soil; n=5 potable water storage tanks). We estimated the proportion of urinary samples with an arsenic concentration above the median according to the distribution of water storage tanks. Spearman's correlation was used to evaluate the relationship between urine and soil arsenic concentration.

RESULTS:The median urinary arsenic in pregnant women was 15 μ g/L (IQR: 9.0–23 μ g/L). After adjusting for seafood intake and drinking water supply source, the proportion of women with urine arsenic concentration above 15 μ g/L was higher in those residing in sectors supplied by the Cerro Chuño water storage tanks (arsenic-p95= 20 μ g/L) compared to those who receive water with a lower concentration (Prevalence ratio= 1.25; 95% CI 1.10, 1.41). Regarding soil arsenic concentration, we accomplished not observe a correlation with the concentration of arsenic in the urine (rho= 0.08; pvalue 0.04).

CONCLUSIONS: This analysis reveals a higher arsenic concentration in the urine of pregnant women residing in sectors with arsenic drinking water levels >10 μ g/L. Continued monitoring is required.

Keywords: Exposures, Pregnancy outcomes, Spatial statistics, Water quality

Association between labor epidural analgesia and autistic traits among Japanese children: evidence from Hamamatsu Birth Cohort for Mother and Child

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BACKGROUND AND AIM: Epidural analgesia is widely used for pain relief to women during labor, particularly in developed countries. A previous study reported an increased risk of autism spectrum disorder (ASD) among offspring associated with the administration of labor epidural analgesia (LEA), while subsequent studies found no significant risk of ASD and thus the findings remain inconsistent. Besides, whether administration of LEA is associated with autistic traits remain unknown. Therefore, this study aimed to examine the association between LEA and autistic traits among children aged 8 years.

METHOD:This study included 810 children aged 8 years, who participated in the Hamamatsu Birth Cohort for Mother and Child. The exposures were administration of epidural analgesia, and doses of epidural analgesia including bupivacaine and ropivacaine. The Social Responsive Scale, Second Edition (SRS-2) was used to assess autistic traits among children at 8 years. SRS-2 total T-score, as well as T-scores for two sub-domains — restricted and repetitive behavior (RRB), and social communication and interaction (SCI)— were calculated. Multivariate linear regression was used to estimate the β coefficient and 95% confidence interval (CI) for the associations.

RESULTS:Out of 810 children, 51.2% were male and 50.5% were first born. Only 5% children were exposed to LEA. Administration of LEA was not significantly associated with SRS-2 total T-score [β =0.83; 95% CI: -2.79 to 4.45], RRB score (-0.06; -3.42 to 3.29) and SCI score (0.99; -3.33 to 5.30). After adjusting for child characteristics, paternal age, maternal prepregnancy and pregnancy related covariates, the results remain materially the same. Higher dose of bupivacaine was associated with decreased total T-score (-1.22; -7.19 to 4.76), while higher dose of ropivacaine was associated with increased total T-score (3.18; -2.39 to 8.75), albeit these associations were not statistically significant.

CONCLUSIONS: The present study suggest that LEA may not be associated with autistic traits among Japanese children.

Keywords: autism spectrum disorder, autistic traits, epidural analgesia, epidural analgesia, neurodevelopmental disorders

Association between polymorphisms of onecarbon metabolism genes and oral cancer risk

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BACKGROUND AND AIM: Head and Neck Cancers (HNCs) rank third among the top ten cancers for men in Taiwan in 2020. It is well known that heavy smoking, alcohol abuse and betel quid chewing are associated with the development of HNCs. Genetic polymorphisms involved in one-carbon metabolism (OCM) demonstrated the risk of alcohol-associated carcinogenesis, including HNCs. Previous studies have reported that *MTHFR* C677T, *MTHFR* A1298C and *MTR* A2756G polymorphisms associated with HNCs risk. However, the relationship between OCM polymorphisms and oral cancer risk in Taiwan is unclear. Therefore, we aimed to investigate the impact of OCM polymorphisms on the susceptibility of oral cancer patients.

METHOD:Oral cancer patients were recruited from the Head and Neck Surgery Department at Chang Gung Memorial Hospital between 1999 to 2019. Controls participants were recruited from Taiwan Biobank. SNP array analysis was processed on Axiom Genome-Wide TWB Array Plate and performed at the National Center for Genome Medicine, Academia Sinica, Taiwan.

RESULTS: This study included 496 oral cancer patients and 2302 healthy controls. Our analysis showed a statistically significant difference in education levels, occupation, alcohol drinking, cigarette smoking, betel nut chewing, tea, coffee, vegetarian and family history of oral cancer between cases and controls. In the *MTHFR* A1298C polymorphism, there was an increased risk of oral cancer in the dominant model (genotypes AC and CC vs. AA) (OR = 1.236, 95% CI = 1.015-1.505). However, after adjusted for above mentioned significant variables, the significant association was disappeared (OR = 1.047, 95% CI = 0.792-1.384). In addition, *MTHFR* C677T and *MTR* A2756G polymorphisms were not associated with oral cancer risk.

CONCLUSIONS: Our results indicated no significant association

between *MTHFR* A1298C, *MTHFR* A1298C and *MTR* A2756G polymorphism with oral cancer risk. Further evaluations for other OCM polymorphisms are recommended.

Keywords: oral cancer, one-carbon metabolism, gene polymorphisms

FP-048[Exposures » Other (to be specified with keywords in the keywords section)]

Problems experienced during case investigations for children with elevated blood lead reported to Health Protection Teams in England, 2014-2021

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BACKGROUND AND AIM:Lead is a non-threshold contaminant with children being most vulnerable to its effects. In England, children (≤16 years) with elevated blood lead are notified via UK Health Security Agency's (UKHSA's) Lead Exposure in Children Surveillance System (LEICSS) to regional Health Protection Teams (HPTs) for case management in collaboration with other agencies. To date, a detailed review of the problems experienced during investigation has not been conducted. AIM: Describe the problems experienced in the public health investigation and management of children with elevated blood lead reported to HPTs in England between 2014 and 2021.

METHOD:Data on problems experienced was collected using a lookback questionnaire with case managers and the following free-text question: "were there any specific problems or issues that arose during the investigation and management of this case?". Data were extracted from Select Survey and deduplicated. A thematic analysis was conducted by applying codes to text and assigning to themes. Multiple codes and therefore multiple themes could be assigned to one entry.

RESULTS:The completion rate for the lookback questionnaire was 74%. Overall, 241 were children reported to HPTs for lead exposure and had a completed lookback questionnaire. A text entry to the 'problems experienced' question was recorded for 123 records (51%) which generated 141 codes and 9 themes. 'Stakeholder engagement/response' was the most common theme that emerged (38%) with parent/guardian engagement most frequently cited, followed by 'Roles and responsibilities' (13%) and 'Needing additional resource' (10%). Resources required included interpreters, expertise, and funding. In order of frequency, the other themes that emerged were 'Contacting stakeholders', 'Source identification', 'Continuity', 'Safeguarding', 'Information errors' and 'Worry (parent/guardian)'. CONCLUSIONS:Whilst multi-agency working is required for managing lead exposure cases in England, increasing stakeholder engagement within the process through education and awareness-raising and having clearly defined roles and responsibilities, would support more efficient case management.

Keywords: lead (Pb) exposure, childhood, public health case management, problems
Maternal occupation and stillbirths in São Paulo, Brazil – FetRisks study preliminary findings

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BACKGROUND AND AIM: Maternal occupation and work-related exposures may represent central risks for pregnancy and childbirth outcomes, although are often overlooked. This study aimed to describe preliminary findings of maternal occupational profile of stillbirths. Stillbirth is poorly studied and a descriptive approach is of great interest.

METHOD: This ongoing hospital-based case-control study aims to evaluate the effect of environmental pollution, maternal infections, access to health services, and other risk factors through interviews, pregnancy records, biomarkers, and secondary data. Absolute and relative frequencies of the mother's marital status, personal income, occupation, number of jobs, employment relationship, job physical exertion, and transportation to work, as well as time worked during pregnancy, are presented. RESULTS: The number of women included was 290. Most were married (72.1%), earned between 1-3 minimum wages (44.9%), or had no personal income (28.5%). Of these, 148 women (51.0%) worked during pregnancy, while the rest were unemployed or housewife. Of those who worked, most had one job (93.8%), a formal contract (56.4%), worked in a fixed place (86.3%), and went to work by public transport (68.4%). About 30% worked more than 41 hours weekly during pregnancy, and 24.5% declared to face physical exertion at work, especially heavy weight carrying or lifting, excessive walking, squatting, or climbing stairs. Most frequent occupations were: service workers in hotels, and food and beverage establishments; sales operators; cashiers; beauty and hygiene services; food service assistants; telemarketing operators; receptionists; and caregivers (range: 11.1% to 4.5% of total).

CONCLUSIONS:Participants reported experiencing work-related risks during pregnancy, including long shifts, physical exertion, and physical and ergonomic hazards. Participants may be also exposed to other unrecognized risks, such as chemicals. Subsequent analyzes will include the comparison between cases and controls, in order to estimate the effect of maternal occupation on the risk of stillbirths in the studied population.

Keywords: Birth outcomes, Pregnancy outcomes, Occupational exposures, Children's environmental health

Liver on Fire? Exposure to PFAS and PAHs in Relation to Liver Function and Serum Lipids in Firefighters (CELSPAC-FIREexpo study)

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BACKGROUND AND AIM:Firefighting is associated with exposure to per- and polyfluoroalkyl substances (PFAS) and polycyclic aromatic hydrocarbons (PAHs), which are suspected to affect the cardiometabolic profile, including liver function and serum lipids. However, only a few studies have investigated the impact of this specific exposure among firefighters. Our study aims to investigate the associations between firefighters' exposure to PFAS and PAHs and liver biomarkers and serum lipids. METHOD:CELSPAC-FIREexpo study included professional firefighters (n=52), newly recruited firefighters in training (n=58), and controls (n=54). They provided exposure questionnaires and blood and urine samples to assess their exposure to PFAS (6 compounds) and hydroxylated metabolites of PAHs (OH-PAHs, 6 compounds), and to determine liver biomarkers (alanine aminotransferase (ALT), gamma-glutamyl transferase (GGT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and total bilirubin (BIL)) and serum lipids (total cholesterol (CHOL), low-density lipoprotein cholesterol (LDL) and triglycerides (TG)). The associations between exposure and biomarkers of liver function and serum lipids were investigated cross-sectionally using multiple linear regression (MLR) with false discovery rate correction and Bayesian weighted quantile sum (BWQS) regression for the mixture of compounds. All models were adjusted for potential confounders.

RESULTS:A positive association between exposure to PFAS/OH-PAHs mixture and BIL (β =28.6%, 95% CrI=14.6 – 45.7%) was observed in the BWQS model. When the study population was stratified, in professional firefighters and controls the mixture showed a positive association with CHOL (β =29.5%, CrI=10.3 – 53.6%) and LDL (β =26.7%, CrI=8.3 – 48.5%). No statistically significant associations with individual compounds were detected using MLR.

CONCLUSIONS:Our results showed that higher exposure to PFAS/OH-PAH mixture is associated with changes in biomarkers of cardiovascular diseases, which can result in an unfavourable cardiometabolic profile, especially in occupationally exposed firefighters.

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Keywords: Occupational exposures, PFAS, Cardiovascular diseases, Environmental epidemiology

Associations of Local Climate Zones with cardiovascular disease: findings from the USbased Nationwide Nurses' Health Study from 2000 to 2016

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BACKGROUND AND AIM:Over 80% of US population lives in urban areas, and the built environment may influence cardiovascular diseases (CVD) by promoting physical activity and shaping exposure to environmental hazards. In 2012, the local climate zone (LCZ) scheme was introduced to characterize and classify urban surface structures with consideration of micro-scale land cover (e.g. paved, low plants, or water) and the associated physical properties. However, little is known how LCZ influences CVD risk. Therefore, we explored the association between LCZ and CVD incidents using longitudinal cohort data.

METHOD: We followed 101,870 participants from the US-based Nurses' Health Study from 2000 to 2016. We derived percentages of urban (compact highrise, compact midrise, compact lowrise, open highrise, open midrise, open lowrise, large lowrise, sparsely built, heavy industry) and natural (dense trees, scattered trees, bush or scrub, low plants, bare rock or paved, bare soil or sand, water) LCZs in the 500m area around each residential address at biennual follow-ups. We modeled hazard ratios (HR) and 95% confidence intervals (95%CI) for fatal and nonfatal coronary heart disease (CHD), stroke, and combined CVD (CHD or stroke) by LCZ classes using time-varying Cox proportional hazards models adjusting age, year, marital status, living-alone, occupational history, education level, smoking history, race, and neighborhood social economic status.

RESULTS: We included 1,406,707 person-years, 3390 cases of CHD and 3636 stroke. We found reduced risks of CVD and CHD among participants living in LCZs with higher proportion of water

[HR=0.97 (95% CI: 0.95, 0.99) and HR=0.96 (0.92, 0.99), respectively, for each standard deviation increment in the percent of LCZ-water] and elevated risks of stroke among participants living in LCZs with higher proportions of low plants [HR=1.06 (1.03, 1.09)] and large lowrise [HR=1.03 (1.01, 1.06)].

CONCLUSIONS: Urban morphology may influence CVD risk; we will further explore these associations considering physical activity as a mediator.

Keywords: Built environment, Local Climate Zone, Cardiovascular diseases, Environmental epidemiology, Nurses' Health Study

Long-term quality-of-care score for predicting the occurrence of heart failure in patients with type 2 diabetes mellitus

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BACKGROUND AND AIM: Heart failure (HF) remains a major cause of mortality, morbidity, and poor quality of life, and diabetes mellitus (DM) is a known risk factor. To develop a long-term quality-ofcare score for predicting the occurrence of HF among patients with type 2 DM on the basis of the hypothesis that good quality of care can reduce the risk of HF in patients with DM.

METHOD:Using Taiwan's Longitudinal Cohort of Diabetes Patients Database and the medical charts of a medical center, we identified incident patients diagnosed with type 2 DM from 1999 to 2003 and followed them until 2011. We constructed a summary quality-of-care score (with values ranging from 0 to 8) with process indicators (frequencies of HbA1c and lipid profile testing and urine, foot and retinal examinations), intermediate outcome indicators (low-density lipoprotein, blood pressure and HbA1c), and co-morbidity of hypertension. The associations between the score and the incidence of HF were evaluated using Cox regression models.

RESULTS: A total of 4339 patients who had sufficient information to calculate the score were enrolled. In comparison with participants who had scores ≤ 1 , those with scores between 2 and 4 had a lower risk of developing HF [adjusted hazard ratio (AHR) = 0.84; 95% confidence interval (95%CI): 0.66-1.07], and those with scores ≥ 5 had an even lower risk (AHR = 0.40; 95%CI: 0.23-0.72). CONCLUSIONS: Management of diabetes can have an impact on clinical events in patients with HF.

Moreover, there is growing evidence suggesting that medications commonly used to treat diabetes have the potential to decrease the occurrence of HF events. The quality-of-care score developed in this study had a significant association with the risk of HF and thus can be applied to guiding the care for these patients.

Keywords: quality-of-care score, heart failure, diabetes mellitus

The association between indoor workplace environment and heart rate variability in office workers of an information service company

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BACKGROUND AND AIM: Indoor air pollution is one of the greatest environmental risks to health. Indoor air pollution-mediated systemic risk is still evolving and related to the morbidity and mortality of various cardiovascular diseases.

METHOD: The employees of an information service company participated. Three stages health assessments including questionnaires, heart rate variability analysis were performed from December 2019 to December 2020. Air quality monitoring devices were used to monitor air quality including PM_{2.5}, carbon dioxide, ambient temperature, and relative humidity. The apparent temperature was used to indicate thermal comfort in workplace. The standard deviation of NN intervals, Root mean square of the successive differences, total power, high frequency power, low frequency power are used as heart rate variability parameters. The generalized linear mixed model was used to evaluate the association between air quality and heart rate variability.

RESULTS:Totally 1254 person-hours were used in model. After adjusting age, gender, BMI, personal diseases, and habits, we found per IQR (12.13 μ g/m³) increase in PM2.5 was positive associated with SDNN (β = 2.28 ms; 95%CI= 1.32 ~ 3.25), LF (28.29 ms²; 14.46 ~ 42.1) and TP (346.4 ms²; 183.1 ~ 510.1). However, per IQR (529.4 ppm) increase in carbon dioxide was negative associated with SDNN (-1.96 ms; -3.18 ~ -0.69), HF (-15.51 ms²; -29.62 ~ -0.85) and TP (-362.9 ms²; -569.4 ~ -145.9). In addition, a significant decrease in SDNN (-2.77 ms; -3.93 ~ -1.53), RMSSD (-1.16 ms; -2.03 ~ -0.23), LF (-26.7 ms²; -43.48 ~ -8.89), HF (-24.35 m²; -37.64 ~ -10.05) and TP (-471.6 ms²; -661.8 ~ -260.4) were associated with per IQR (2.46°C) increases in apparent temperature. CONCLUSIONS:The study provided important evidence of decrease in HRV while working in an indoor office environment with higher CO₂ concentration and apparent temperature. Our study verified that air pollutants and thermal comfort are immediate environmental stressors.

Keywords: Built environment, Multi-pollutant, Temperature, Cardiovascular diseases

Microplastics and Autism: A plausible link

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BACKGROUND AND AIM:An alarming 5-fold increase in the prevalence of Autism Spectrum Disorder (ASD) on the island of Guam from 2016 to 2022. This trend correlates with the environmental exposure of humans, particular young children to the ubiquitous but toxic microplastics. The nature and magnitude of its impacts to developing nervous system are only beginning to be understood. This study aims to fill the knowledge gap regarding the theoretical link of the potential neurotoxic effects of environmental microplastics in the face of increasing prevalence of Autism on Guam by reviewing the current evidence in literature.

METHOD: Topic-focused reviews that examine the neurotoxic effects of microplastics as a potential risk factor for development of autism was conducted to cover relevant articles in Pubmed from 2020-2023 using the combinations of this search words: Autism and Microplastics, Neurotoxicity and Microplastics.

RESULTS:A total of 127 articles were analyzed. Only 3 articles addressed directly the link between neurotoxicity of various microplastics on children and development of ASD symptoms. The author reviewed 95 studies on the neurotoxic effects of microplastics on other species, including fish, mice, mollusks, nematodes, crustaceans and chicken. All studies have demonstrated neurotoxicity and most common mechanisms reported include 1. induction of oxidative stress resulting to neuronal damage and neuroinflammation, 2. inhibition of acetylcholinesterase activity, 3. altered neurotransmitter levels, which all could lead to ASD like symptoms. Microplastics are taken up via ingestion and inhalation, which can reach systemic circulation and ultimately cross the blood brain barrier, where it exerts its neurotoxic effects.

CONCLUSIONS: There is an increased trend of ASD on Guam, which parallel with the widespread exposure of young children to microplastics, both of which require equal attention. There is much to be understood about neurotoxic effects of microplastics to children's developing brain and further research is imperative to establish its potential linkage to ASD.

Keywords: Autism and Microplastics, Neurotoxicity and Microplastics

FP-055[Air pollution » Particulate matter]

The Need of Customized Air Quality index for Environmental Diseases

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BACKGROUND AND AIM: The World Health Organization (WHO) provides recommendations for air quality guideline levels. In Korea, the PM10 concentration standard is limited to $100 \mu g/m^3$ per 24 hours. But that does not mean it's suitable for general population. In particular, sensitive and vulnerable people may need more strict standards. This study aimed to identify the appropriate air quality concentration for health management by environmental disease.

METHOD: This study used national population data from the National Health Insurance Service and Air Korea data, which summarized air pollutant concentrations. The subjects were patients who were diagnosed as outpatients for environmental diseases from 2015 to 2019 and received emergency department visits or hospitalizations after the first diagnosis. The cut-off point of PM10 for each environmental disease that separates exacerbation was calculated through Maximal standardized log-rank statistic. Hazard ratios were estimated for the two groups (below the cut-off point vs. above the cut-off point) using Cox proportional -hazards models.

RESULTS:The calculated cut-off points of PM10 were COPD 49, Asthma 50, Stroke 50, Arrhythmia and Heart Failure 50. The risk of exacerbation when classified based on the cut-off point for each environmental disease is as follows(below the cut-off point vs. above the cut-off point). COPD:<49, HR 0.50(95% CI 0.36-0.70); \geq 49, HR 2.00(95% CI 1.42-2.81). Asthma:<50, 0.37(0.28-0.50); \geq 50, 2.69(2.01-3.60). Stroke:<50, 0.48 (0.34-0.69); \geq 50, 2.07(1.45-2.97). Arrhythmia and Heart Failure:<50, 0.49(0.31-0.77); \geq 50, 2.06(1.30-3.26). The two groups divided based on the cut-off point showed a statistically significant difference(log-rank P < 0.0001). As a result of sensitivity analysis by vulnerable group, appropriate concentrations were different for each group. CONCLUSIONS:The cut-off points calculated in this study indicate that the air quality index standards designated by Korea are not suitable for particularly sensitive and vulnerable people. These results suggest the need for a customized air quality index based on environmental diseases and individual characteristics.

Keywords: Particulate matter, Air pollution, Long-term exposure, Big data

Paternal age and risk of epilepsy in the offspring: A population-based multi-generation and sibling comparison study in Taiwan

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BACKGROUND AND AIM: Whether paternal age associated with offspring's epilepsy risk is a cause of de novo mutation as men age or just an association due to confounding factors is still unclear. We examined whether there is an independent role of paternal age in increased risk of epilepsy in offspring.

METHOD:A total cohort of 2,751,232 singletons born 2000-2017 was included in Taiwan; 819,371/826,087 with information on paternal/maternal grandparents were enrolled for multigeneration analyses; 1,748,382 with sibling(s) were selected for sibling-comparison. Incidence of epilepsy was followed until 2020. Cox model was used to estimate the hazard ratio (HR) and 95% confidence interval (CI).

RESULTS:In the total cohort, there was an increased risk of epilepsy in individuals with advanced paternal age, e.g., the HR for paternal age $\geq 50 = 1.36$ (95% CI:1.15-1.61) compared with paternal age 25–29, and fathers older than mothers, e.g., the HR for parental age difference $\geq 15 = 1.29$ (95% CI:1.16–1.43). When accounting for parental age difference, advanced paternal age was not associated with offspring's epilepsy (HR for paternal age $\geq 50 = 1.11$, 95% CI:0.93-1.34). Multigeneration analyses showed that advanced grand-paternal age at childbirth of the parent was not associated with offspring's epilepsy. Sibling comparison analyses showed that younger siblings did not have an increased risk of epilepsy.

CONCLUSIONS: These results do not support the hypothesis that de novo mutations associated with advanced paternal age play a direct causal role in the etiology of epilepsy. Instead, familial factors may explain the observed paternal age association with the offspring's epilepsy risk.

Keywords: paternal age, de novo mutation, epilepsy, sibling comparison

Living in Proximity to Petrochemical Industrial Parks and Risk of Major Depression Disorder in Adults

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BACKGROUND AND AIM: Extensive investigation has suggested that exposure to environmental health threats, such as polluting industrial activity, has harmful effects on mental health. Aim of present study is using different surrogate indices of petrochemical industrial parks (PIPs) exposure to evaluate the effect on the occurrence of major depressive disorder (MDD) in adults.

METHOD: We conducted a 1:1 sex and year of birth matching case-control study by using the Nation Health Insurance Research Database (NHIRD). We included individuals without any catastrophic illness or mental disorders, aged 20-65 years old, and living in the western part of the main island of Taiwan as our target population. Those newly diagnosed as having MDD after 2006 as cases. Controls were selected from those without any medical visits for mental disorders. The distance to the nearest PIPs, probability of PIPs exposure, and benzene exposure level were used as surrogating PIPs exposure indices. The conditional logistic regression was used to determine the odds ratios (ORs) and 95% confidence intervals (CIs) of PIPs exposure indices and MDD.

RESULTS: In total, 252,477 MDD cases were newly diagnosed during 2006-2018. The results showed that compared with those living in the farthest, living in proximity to PIPs were observed to have an increased risk of MDD occurrence. Considering the prevailing wind direction, a higher probability of PIPs exposure was also related to an increased risk of MDD. Higher benzene exposure levels having higher risks of MDD were also found.

CONCLUSIONS: In the present study, we found that all of three surrogate PIPs exposure was associated with an increased risk of MDD. Living in proximity to PIPs might have adverse effects on psychiatric health.

Keywords: Mental health outcomes, Environmental disparities, Environmental epidemiology

Association between changes in short-term air pollution and circulatory and respiratory death

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BACKGROUND AND AIM: It is well established that short-term exposure to air pollution is associated with increased death from circulatory and respiratory diseases. However, most studies only consider average air pollution concentrations and do not reflect fluctuations in air pollution concentrations over time. Therefore, this study aims to confirm the association between short-term changes in air pollution and death from circulatory and respiratory diseases.

METHOD: We analyzed the statistics of the cause of death in Korea in 2021, air pollution data from Air Korea, and weather data from the Korea Meteorological Administration. Using the time-stratified casecontrol design, we selected the stratum as month and case and control as 1:2. Change groups were estimated using trajectory analysis as air pollution data per hour. The association between air pollution and circulatory and respiratory system deaths was confirmed through conditional logistic regression.

RESULTS:As a result of the analysis, the risk of death from the circulatory and respiratory system was highest in the group with particulate matter $\leq 10 \mu m$ in diameter and particulate matter $\leq 2.5 \mu m$ in diameter, and the risk of death was higher in the group with moderately increased concentration compared to the group with continuously low concentration. In particular, even if the average concentration was low, the risk of death was high when the peak value was included among the daily exposed air pollution concentrations. These results were the same in the vulnerable groups, such as children, the elderly, and a group with a low level of education.

CONCLUSIONS: Most air pollution studies use average air pollution concentrations, but it is difficult to accurately confirm the influence of extreme values in such cases. Reflecting the characteristics of repeatedly measured air pollution data, research on mortality due to air pollution changes is required. In the future, it can also be extended through deep learning methods.

Keywords: short-term air pollution, circulatiory system death, respiratory systerm death, trajectroy

Profile of High-Risk Silicosis Industries in Taiwan---A Nationwide Analysis from 2004 to 2020

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BACKGROUND AND AIM:Silicosis is a well-known non-neoplastic pulmonary fibrosis disease caused by exposure to crystalline silica in the workplace. This exposure can lead to severe and irreversible cardio-pulmonary complications. Over the last decade, an increasing number of silicosis cases have been observed in the Taiwan Occupational Disease and Injury notification System (TODIS). Therefore, there is an urgent need to identify the industries that are at risk for silicosis through evidence-based medicine approaches, as well as to analyze the period of silicosis induction and the survival of silicosis patients in Taiwan.

METHOD:To find silicosis cases from 2004 to 2020, this study combined the National Labor Insurance Research Database (NLIRD) and National Health Insurance Research Database (NHIRD), which covered more than 88.5% of workforce and 99.9% of citizens, respectively. We enrolled silicosis cases who have been insured by the Labor Insurance for more than 6 months prior to receiving silicosis compensation for labor insurance benefits or a diagnosis of silicosis (ICD10: J60 or ICD9: 502) were enrolled in the analysis. The International Standard Industrial Classification of All Economic Activities (ISIC) was used in this study.

RESULTS:Based on the industry-specific incidence rates, we have identified 14 industries with high risk for silicosis, including 5 emerging high-risk industries: (1) Materials Recovery, (2) Construction of Roads and Railways, (3) Site Preparation, Foundation and Structure Construction, (4) Landscape Construction, and (5) Wholesale of Brick, Sand, Cement and Products. Among the 14 high-risk industries, the age-standardized incidence increased from 10.0 per 100,000 persons in 2004 to 25.6 in 2020 per 100,000 persons, based on the 2000 WHO World Standard Population.

CONCLUSIONS: We have observed an upward trend in silicosis cases and have identified emerging industries with a risk of silicosis in Taiwan. Furthermore, additional field and epidemiological studies are needed to examine these observation in detail.

Keywords: Silicosis, National Labor Insurance Research Database, National Health Insurance Research Database.

A Comprehensive Review on Social Inequalities and Pregnancy Outcome-Identification of Relevant Pathways and Mechanisms

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BACKGROUND AND AIM: Scientific literature tends to support the idea that the pregnancy and health status of fetuses and newborns can be affected by maternal, parental, and contextual characteristics. In addition, a growing body of evidence reports that social determinants, measured at individual and/or aggregated level(s), play a crucial role in fetal and newborn health. Numerous studies have found social factors (including maternal age and education, marital status, pregnancy intention, and socioeconomic status) to be linked to poor birth outcomes. Several have also suggested that beyond individual and contextual social characteristics, living environment and conditions (or "neighborhood") emerge as important determinants in health inequalities, particularly for pregnant women. METHOD: Using a comprehensive review, we present a conceptual framework based on the work of both the Commission on Social Determinants of Health and the World Health Organization (WHO), aimed at describing the various pathways through which social characteristics can affect both pregnancy and fetal health, with a focus on the structural social determinants (such as socioeconomic and political context) that influence social position, as well as on intermediary determinants. We also suggest that social position may influence more specific intermediary health determinants; individuals may, on the basis of their social position, experience differences in environmental exposure and vulnerability to health-compromising living conditions.

RESULTS: Our model highlights the fact that adverse birth outcomes, which inevitably lead to health inequity, may, in turn, affect the individual social position.

CONCLUSIONS: In order to address both the inequalities that begin in utero and the disparities observed at birth, it is important for interventions to target various unhealthy behaviors and psychosocial conditions in early pregnancy. Health policy must, then, support: (i) midwifery availability and accessibility and (ii) enhanced multidisciplinary support for deprived pregnant women.

Keywords: birth outcomes, neighborhood, social determinants, social inequalities

A Comprehensive Review on Social Inequalities and Pregnancy Outcome-Identification of Relevant Pathways and Mechanisms

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BACKGROUND AND AIM: There is a growing number of international studies on the association between ambient air pollution and adverse pregnancy outcomes, this study has been conducted focusing to assess the variability of the critical windows of exposure of sensitivity of the fetus to nitrogen dioxide (NO2) and particular matter (PM), according to the socio-economic environment, and the spatio-temporal practice of women of their territory during pregnancy.

METHOD:A bayesian distributed lag interaction model (BDLIM) has been performed on the association between maternal exposure during pregnancy to nitrogen dioxide (NO2) or particular matter (PM) and the risk of adverse birth outcomes, including low birth weight (LBW) and preterm birth (PTB), in relation to their socio-economic environment and their weekly mobility. This approach will allow us to relate the different exposure combinations for each gestational period to the estimated adverse pregnancy outcomes in our study area during our study period. These modeling approaches will be implemented to identify the critical window of vulnerability during the gestational period where environmental exposure is associated with an adverse pregnancy outcome.

RESULTS: The model set up will analyze in a first phase the exposure to the different pollutants NO2, PM10, PM2.5 without taking into account the socio-economic profile and spatio-temporal practice of the pregnant women, then in a 2nd phase with taking into account these profiles during each pregnancy trimester.

CONCLUSIONS: The main results suggest that increased air pollution exposure during the first and the third trimester of pregnancy might contribute to adverse birth outcomes, especially LBW, especially for unfavorable socio-economic environments.

Keywords: birth outcomes, windows of exposure, spatio-temporal practice, social inequalities, Bayesian distributed lag interaction models

FP-062[Exposures » Food/nutrition]

Risk assessment of plumbum for rice products in Taiwan

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BACKGROUND AND AIM: It is an important issue about public health risk, such as heavy metal pollution. Rice, one of the most common food ingredients in Taiwan snacks, may accumulate high levels of plumbum within environmental pollution. According to the data from the International Agency for Research on Cancer (IARC), plumbum compounds are carcinogenic to humans (Group 2A). This study aims to focus on the risk assessment and exposure assessment of plumbum related to rice consumption around 2005-2012 in Taiwan.

METHOD: The participants of our study were all age groups of the national representative survey. The hazard quotient (HQ) and lifetime average daily dose (LADD) were calculated to evaluate the risk of systemic adverse effects of plumbum in rice (formula A and B). If the value of HQ was less than 1, it means it is within the acceptable range of dietary exposure. EF is exposure frequency. C was taken from HSU et.al 2010 (0.02ppm) and the reference dose (RfD) was taken from the Joint FAO/WHO Expert Committee on Food Additives (JECFA). The average time (AT) and exposure duration (ED) were set to 70 years. The values of consumption rate (CR) and body weight (BW) were obtained from National Food Consumption Database in Taiwan.

HQ=LADD/Rfd (A)

LADD = (C*CR*ED)/(BW*AT) (B)

RESULTS: The CR of >65 years old male has maximum consumption of rice (2635.53 grams). CR in consumer only participant showed the highest was >65 year old male (mean \pm SD: 524.31 \pm 445.94 grams). The LADD of 6-12 year old male who had the maximum dose of rice (0.00138 mg/kg-day) was in the acceptable range and HQ (0.055) was in the acceptable range.

CONCLUSIONS: The systemic risk of plumbum in rice as within the acceptable range, and the systemic effect seemed to be within the acceptable exposure range. Further study is needed.

Keywords: Consumption database, Plumbum, Food risk assessment

Dietary Supplement Use and Self-Reported Symptoms among Adults Real-Time Chain Polymerase Reaction (RT-PCR) Tested for Coronavirus 2019 (COVID-19)

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BACKGROUND AND AIM:To date, no scientific evidence supports recommendations for dietary supplement use to prevent or treat COVID-19. Moreover, US law prohibits the marketing of dietary supplements as a treatment, prevention, or cure for any disease. However, sales of dietary supplements promoted for immune health increased because of media/social media claims that these products could confer protection against SARS-CoV-2 infection, or reduce disease or symptom severity if infected. We investigated use of dietary supplements and reported symptoms by COVID-19 status using population-based data.

METHOD: From March - August 2020, the University of Arkansas for Medical Sciences provided COVID-19 testing to hospital patients and community members at clinics and, drive-thru or mobile sites across Arkansas. Sociodemographic factors, COVID-19 symptoms, dietary supplement and medication use, and health information was collected at time of testing, and at days 7 and 14 post-testing. Prevalence ratios (PRs) and 95% confidence intervals (CIs) for each symptom by supplement status was calculated stratified by COVID-19 status using Poisson regression with robust variance estimation. RESULTS:Out of 27,181 adults tested, 9.0% tested positive and 7.8% were using any supplement to prevent or treat COVID-19 at time of testing. Among supplement users 14.0% tested positive; but among non-users only 8.7% tested positive. Those COVID-19 positive were more likely to report using any supplement, Astragalus, multivitamins, Vitamin C, Zinc, Vitamin B/Complex/B12/B6, Elderberry, and Vitamin D than COVID-19 negative adults (PRs ranged from 1.33 to 2.58 and 95% CIs excluded 1.00). No difference was observed in the PRs for self-reported symptoms at time of testing and day 7 post-testing between those who tested positive and those who tested negative. CONCLUSIONS: Although COVID-19 positive adults were more likely to report taking dietary supplements than those who tested negative the supplements did not appear to improve symptoms or shorten time experiencing symptoms.

Keywords: COVID-19, food/nutrition

FP-064[Air pollution » Long-term exposure]

Socioeconomic and regional disparities in of mortality burden long-term exposure to NO2 above the new WHO air quality guideline

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BACKGROUND AND AIM: It's of high importance to quantify the spatial and socioeconomic variation of mortality burden attributable to ambient nitrogen dioxide (NO2). This study aims to examine the regional and socioeconomic disparities in the mortality burden attributable to long-term exposure to ambient NO2 in China.

METHOD:Regional and socioeconomic disparity in all-cause mortality burden among adult (age \geq 16 years) attributable to the long-term exposure to ambient NO2 above the WHO new air quality guideline (10 µg/m3annual mean) was estimated based on NO2 concentration and mortality data from 231 Chinese cities from 2015 to 2019. Kruskal-Wallis H test was used to test the differences among groups. The mortality burden measurements included attributed fraction (AF), attributed deaths (AD), attributed mortality rate (AMR) and total value of statistical life lost (VSL).

RESULTS:The annual ambient NO2 concentration was 28.4 ug/m3 (standard deviation: 9.8 ug/m3) in China from 2015 to 2019, which attributed to AF:19.2% [95% confidence interval (CI): 7.2, 29.3], AD: 1356.3 thousand deaths (95% CI: 513.7, 2050.7), 115.5/105 (95% CI: 43.4, 176.0) AMR, and US\$958.2 billion lost. From 2015 to 2019, the ambient NO2annual concentration decreased from 28.6 ug/m3 to 26.5 ug/m3, leading to the AMR decreased from 118.7/105 (95% CI: 44.7, 180.5) to 106.4/105 (95% CI: 39.6, 163.4). The cities of north region, and cities with high level of GDP per capita (PGDP) suffered the highest mortality burden. The highest AD and economic loss were observed in the eastern region with high level of PGDP. Most of top ten cities of AF, AMR and VSL were with high level of urbanization.

CONCLUSIONS: There are significant regional and socioeconomic disparities in NO2 attributed mortality burden across cities in China. This study can provide evidence for making effective mitigation policies and local air pollution regulations for different regions in China.

Keywords: Regional disparity, long-term exposure, NO2, mortality burden

The association between air pollution exposure and incident nonalcoholic fatty liver disease in a Taiwan cohort

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BACKGROUND AND AIM:Nonalcoholic fatty liver disease (NAFLD), strongly associated with obesity, insulin resistance or type 2 diabetes mellitus, and dyslipidemia, exists among approximately one-third of general adult population. This study examined the association between long-term exposure to ambient air pollution and the development of NAFLD.

METHOD: The participants were 43,153 who enrolled between 2007 and 2016 in MJ regular health examinations, and did not consume alcohol. The development of NAFLD was based on liver ultrasonography, and medical history obtained from self-administered questionnaire. The exposure levels to ambient air pollutants, including particulate matter with a \leq 2.5-µm diameter (PM2.5), nitrogen dioxide (NO2) and carbon monoxide (CO), were estimated based on participants' residential areas at a 50 × 50 m grid resolution by using a hybrid Kriging/land-use regression (LUR) model executed using the XGBoost algorithm and a hybrid Kriging/LUR model, respectively. Logistic regression with baseline covariates and average air pollution concentration during follow-up was conducted, and smoothing splines were further performed to examine the linear association between air pollution and NAFLD.

RESULTS:During the average follow-up period of 1.8 years, 13.6% of the participants developed NAFLD without liver cirrhosis. After adjustments for potential covariates (e.g., age, sex, exercise, fried food consumption, triglyceride, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol), NO2 and CO were found to be positively associated with the incidence of NAFLD, and CO remained significant in the two-pollutant model. Logistic additive model with NAFLD development against CO using smoothing spline while adjusting for the above covariates showed that CO was linearly associated with NAFLD odds. The adjusted odds ratio of per 0.1 ppm increase in CO was 1.05 (95% confidence interval [CI] = 1.04, 1.06). The adjusted OR of per interquartile range (0.42–0.68 ppm) was 1.14 (95% CI = 1.08, 1.20).

CONCLUSIONS: Our findings suggest that exposure to CO might be associated with the occurrence of NAFLD.

Keywords: long-term exposure, particulate matter, oxides of nitrogen, carbon monoxide, fatty liver

Indoor air dust levels of polybrominated diphenyl ethers and polybrominated dioxins/furans (PBDD/Fs) at the Southern Taiwan Drug Administration

<u>Yi Hung Lin</u>¹, How Ran Chao² ¹Yi-Hung Lin ²How-Ran Chao

BACKGROUND AND AIM:PBDEs and PBDD/Fs are considered as emerging types of persistent organic pollutants (POPs) that are highly toxic. Previous research has demonstrated that PBDEs can act as a precursor to PBDD/Fs. A number of studies have shown that higher concentrations of PBDEs are found in indoor air and dust compared to outdoor environments. In Taiwan households, the main routes of human exposure to PBDEs and PBDD/Fs are through ingestion (via diet or dust) and inhalation (indoor air). However, there is limited literature available on exposure to PBDEs and PBDD/Fs in indoor environments, particularly in pharmacies. While air conditioning systems are crucial to maintaining a controlled environment for drugs and medicines in modern pharmacies in Taiwan, they also contribute to the accumulation of PBDEs and PBDD/Fs in the dust, medical equipment, and powders within enclosed spaces.

METHOD: This study aims to investigate the concentrations of PBDEs and PBDD/Fs by collecting 10 dust samples from indoor pharmacies. The levels of PBDEs and PBDD/Fs will be analyzed using High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS).

RESULTS: In addition, the health risks associated with indoor environmental problems, environmental risk assessment, and toxic effects from PBDEs and PBDD/Fs via indoor dust will be investigated. The HQ value of BDE-209 in indoor dust was found to be 9.10×10^{-3} , which is below the non-carcinogenic risk threshold of 1.00, and the R value of BDE-209 is 4.46×10^{-8} , which is also lower than the carcinogenic risk threshold R=1×10-6.

CONCLUSIONS: The results suggest that the dust samples from pharmacies do not pose a clear noncarcinogenic or carcinogenic risk to the pharmacy staff.

Keywords: pharmacies, dust level, PBDE, PBDD/F, toxicity

FP-067[Air pollution » Particle components]

Polybrominated diphenyl ethers and polybrominated dibenzo-p-dioxins/furans in Taiwanese pharmacies

<u>Yi Hung Lin</u>¹, How Ran Chao² ¹Yi-Hung Lin ²How-Ran Chao

BACKGROUND AND AIM:Polybrominated diphenyl ethers (PBDEs) and polybrominated dibenzo-pdioxins/furans (PBDD/Fs) are considered as emerging compounds of persistent organic pollutants (POPs) that are highly toxic. Previous research has demonstrated that PBDEs can act as a precursor to form PBDD/Fs. A number of studies have shown that higher concentrations of PBDEs are found in indoor air and dust compared to outdoor environments.

METHOD:In Taiwan households, the main routes of human exposure to PBDEs and PBDD/Fs are through ingestion (via diet or dust) and inhalation (indoor air). However, there is limited literature available on exposure to PBDEs and PBDD/Fs in indoor environments, particularly in pharmacies. While air conditioning systems are crucial to maintaining a controlled environment for drugs and medicines in modern pharmacies in Taiwan, they also contribute to the accumulation of PBDEs and PBDD/Fs in the dust, medical equipment, and powders within enclosed spaces.

RESULTS: This study aims to investigate the concentrations of PBDEs and PBDD/Fs by collecting 20 dust samples from indoor pharmacies. The levels of PBDEs and PBDD/Fs will be analyzed using High Resolution Gas Chromatography/High Resolution Mass Spectrometry. In addition, the risk assessments associated with toxic effects from PBDEs and PBDD/Fs via indoor dust were investigated. The HQ value of BDE-209 in indoor dust was found to be 9.10×10^{-3} , which is below the non-carcinogenic risk threshold of 1.00, and the R value of BDE-209 is 4.46×10^{-8} , which is also lower than the carcinogenic risk threshold R= 1×10^{-6}

CONCLUSIONS: The results suggest that the dust samples from pharmacies do not pose a clear noncarcinogenic or carcinogenic risk to the pharmacy staff.

Keywords: pharmacies, PBDE, PBDD/Fs, toxicity, risk health

Air Pollution Reduction and Brain Aging among Older Adults: a Community-Based Cohort study in Taiwan

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BACKGROUND AND AIM: Air pollution is recognized as a modifiable risk factor for dementia, and recent evidence suggests that improving air quality could attenuate cognitive decline and reduce dementia risk. However, studies have yet to explore the effects of improved air quality on brain structures. This community-based cohort study examines the impact of air pollution reduction on cognitive functions and structural brain differences among cognitively normal older adults in Taiwan.

METHOD: Four hundred and twenty cognitively normal older adults were from the Epidemiology of Mild Cognitive Impairment study in Taiwan (EMCIT), a community-based cohort of adults aged 60 and older in New Taipei City established in 2017. Annual concentrations of PM2.5, NO2, O3, and PM10 at participants' residential addresses during the 10 years before enrollment were estimated using hybrid kriging/land-use regression models. Each participant's 10-year change (slope) in air pollutants was estimated. At enrollment, participants received neuropsychological tests and brain magnetic resonance imaging (MRI). The associations of 10-year air pollution change with cognitive functions and brain structures were examined by linear regression models.

RESULTS:Overall, all pollutant concentrations, except O3, decreased over the 10-year period. A greater reduction in PM2.5 was associated with better attention [b=-0.2, 95% CI: -0.38, -0.02], and a greater reduction in PM10 was associated with better attention [b=-0.22, 95% CI: -0.38, -0.08] and executive function [b=-0.24, 95% CI: -0.44, -0.04]. In addition, the diffusion tensor imaging analysis revealed that a greater reduction in PM2.5 was significantly correlated with higher white matter integrity in several white matter tracts, including anterior thalamic radiation, superior longitudinal fasciculus, inferior longitudinal fasciculus, corticospinal tract, and inferior fronto-occipital fasciculus. CONCLUSIONS:Greater reduction in air pollution, particularly PM2.5, was associated with better attention and attention-related white matter integrity. These results provide insight into the mechanism underlying the relationship between air pollution, brain health, and cognitive aging among older adults.

Keywords: Air pollution, Particulate matter, Ozone, Oxides of nitrogen, Environmental epidemiology

Preterm birth and term low birth weight associated with wildfire PM2.5: a cohort study in New South Wales, Australia

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BACKGROUND AND AIM: To evaluate the risk and burden of preterm birth/term low birth weight associated with maternal exposure to wildfire PM2.5.

METHOD: 330,884 birth records in 523 residential communities were obtained from the New South Wales Australia during 2015–2019. Daily wildfire PM2.5 with a $0.25^{\circ} \times 0.25^{\circ}$ resolution was estimated by a machine learning technique combining 3-D chemical transport model. Cox proportional hazards models were performed to evaluate the association between wildfire PM2.5 and preterm birth/term low birth weight, from which attributable burdens were calculated respectively. RESULTS: Overall, 24,034 preterm births and 7,160 term low birth weight cases were recorded, dominating 7.3% and 2.2% of new-borns, respectively. Per one interguartile range rise in wildfire PM2.5 was associated with 6.9% (HR: 1.069, 95% CI: 1.058–1.081) and 6.5% (HR: 1.065, 95% CI: 1.053–1.077) increased risks of preterm birth and term low birth weight, respectively. The most susceptible gestational window was the 2nd trimester for preterm birth whereas the 1st trimester for term low birth weight. Additionally, 16.56% preterm births and 15.43% term low birth weight cases were attributable to maternal exposure to wildfire PM2.5 during the full pregnancy. Male infants and mothers aged \geq 40, experiencing temperature extremes, living in the inner region, or conceived during spring had higher risks of preterm birth/term low birth weight associated with wildfire PM2.5. Exposed to wildfire PM2.5, mothers with advanced age had a significant risk of preterm birth while younger mothers were more inclined to deliver term new-borns with low birth weight. Furthermore, pregnancy-induced hypertension might enhance the risk of preterm birth associated with wildfire PM2.5.

CONCLUSIONS:Robustly, the enhanced risk of preterm birth/term low birth weight was associated with maternal exposure to wildfire PM2.5. Given both higher frequency and stronger intensity of wildfire occurrences globally, it is crucial to prioritize the health and welfare of pregnant women and infants.

Keywords: wildfires, air pollution, environmental epidemiology

Association of short-term exposure to ozone with daily records of nasal and respiratory symptoms in adolescents

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BACKGROUND AND AIM:Recently, ambient ozone concentration has increased in Japan. Many studies have indicated the adverse effects of exposure to ozone on respiratory systems. However, the effects of ozone exposure in daily life on healthy adolescents are not well known. We investigated the associations of short-term exposure to ozone with daily records of nasal and respiratory symptoms in healthy adolescents.

METHOD:A panel study was conducted from 10th May to 27th June 2022 among healthy adolescents at a school in Yuge Island, in the Seto Island Sea, Japan. The indoor and outdoor ozone concentrations were continuously measured. We calculated the indoor and outdoor ozone concentrations of daily 1-hour maximum average, maximum 8-hour average, and 24-hour average. Nasal and respiratory symptoms were recorded daily by each subject. Mixed effect models were used to estimate the association between the ozone concentrations and daily symptoms.

RESULTS:The means±standard deviations of the daily average concentrations of outdoor and indoor ozone were 45.4±20.1 and 44.4±20.4 ppb, respectively. The increase in outdoor daily 1-hour maximum average ozone was associated with presence of rhinorrhea (odds ratio (OR): 1.02 [95% confidence interval (CI): 1.00 to 1.03] for an interquartile range (IQR) increase of 70 ppb). The IQR increase (80 ppb) in indoor 1-hour maximum average ozone was associated with nasal obstruction (OR: 1.02 [95% CI: 1.00 to 1.04]). The indoor and outdoor 1-hour maximum average ozone concentrations were also associated with cough. Alternatively, indoor and outdoor ozone concentrations of daily maximum 8-hour average and 24-hour average were not significantly associated with the any daily symptoms.

CONCLUSIONS:Our results suggest that short-term exposure to ozone in daily life may be associated with nasal and respiratory symptoms in healthy adolescents.

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Keywords: Ozone, Short-term exposure, Respiratory outcomes

Real-time Feedback System for High Quality Cardiopulmonary Resuscitation Training with the AI Technology

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BACKGROUND AND AIM: Cardiopulmonary resuscitation is a basic skill required by emergency and severe units. To achieve effective first aid goals, precise training is required at ordinary times. However, the results of the instructor's visual inspection often cannot allow the trainees to confirm whether the goal of high-quality CPR training has been achieved. At present, although QCPR can inform trainees of compression depth and speed, it is expensive and difficult to popularize. Therefore, we use the AI edge computing module to effectively and instantly give back to the trainees' compression quality.

METHOD: This project has successfully built (A) a standardized edge smart CPR system environment through OpenPose human posture estimation technology. (B) Android version of the application (App). First of all, the standardized edge smart CPR system has been built, which can judge and give real-time text and voice feedback to the trainee's posture, pressing depth, pressing frequency and pressing position in the CPR teaching environment. In the future, we will continue to optimize the system and complete the Android version of the application.

RESULTS: Comparing the teacher's visual inspection with QCPR and AI real-time video feedback system, the results show that the AI real-time video feedback system can effectively identify compression depth, frequency, positioning, elbow angle, etc. Compared with the teacher's visual inspection, the accuracy is closer to QCPR (AUC 90%).

CONCLUSIONS: Using the AI image real-time feedback recognition system can effectively achieve the goal of high-quality CPR training. and more widely accepted by trainees.

Keywords: Cardio-Pulmonary Resuscitation (CPR), Human Pose Estimation, Deep Learning, Emergency Medicine, High-Quality CPR.

FP-072[Respiratory and allergic outcomes » Other (to be specified with keywords in the keywords section)]

ITIH4 involved in Hippo signaling pathwayregulated apoptosis on type 2 alveolar epithelial cells of acute respiratory distress syndrome

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BACKGROUND AND AIM: Acute respiratory distress syndrome (ARDS) is a severe inflammatory lung injury, characterized by diffuse alveolar damage and increased alveolar endothelial cell permeability. Inter-alpha-trypsin inhibitor heavy chain 4 (ITIH4) is an anti-inflammatory protein. However, the role of ITIH4 in the lungs and its underlying mechanisms remains unclear. This study aims to investigate the role of ITIH4 in regulating apoptosis of type 2 alveolar epithelial cells via the Hippo signaling pathway in ARDS.

METHOD:Alveolar epithelial cell type II (AECII) A549 cells were treated with different concentration of ITIH4 (0, 10, 50, or 100 ng/mL) for 24 h. Next, cells were exposed to lipopolysaccharides (LPS) at 10 μ g/mL for 6 hours, followed by adding ITIH4 (0, 10, 50, or 100 ng/mL) for 24 h. In addition, A549 cells were transfected with ITIH4 siRNA or DNA sequences. Expression of E-cadherin, β -catenin, ATM, p53, SIRT1, Caspase-3, YAP, and TAZ were examined using Western Blot. The expression of YAP+ and SPC+ cells in alveolar regions of LPS-induced ARDS mice was observed by immunofluorescence staining.

RESULTS:We observed that the deficiency or overexpression of the ITIH4 gene could impact the activity of downstream factors of the Hippo pathway, such as YAP and TAZ. Next, we found that ITIH4 increased the expression of E-cadherin, β -catenin, and SIRT1, reduced the expression of ATM and caspase-3, and regulated YAP/TAZ pathway on A549 after LPS exposure (p<0.05). The immunofluorescence staining results revealed that AECII cells in the damaged zone and severe zone showed an upward trend in YAP expression compared to the undamaged area.

CONCLUSIONS: In summary, our findings provide evidence that ITIH4 involves in the Hippo signaling pathway-regulated apoptosis on AECII of LPS-induced injury. This study offers a unique perspective on the potential use of ITIH4 in future ARDS management.

Keywords: ARDS, ITIH4, Hippo pathway

FP-073[Air pollution » Traffic-related]

Effects of Long-Term Exposure to Air Pollutants on the Renal Function of Patients with Type 2 Diabetes

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BACKGROUND AND AIM:Patients with Type 2 Diabetes (T2D) often present with chronic kidney disease (CKD). CKD development is associated with patients' exposure to air pollutants. However, few studies examined the effects of long-term exposure to air pollutants on the renal function of patients with T2D. In this study, we investigated the effects air pollution exposure on renal function changes in T2D participants.

METHOD: Between 2003 and 2005, we recruited 1,316 patients with T2D; the patients were followed up until the end of 2012. Their baseline information regarding demographics, medical history, and biomarker levels were obtained. Using the CKD epidemiology collaboration equations for Taiwanese adults, we calculated the patients' eGFRs on the basis of their blood reports (2006–2012). Furthermore, we

obtained data regarding the monthly averages of various air pollutants, such as carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide (NO2), and particulate matter (diameter of $\leq 2.5 \mu$ m) from 72 air-quality-monitoring stations. Applying the kriging method, we interpolated the aforementioned data to the residential addresses of the participants. The possible correlation between air pollutants and the decrease in patients' eGFRs was investigated using a mixed-effects model with random intercepts. RESULTS:This study included 989 patients (mean age, 58.8 years). The mean follow-up duration was 6.0 years with a total of 9,298 medical visits. After covariate adjustment, exposure to elevated concentrations of ambient NO2 was related to more rapid decrease in the eGFR of the patients with T2D. Other significat factors for accelerated reduction o eGFR included duration of diabetes, and urinary albumin-to-creatinine ratio at the beginning of follow-up.

CONCLUSIONS:Long-term exposure to elevated NO2 levels may be related with decreased renal function in patients with T2D. Our study serves as a reference for future studies aimed at improving the quality of life of patients with diabetes who are exposed to air pollutants for prolonged periods.

Keywords: air pollution, NO2, traffic emission, renal function, diabetes

Association between dry eye disease and intraocular pressure in adults: Korean National Health and Nutrition Examination Survey 2010-2012 analysis

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BACKGROUND AND AIM:Despite reporting mechanisms through which dry eye disease (DED) can potentially affect intraocular pressure (IOP) in animal experiment studies, no epidemiological studies have been conducted to confirm this association in large general populations. Therefore, this study aimed to investigate the association between DED and IOP in the general adult population of South Korea.

METHOD: This study analyzed 14,625 adults aged 19 and above who participated in the fifth Korea National Health and Nutrition Examination Survey (KNHANES) (2010–2012). IOP was measured using the Goldman applanation tonometry. As the correlation between the left and right eyes was very high (r=0.833), only the measurement values of the left eye were presented. We sequentially conducted multiple linear and logistic regression analyses to investigate the association between DED and IOP as well as high IOP (>21 mmHg) prevalence.

RESULTS:The prevalence of DED in Korean adults was found to be 8.7%, and the geometric mean of IOP in the left eye was 13.7±1.0 mmHg. In the fully adjusted model, males with DED had significantly lower IOP compared to males without DED (β (95% CI) = -0.074 (-0.124, -0.023)). In the overall population, participants with DED had a significantly lower prevalence of high IOP compared to participants without DED (OR (95% CI) = 0.38 (0.15, 0.96)), and this trend was more pronounced in males (OR (95% CI) = 0.15 (0.03, 0.74)).

CONCLUSIONS: The results of this study suggest that DED may affect IOP reduction among Korean males.

Keywords: dry eye disease, intraocular pressure, adults, KNHANES, epidemiology

The association between sodium intake assessed by 24-h urinary sodium excretion and nonalcoholic fatty liver disease in Koreans

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BACKGROUND AND AIM: High sodium intake was associated with the occurrence of NAFLD, the evidence is not yet sufficient. This study is to examine the association between sodium intake assessed by 24-h urinary sodium excretion and the risk of NAFLD incidence.

METHOD:Using data from a Korean prospective cohort study, participants without urinary sodium levels and with a history of NAFLD were excluded. Finally, this study included 2,782 adults (aged 40-69 years. The total amount of sodium excretion in 24-h urine was estimated using Tanaka's equations from spot urine specimens. The participants were classified into three groups based on the levels of estimated 24-h urinary excretion: lowest (T1), middle (T2), and highest (T3). In addition, to assess the association of NAFLD occurrence, participants were classified into non-NAFLD (<30) and NAFLD (>36) groups based on the hepatic steatosis index.

RESULTS:During the 12-year follow-up period, NAFLD was occurred in 334 men and 725 women. In crude analysis and multivariate analysis, the risk of NAFLD in women was significantly increased in T2 and T3 compared to T1 (OR 1.43, 95% CI 1.09-1.88; OR 1.68, 95% CI 1.29-2.20, respectively). CONCLUSIONS:Therefore, the risk of NAFLD incidence gradually increased in women with the degree of sodium intake. Individuals with high sodium intake showed properly counseled and monitored for risk for NAFLD.

Keywords: nonalcoholic fatty liver disease, sodium intake, Korean Genome and Epidemiology study

Artificial Stone Associated Silicosis in Taiwan: A Systematic Review of Case Reports

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BACKGROUND AND AIM: Hundreds of silicosis cases associated with artificial stone manufacture and installation (commonly used for kitchen and bathroom countertops) have been reported globally for the past ten years. These workers were found to have less exposure latency and a younger onset age than miners or masons with silicosis; thus, the potential years of life lost was greater. Since the details of the industry in Taiwan are yet to be surveyed, we aim to review all domestic case reports systematically and summarize demographic characteristics.

METHOD:Databases with PubMed, Medline, EMBASE, Google Scholar, and Airiti Library were searched for studies published up to June 30th, 2023. Searching terms with "artificial stone or engineered stone," "silicosis," and "Taiwan" were applied via English and Chinese. An additional conference paper with two cases presented by the authors in April 2023 was added for the purpose of including all known cases in Taiwan.

RESULTS: Six case reports were reviewed; two of them presented different courses of the disease from the same case. All cases were male, whose mean age when diagnosed was 36 (ranging from 30 to 43), and their mean exposure years to silica dust were 6.8 (ranging from 4.5 to 9). Two cases were foreign workers, while the others' ethnicity was not disclosed. On the date of each publication or presentation, three cases underwent lung transplantation, and one of them eventually died. Another case also died before the lung transplantation.

CONCLUSIONS: The mean age is younger and the mean exposure years are lower in Taiwan than in most of the studies reported abroad; this may help identify similar exposure groups in Taiwan. Further, workplace monitoring and health surveillance for the artificial stone industry are important issues for occupational medicine and public health practitioners.

Keywords: respiratory and allergic outcomes, respiratory outcomes, occupational epidemiology

The novel terminology "discernible" undiscerned Conclusions: A Critical Review of UNSCEAR 2020/21 Fukushima Report 2

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BACKGROUND AND AIM:On March 2022, UNSCEAR released the updated Fukushima Report. This study examines the UNSCEAR 2020/21 Report from viewpoints of (1) risk communication, (2) quality of literature review, and (3) consistency between analysis and description in the Report. METHOD:A critical review of the UNSCEAR Fukushima report 2013, 2020/2021 and their Attachments was conducted.

RESULTS:(1) The Report introduced the novel terminology "discernible" which is equivalent to statistically enough power to detect. However, UNSCEAR's news releases and briefings do not explain the meaning of "discernible," leading reporters and the general public to misinterpret "no discernible" is "no risk." That is a serious failure in risk communication. (2) For thyroid cancers identified in Fukushima Ultrasound Examination (TUE), the Report concludes "the excess (nip) a result of the application of highly sensitive ultrasound screening procedures (para. 246)." Because compared to Chernoby where a significant increase was observed among children under 5 years after 4 years of the accident, in Fukushima, a large part of thyroid cancer was detected in adolescents within three years. The report missed difference in protocol of TUE in Chernobyl and Fukushima, in Chernobyl, TUE started in the 1990s or after 4 years of the accident. On the contrary, TUE started after six month of accident. (3) For solid cancer (excluding melanoma and thyroid cancer), UNSCEAR's power analysis in the Attachment A-23 indicated a lifetime increase likely to be detectable (LFR is 1.2% for 10 yrs girls subpopulation with a statistical power of 0.80). On the contrary, the report describes, "the levels of exposure of members of the public have been too low for the Committee to expect distinctive increases in the incidence of breast cancer or other solid cancers (para.247)." CONCLUSIONS: A Critical review revealed serious problems in the UNSCEAR2020/21 Fukushima Report. The Report must be corrected or updated accordingly.

Keywords: Thyroid cancer, radiation epidemiology, Fukushima nuclear disaster, UNSCEAR

Indoor Pollution Emission Characteristics of Air Fryer and the Influence of PM2.5 Toxicity on The Development of Caenorhabditis Elegans

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BACKGROUND AND AIM: The purpose of this study was to examine the emission characteristics of indoor air pollution caused by air fryers and their potential effects on human health, specifically the impact of PM2.5.

METHOD: To achieve this, we utilized Caenorhabditis elegans (C. elegans) as an animal model due to its genetic similarity to humans. We established an in vivo model and conducted toxicity exposure tests to evaluate lethality, reproductive toxicity, locomotor behavior, body length, and lifespan. Analysis of body length and lifespan was used to determine the five major outcomes.

RESULTS:A statistical analysis revealed that the concentration of PM2.5 did not prove to be fatal for C. elegans. However, there was a locomotor behaviour effect that was noticed at a dosage of 7.5 x 10-3 g/L and was significantly different from the control group. At higher concentrations of 7.5 x 10-2 μ g/L and 7.5 x 10-1 μ g/L, the negative impact on the body length, locomotor behavior, and reproductive toxicity of C. elegans was noticeable. In particular, the locomotor system of C. elegans was affected, causing a significant reduction in locomotor behavior, body length, and reproductive capacity when compared to the control group.

CONCLUSIONS: The air fryer generated PM2.5 at toxic concentrations can impede the development of C. elegans and studying the organism's other physiological characteristics can provide valuable insights for diverse research applications.

Keywords: Air fryer, Indoor air pollutants, PM2.5, C. elegans

Derivation of sex and age-specific reference intervals for clinical chemistry analytes in healthy Ghanaian adults

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BACKGROUND AND AIM: Clinical laboratory reference intervals (RI) are supposed to be established and verified in every country. However, few countries carry out their own RI studies due to challenges and cost involved. Ghana diagnostic laboratories rely on reference intervals provided by the manufacturers of in vitro diagnostic instruments. These RIs may have been derived from a population with different characteristics which might not be appropriate. Hence this study aimed at establishing RIs of 40 chemistry and immunochemistry analytes for Ghanaian adults based on IFCC Committee on Reference Intervals and Decision Limits (C-RIDL) protocol.

METHOD:A total of 501 healthy volunteers aged \geq 18 years were recruited from the northern and southern regions of Ghana. Blood samples were analyzed with Beckman-Coulter AU480 and Centaur-XP/Siemen auto-analyzers. Sources of variations of reference values (RVs) were evaluated by multiple regression analysis (MRA). The need for partitioning RVs by sex and age was guided by the SD ratio (SDR). The RI for each analyte was derived using parametric method with application of the latent abnormal values exclusion (LAVE) method.

RESULTS:Using SDR≥0.4 as threshold, RVs were partitioned by sex for most enzymes, creatinine, uric acid, bilirubin, immunoglobulin-M. MRA revealed age and body mass index (BMI) as major source of variations of many analytes. LAVE lowered the upper limits of RIs for alanine/aspartate aminotransferase, γ -glutamyl transaminase and lipids. Exclusion of individuals with BMI≥30 further lowered the RIs for lipids and CRP. After standardization based on value-assigned serum panel provided by C-RIDL, Ghanaian RIs were found higher for creatine kinase, amylase, and lower for albumin and urea compared to other collaborating countries.

CONCLUSIONS: The LAVE effect on many clinical chemistry RIs supports the need for the secondary exclusion for reliable derivation of RIs. The differences in Ghanaian RIs compared to other countries underscore the importance of country specific-RIs for improved clinical decision making.

Keywords: Clinical diagnosis, Reference interval, Clinical parameters, between-country differences; bias ratio; latent abnormal values exclusion method
Ambient arsenic concentration is associated with hepatocellular carcinoma incidece and differential effects exist among race/ethnicity and sex groups

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BACKGROUND AND AIM:Primary liver cancer has the sixth highest incidence and fourth highest cancer mortality worldwide. In the United States, liver cancer incidence has more than tripled between 1975 to 2017 and mortality has also increased in the same time frame. Exposure to toxins or chemical pollutants account for significant liver disease burden globally. Arsenic is known to accumulate in the liver, and several mechanisms of carcinogenesis have been proposed, however, the evidence in human populations is limited. A better understanding of the role of chemical risk factors in HCC is required. We assessed the association between ambient arsenic concentration and HCC in Texas—the state with the highest rates of HCC in the US.

METHOD: The outcome measure is HCC incidence based on Texas Cancer Registry (TCR). Primary exposure is census tract (neighborhood) estimate of Arsenic inhalation exposure concentrations as reported in the 2011 National Air Toxics Assessment (NATA) inventory. We measured and adjusted the main analyses for several individual-derived and neighbood-derived characteristics. We created separate study subgroups based on the patients' race/ethnicity and sex. We assessed the association between Arsenic and HCC separately for the subgroups using the negative binomial Poisson regression (NBR) model.

RESULTS:Texas has 5,265 census tracts and TCR reported 18,235 new ≥20 years old HCC diagnoses between 2007-2015. In our assessment of the relationship between neighborhood-level Arsenic exposure air concentration and HCC in Texas, we observed significant differences along racial-ethnic and sex groups while accounting for covariates. Independent association between Arsenic and HCC was largely more evident among men versus women, and also more eviden in Not Hispanic Black, followed by NH White subgroups versus Hispanics.

CONCLUSIONS: Our finding suggests a potential inhalation pathway for Arsenic-HCC association,

though its ecological nature precludes the interpretation of a causal link. This ecological finding should be further examined in direct association studies

Keywords: Chemical exposures, Cancer and cancer precursors, Environmental disparities, Environmental epidemiology

Mixture effects of particle components on Parkinson's disease in adults ages 40+ in the United States from 2000 to 2016

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BACKGROUND AND AIM: More and more studies are documenting that air pollutants such as PM2.5 and ozone may have adverse effects on neurological disorders. However, few studies have investigated the long-term exposure of particle components in conjunction with nitrogen dioxide and ozone to assess their mixture effects on Parkinson's disease. We aim to utilize weighted quantile sum regression to assess the cumulative effects of five major particle components including organic carbon (OC), elemental carbon (EC), nitrate, sulfate, and ammonium, along with nitrogen dioxide and ozone, on counts of inpatient Parkinson's hospitalizations for adults ages 40 years and up. METHOD:Inpatient records for Parkinson's hospitalizations were collected from the State Inpatient

Databases which included hospitals from 12 U.S. states ranging in years from 2000 through 2016. We also included temperature from Daymet and variables from the U.S. census to control for socioeconomic status. All variables were aggregated to the annual level.

RESULTS:We observed an increase of 7.2% (95%CI: 6.4%,8.1%) in the number of Parkinson's inpatient hospitalizations each year for each decile increase of the pollutant mixture in adults ages 40 years and up. Ozone contributed the most weight to the pollutant mixture while the other 6 pollutants carried the same relatively small weights.

CONCLUSIONS:Our results emphasize the significance of the effects of ozone on Parkinson's disease while also contributing to the growing body of literature on neurological disorders.

Keywords: Parkinson's Disease, PM Components, Ozone, WQS

The relation between air pollution exposure and breast cancer risk: a case-control study in Taiwan

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BACKGROUND AND AIM: Breast cancer is the most common cancer worldwide, has surpassed lung cancer from 2018 to 2020, and Taiwan has a similar pattern. Many epidemiologic studies indicated that occurrence of female breast cancer might associate with body mass index (BMI), age of menarche and menopause, pregnant and breastfeeding experience, family history, and past history. However, the relation to environment exposure and breast cancer has been strongly suspected the major risk factor. This study aims to investigate whether air pollution exposure and breast cancer risk are associated.

METHOD: We had been conducted a case-control study in National Taiwan University Hospital (NTUH) from October 2010. The participants included female volunteers with no history of malignancy or breast disease (defined as healthy volunteers), biopsy-proven benign breast disease, or breast cancer patients. At enrollment, the participants provided a fasting blood sample, urine sample, and completed an assisted questionnaire. To reduce treatment-related bias, blood samples were collected before any treatment for breast cancer was initiated. Blood samples were centrifuged immediately after collection, and the plasma samples were stored at 80C. The questionnaire included questions on the risk factors for breast cancer, including age, parity, breastfeeding history, BMI, smoking and drinking habits, menopause status, education level, and family history of breast or ovarian cancer.

RESULTS:We enrolled 257 breast cancer patients as case group and 228 healthy volunteers as control group. Air pollution included particulate matter <2.5 μ m (PM2.5), nitrogen dioxide (NO2), and ozone, the exposure period was estimated from 2000 to 2020.

CONCLUSIONS: We calculated odds ratios (OR) and 95% confidence intervals (CI) by conditional logistic regression with adjustment for marital status, educational level, occupational status, personal income, medication and area-level socio-economic indicators.

Keywords: air pollution, Breast cancer

Assessing the Relationship Between Persistent Organic Pollutants in Adipose Tissue and Female Breast Cancer Risk in Taiwan: A Prioritization Study

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BACKGROUND AND AIM: This study aimed to explore the relationship between a mixture of persistent organic pollutants (POPs), including polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), and various pesticides, and breast cancer (BC) risk in Taiwanese women.

METHOD:A case-control study was conducted with 73 BC patients and 27 women with biopsy-proven benign breast disease. The participants completed a questionnaire and provided blood samples. Adipose tissue samples were analyzed for the presence of POPs, and random forest machine learning methods were used to predict BC risk.

RESULTS: The results showed that the concentrations of certain PCDDs, PCDFs, and PCBs were significantly higher in BC patients compared to controls. The most important POPs related to BC were 1,2,3,4,7,8,9-HeptaCDF, 1,2,3,7,8-PentaCDF, and 4,4'-DDD. After adjusting for covariates, 1,2,3,7,8-PentaCDF, 1,2,3,4,7,8,9-HeptaCDF, and 1,2,3,7,8,9-HexaCDF were the top three most important components related to BC.

CONCLUSIONS: The study highlights the importance of considering mixtures of chemicals in

understanding the relationship between POPs and BC risk. This information could then be used to inform public health policies and interventions aimed at reducing the risk of breast cancer associated with POP exposure.

Keywords: breast cancer, persistent organic pollutants, random forest machine learning, Taiwan

FP-085[Air pollution » Short-term exposure]

Assessment of indoor air pollutants exposure of the commuters on the platform in Taipei mass rapid transit

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BACKGROUND AND AIM: More than 3 million passengers take Taipei mass rapid transit (MRT) system every work day. There is a growing concern about the air quality because of the potential effects to passengers' health. This study aimed to investigate the impact of various environmental factors on indoor air pollutants(IAPs) exposure on the platform in MRT stations and rank their importance on the effects of IAP levels.

METHOD: This study investigated the IAPs on the platform, including particulate matter (PM10, PM2.5, PM1), polycyclic aromatic hydrocarbons(PAHs), volatile organic compounds (VOCs), carbon monoxide (CO) and carbon dioxide (CO2) in ten MRT stations with varying platform (underground, ground-level, elevated), station designs (side, island, stacked island), and platform screen door (PSD) types (full coverage, half coverage, no coverage).

Random Forest analysis were used to evaluate the impact of environmental factors on IAPs, including outdoor air quality, weather conditions, temperature, relative humidity (RH), rush hours, and entry/exit gates. Marginal effect plots were used to assess each variable's influence on IAPs. RESULTS:Results showed that all IAP levels on the platform met the stipulated standards as regulated by Taiwan's Indoor Air Quality Management Act, with higher IAP concentrations during morning rush hours than afternoon rush hours. The underground IAP concentrations were higher than the ground-level and elevated stations IAP concentrations.

Temperature was positively correlated with CO2 concentrations, while RH (60-80%) was negatively correlated with CO2 concentrations in marginal effect plots. The importance ranking revealed that temperature, RH, station design and waiting location dominated IAP concentrations mostly. CONCLUSIONS:Optimizing the ventilation systems could assure the indoor air quality in MRT stations during rush hours. Thermal conditions, station design, CO2, and waiting location are the observable parameters to alert the IAPs exposure.

Keywords: Particulate matter, Exposure assessment, Traffic-related

Comparison of Risks of Major Adverse Cardiovascular Events and Mortality in patients with Deep Vein Thrombosis and Pulmonary Embolism

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BACKGROUND AND AIM: This study aimed to evaluate the subsequent major adverse cardiovascular events (MACEs) and mortality after patients with a new diagnosis of deep vein thrombosis (DVT) or pulmonary embolism (PE).

METHOD: We conducted a nationwide, population-based, frequency-matching cohort study using Taiwan's National Health Insurance Research Database. The study cohort comprised 693 newly diagnosed DVT patients (without PE) or PE patients (without DVT) who were frequency-matching by age, sex, urban, and index year without a diagnosis of DVT and PE in the comparison cohort. We evaluate the subsequent major adverse cardiovascular events and mortality. Each patient case was followed from 2000 to 2012. We constructed a Cox proportional hazard model and plotted Kaplan-Meier curves to evaluate the association between DVT, PE, MACEs, and mortality.

RESULTS:We identified 75, 67, and 51 MACEs cases in the study (DVT, PE) and comparison cohorts during the mean follow-up period of 5.78, 5.06, and 7.18 years, respectively. After adjusting for potential confounders, the adjusted hazard ratio (HR) for DVT was 1.48 (95% confidence interval [CI] 1.01–2.16) and PE was 1.44 (95% [CI] 0.97–2.14). The mortality cases were 106, 121, and 28 in the study (DVT, PE) and comparison cohorts, respectively. The adjusted HR for DVT was 2.91 (95% [CI] 1.88–4.5) and PE was 4.29 (95% [CI] 2.8–6.58). The survival analysis curve demonstrated both DVT or PE had an impact on the deaths.

CONCLUSIONS: Patients with DVT have a higher incidence of MACE. However, patients with PE have a higher incidence of mortality. Either DVT or PE may increase the risk of MACE and mortality.

Keywords: Deep vein thrombosis, Pulmonary embolism, Major adverse cardiovascular event

FP-087[Other » Other (to be specified with keywords in the keywords section)]

Suicide Risk Among Low-Income Household Members Suffering From Depression: A Population-Based Retrospective Cohort Study

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BACKGROUND AND AIM:Low income in depressed patients is associated with further suicide-related risk factors. Depression and suicide risk among low-income individuals share common epidemiological and underlying molecular mechanisms. We hypothesized that low-income depressed patients are at a high risk of suicide. To test this hypothesis, we used the National Health Insurance Research Database (NHIRD) to evaluate whether depression among low-income individuals is significantly linked with suicide.

METHOD: The present cohort study adopted data from the Taiwan National Health Insurance Program. Total 1,936,512 patients included in the Longitudinal Health Insurance Dataset between the period 2000–2015, 771 low-income participants who had suffered from depression and 3,084 controls matched for sex and age were selected. Cox proportional hazard regression analysis was used to explore the hazard ratio (HR) and 95% confidence interval for the risk of depression with low income being associated with the risk of developing psychiatric disorders during the 16 years of follow-up period.

RESULTS:Of the low-income, depressed patients and 3,084 control participants, 60 (8,514.66 per 105 person-years) and 138 (36,269.29 per 105 person-years) developed suicidal thoughts, respectively. The Cox regression model revealed an adjusted HR of 1.771 (95% confidence interval = 1.289–2.432, P < 0.001) after adjusting for all the covariates. Depression among low-income individuals was associated with Charlson Comorbidity Index (adjusted HR, 1.097; 95% confidence interval = 1.004 – 1.186; p=1.186). Factors of suicide methods by using Cox regression included other gases and vapors (AHR= 8.149; 95% CI=5.926–11.196, P<0.001), and cutting and piercing (AHR= 2.789; 95% CI=2.021–3.864, P<0.001).

CONCLUSIONS: Depression with low-income are independent risk factors for suicide. Depressed patients with low income are at higher risk of developing suicidal thoughts compared with depressed patients that would not be characterized as low income. Among suicide methods, other gases and vapors have the highest risk. Clinicians should pay attention to income level of depressed patients.

Keywords: Depression, low income, National Health Insurance Research Database

FP-088[Other » Other (to be specified with keywords in the keywords section)]

Association between low-density cholesterol and its related risk factors among young workers in southern Taiwan

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BACKGROUND AND AIM: Low density cholesterol is highly correlated with cardiovascular diseases. In previous studies, the prevalence of low-density cholesterol was found to be elevated among theses years, but only few studies focus on young workers. Therefore, we conducted a study to evaluate the risk factors with low-density cholesterol among young workers in southern Taiwan. METHOD: We recruited workers working in southern Taiwan during their routine annual health examination between May 1 and December 31, 2022. Participants accept blood sampling and received anthropometric measurements. The younger worker defined by age less than 40 years old. RESULTS: A total of 6091 workers participated in this study, and 3336 workers age less than 40 years old. The prevalence rate of low-density cholesterol was 37.9% in total study population and 35.1% in younger workers. We observed positive associations between low-density cholesterol and age less than 40 years old, body mass index (BMI), hypertension, waist, and GPT (all with p < 0.05). Through further analyses using logistic regressions in younger workers, we found hypertension, and waist were predictors of low-density cholesterol. After adjusting for other factors, we found hypertension (adjusted odds ratio [AOR] =1.32, 95% confidence interval [CI]: 1.07-1.62), and waist (AOR =1.88, 95% CI: 1.59-2.21), were independent predictors of low-density cholesterol. CONCLUSIONS: In the young workers less than 40 years old, low-density cholesterol is associated with hypertension, and waist. However, further studies still need to be constructed to clarify the association between low-density cholesterol and possible risk factors.

Keywords: : Low density cholesterol, cardiovascular diseases, young worker

Prenatal Phthalate Exposure Modifies the Genetic Impact on IQ

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BACKGROUND AND AIM: Exposure to phthalates during fetal development has a negative impact on children's cognitive development, with intelligence (IQ) often serving as an assessment measure. To assess the hypothesis that prenatal phthalate exposure might interfere with the genetic influence on IQ, we used polygenic risk score (PRS) to estimate the overall genetic contribution to children's cognitive ability and examine its interaction with environmental exposures to phthalates. METHOD: Participants were 137 mother-infant pairs from the central region of the Taiwan Maternal and Infant Cohort Study. To gauge prenatal exposure, we measured phthalate metabolites, including mono-methyl phthalate (MMP), mono-ethyl phthalate (MEP), mono benzyl phthalate (MBzP), mono-nbutyl phthalate (MnBP), and the sum of three metabolites of di (2-ethylhexyl) phthalate (Σ MEHP), in the mothers' urine during the third trimester of pregnancy. IQ tests were performed for the children at their age of 4. We applied PRS-CS method to generating PRS for IQ and educational attainment (EDU), using data from a genome-wide association study (GWAS) involving 269,867 individuals for IQ, and GWAS results from Taiwan BioBank involving 100,000 individuals for educational attainment, which has been considered as a proxy of cognitive ability in young adults. We then conducted multiple linear regression analyses to examine the interaction between prenatal phthalate exposure and PRS. RESULTS:Our study revealed a significant interaction (p=0.001) between IQ-PRS and maternal urine MBzP concentration. Moreover, the low MBzP concentration group exhibited a stronger correlation between IQ-PRS and IQ, compared to the high concentration group. Similar results were observed for the interaction between EDU-PRS and MMP.

CONCLUSIONS: These findings suggest that prenatal phthalate exposure may act as an effect modifier in the relationship between genetic influence on cognitive ability and children's IQ.

Keywords: Children's environmental health, Endocrine disrupting chemicals, Exposures, Phthalates

Preliminary investigations on the mental health impact of socio-economic and living environment characteristics in residents of informal housing

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BACKGROUND AND AIM: This study investigates the relationships between the socio-economic and environmental characteristics and the mental health outcomes of adults and children living in subdivided flat units(SDU), a common type of informal housing where >0.21million population lives in Hong Kong. These units are known for cramped living space (median floor area/capita:6.0m2, population average:15.9m2) and poor housing quality (e.g. lack of bathroom/cooking space). Such living conditions may impact on the residents' mental health.

METHOD:A community-based health screening program was conducted 01.07.2021-31.01.2023 with a convenient sample referred by non-government organizations, involving 438 caregiving dyads living in SDUs in Hong Kong. Interviewer-administered questionnaire was used to assess socio-economic and housing characteristics along with the Depression, Anxiety, and Stress Scale-21(DASS-21). Multivariate logistic regression yielded adjusted odds ratios (ORs) and 95% confidence intervals(CI) for DASS-21 defined depression and anxiety after adjusting for age and sex of the individuals. RESULTS: The 438 caregiving dyads screened were predominantly middle-aged caregivers (94.3% female, mean age[standard deviation(SD)] = 39.8[7.79]) and their children aged 13 and over (age= 14.5[0.94]). These respondents lived with a median monthly household income of USD 1,600, which is 44.5% of Hong Kong average. Sharing a residence with median per-capita floor area of 4.34m2 (Interguartile range=3.90-5.57), 27.3% respondents faced moderate/severe anxiety risk and 18.4% faced depression risk (comparing to14% and 19% in general population). Living in a residence with a total floor area <13.0m2 is significantly associated with an increased risk of depression (OR=1.77, p<0.05) and anxiety (1.83, p<0.01) in adults, and a non-significant elevated risk of anxiety in children (3.44, p=0.36). Other socio-economic/physical environment factors (e.g., household income, caregiver education, stove ownership) were not associated with the residents' mental health outcomes.

CONCLUSIONS: With a larger proportion of population being affected by anxiety, the physical attributes of the home environment could significantly influence the mental health of SDU residents.

Keywords: Community outreach, Mental health outcomes, Environmental disparities, Environmental justice

Mapping of Exposure Scenarios from Industrial Combustion Facilities to Health Outcome through Systematic Review

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BACKGROUND AND AIM: Industrial combustion facilities emit various pollutants through their stacks and pollute the surrounding environment. Living near those facilities can affect residents' health. We conducted systematic reviews of environmental vulnerable regions and integrated exposure scenarios from emission source to health outcome into a map.

METHOD: Systematic reviews of studies on residents near smelters, incinerators, and fired power plants were conducted separately and integrated into a map. The literature search was conducted from 21 June to 22 December 2021, on PubMed. Non-human studies such as environmental concentration measurements, in-vivo, and in-vitro studies, occupational studies, review articles, book sections, and gray literatures were excluded, and years of publication were restricted from 2000 to 2021. Among 232 articles, health effects studied in more than five articles from each source were selected. For the reviewed articles, assessments of the evidence level were carried out. RESULTS:Following the bold lines in our map, near incinerators, persistent organic pollutants are exposed to human and cause non-Hodgkin's lymphoma consistently among published literatures. In the vicinity of smelters, metal exposures are investigated and associated with renal tubular damage. Fired power plants areas are shown to be polluted by nitrogen oxides (NOx), particulate matter (PM), and polycyclic aromatic hydrocarbons (PAHs). Among those pollutants, NOx causes a decrease in pulmonary function and PM causes lung cancer and chronic obstructive pulmonary disease. PAHs from fired power plants are associated with delays in neurobehavior.

CONCLUSIONS: This study provided a map of exposure scenarios and evidence for priority selection to be considered in future studies of residents' health impact assessment near combustion facilities.

FUNDING: The Korea Environment Industry and Technology Institute through the Core Technology Development Project for Environmental Disease Prevention and Management, funded by the Korea Ministry of Environment (grant number 2021003320003).

Keywords: Chemical exposures, Environmental epidemiology, Outcomes

Particle exposure and cytotoxicity assessment of indoor air pollution from cooking emissions in a low-income home

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BACKGROUND AND AIM: This study was conducted to determine the exposure and the cytotoxic effects of in-kitchen aerosols of PM2.5 on human lung cells.

METHOD:PM2.5 levels were measured using real-time portable monitor during cooking and noncooking days. Indoor and outdoor PM2.5 samples were collected for 24 hours simultaneously on a 37 mm polyvinyl chloride (PVC) membrane filter using a portable low-volume personal air sampler. The samples were then extracted using methanol. MTT assay was used to determine the cytotoxic activity of indoor and outdoor PM2.5 at different concentrations (25 - 200 μ g/mL) on human lung cells (MRC-5) at 24 hours incubation period.

RESULTS:The average concentrations of PM2.5 were approximately 2 times higher during cooking days compared to non-cooking days. Exposure of indoor PM2.5 on MRC-5 cells induces cytotoxicity at higher concentrations compared to control cells, but the value is not significant (p>0.05). In contrast, exposure to outdoor PM2.5 at 100 and 200 µg/mL significantly (p<0.05) induce cell viability in MRC-5 cells compared to control cells. The indoor and outdoor PM2.5 sampling can be further optimized in order to increase the yield of samples collection. This will allow further evaluation of the cytotoxic activity of indoor and outdoor PM2.5 at higher concentrations (>200 µg/mL).

CONCLUSIONS: The results of the study indicate that exposure to fine particulate aerosols in the kitchen could be a risk factor for the development of oxidative stress, but further research is needed. The determinants of the temporal pattern of activity and the characterization of exposure need to be considered in a future study, especially in a low-income home-based food business.

Keywords: indoor air quality, cooking emissions, low-income neighbourhood, PM2.5, lung cancer

FP-093[Air pollution » Short-term exposure]

Assessment of Household Air Pollution Exposure in Kampala Capital City, Uganda

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BACKGROUND AND AIM:Air pollution (AP) is a major public health problem affecting nearly all spheres of human wellbeing and affects social and economic development. Worldwide, estimated 4.3 million people dies every year as a result of exposure to Indoor air pollution. Kampala Capital City like many other cities in low income countries Almost the entire population (99%) breathe air that exceeds the WHO guideline limit

METHOD: We sampled 160 Households from our previous bigger study sample 1000 East Africa Child Health Study in urban households in 5 sub cities of Kampala Capital City Authority between March 2020 and August 2021. The Ultrasonic Personal Aerosol Sampler (UPAS) equipment is a gravimetric filter-based instrument for estimating personal exposure was used to measure air pollution exposure among children. The Teflon Filters were weighed before and after deployment at Colarado State University.

RESULTS: The majority 84.4% (103/122) and 86.1% (105/122) of the households used Charcoal stove unimproved for cooking lunch and dinner respectively. The average PM2.5 concentration from personal exposure assessment among children was 5 times higher (78.7μ g/m³)

CONCLUSIONS: The average PM2.5 concentration from personal exposure assessment among children was 5 times higher ($78.7\mu g/m^3$) than the WHO recommended range of $15\mu g/m^3$ as per Air Quality Guideline 2021.

Keywords: Air pollution, Personal Exposure Assessment

FP-094[Outcomes » Obesity and metabolic disorders]

Association between organophosphate flame retardant exposure and lipid metabolism: Data from the 2013–2014 National Health and Nutrition Examination S

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BACKGROUND AND AIM:Organophosphate flame retardants (OPFRs) are emerging environmental pollutants that can be detected in water, dust, and biological organisms. Certain OPFRs can disrupt lipid metabolism in animal models and cell lines. However, the effects of OPFRs on human lipid metabolism remain unclear.

METHOD:We included 1,580 participants (\geq 20 years) from the 2013–2014 National Health and Nutrition Examination Survey (NHANES) to explore the relationship between OPFR exposure and lipid metabolism biomarkers.

RESULTS:After adjusting for confounding factors, results showed that one-unit increases in the log levels of diphenyl phosphate (DPhP) (regression coefficient = -5.755; S.E. = 2.289; p = 0.023) and log bis-(1-chloro-2-propyl) phosphate (BCPP) (regression coefficient = -4.637; S.E. = 2.019; p = 0.036) were negatively associated with the levels of total cholesterol (TC) in all participants. One-unit increases in the levels of DPhP (regression coefficient = -2.292; S.E. = 0.802; p = 0.012), log bis(1,3-dichloro-2-propyl) phosphate (BDCPP) (regression coefficient = -2.046; S.E. = 0.825; p = 0.026), and log bis-2-chloroethyl phosphate (BCEP) (regression coefficient = -2.604; S.E. = 0.704; p = 0.002) were negatively associated with the levels of high-density lipoprotein cholesterol (HDL-C). With increasing quartiles of urine BDCPP levels, the mean TC levels significantly decreased in all participants (p value for trend=0.028), and quartile increases in the levels of DPhP (P value for trend=0.001), BDCPP (p value for trend=0.001), and BCEP (p value for trend<0.001) were negatively corelated with HDL-C, with approximately 5.9%, 9.9%, and 12.5% differences between the upper and lower quartiles.

CONCLUSIONS: In conclusion, DPhP, BDCPP, and BCEP were negatively related to HDL-C concentration, whereas DPhP and BCPP levels were negatively associated with TC level. Thus, exposure to OPFRs may interfere with lipid metabolism.

Keywords: organophosphate flame retardant, cholesterol, high-density lipoprotein cholesterol, NHANES

The effects of extreme temperature exposure on gestational diabetes mellitus and hypertension

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BACKGROUND AND AIM: Exposure to heat stress from heatwaves and extremely cold temperature have negative effects on mothers. However, studies on the association between extreme temperature exposure and pregnant women are limited, especially in women with gestational diabetes mellitus and hypertension. The presence of these diseases is likely to affect the ability of the mother to adapt to the demands of pregnancy and, as a result, may influence fetal growth and development. We examined the association between exposure to extreme temperature and gestational diabetes mellitus and hypertension.

METHOD:In this study, using Health Insurance Review and Assessment Service data, pregnant women who visited the hospital from January 2015 to December 2020 were analyzed. Adjusted factors were treatment date, treatment code, residence, mean age of mothers and crude birth rate. The exposure period was obtained from the average temperature exposed during pregnancy. The study was verified through regression analysis of the temperature and the number of subjects with gestational diabetes mellitus and hypertension.

RESULTS:Our study included 370,254 subjects in total, among the subjects, 342,965 and 27,289 subjects were diagnosed with gestational diabetes mellitus and hypertension, respectively. We found positive associations with increase in number of subjects with gestational diabetes mellitus in factors such as heat exposure temperature (E: 15.568, 95% CI 8.397, 22.739, p-value= 0.039), exposure period, and environmental change. On the other hand, we found that the number of subjects with gestational hypertension significantly increased when the temperature fell to the extreme (E: -1.332, 95% CI -1.953, -0.711, p-value= 0.037).

CONCLUSIONS:Our findings suggest that maternal exposure to extreme temperature during pregnancy is associated with endocrine disorders such as gestational diabetes mellitus and hypertension. Pregnant women should pay attention to outdoor activities and regulate the temperature of the surrounding environment through appropriate adjustments (use air conditioners or heaters and refrain from outdoor activities).

Keywords: gestational diabetes mellitus, gestational hypertension, pregnant women, heatwaves, environmental exposure

Association of short term Particulate matter (PM 2.5) exposure with cardio-respiratory outpatient visits in secondary hospital in North India

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BACKGROUND AND AIM: Air pollution adversely affects the health of individuals, especially the most vulnerable. We aimed to document the short-term effects of PM2.5 exposure and outpatient visits for cardio-respiratory causes at the secondary care hospital.

METHOD:Daily outpatient visit data with cardio-respiratory disease specific diagnosis along with demographic characteristics was collected for three years (2018–2020) hospital records in Faridabad District of Haryana. Daily PM 2.5 exposure at patients' residence level was assessed using satellite-based PM2.5 (1-km) exposure that was calibrated against the ground-based measurements. Surface PM2.5 concentrations were estimated by converting aerosol optical depth (AOD) from Moderate Resolution Imaging Spectroradiometer (MODIS). Multi-variable analysis was done, including information on demographic variables, meteorology, Normalized Difference Vegetation Index, using a generalized linear model with Poisson's distribution.

RESULTS:The median age of the participants visiting the OPD with respiratory complaints was 9 years (IQR: 3,26). On univariate analysis, the association between PM 2.5 values and the number of OPD visits for respiratory complaints was not statistically significant. The model showed a significant increase in OPD visits for cardio-respiratory causes and PM2.5 levels with a lag period of 7 days taking into account seasonality (IRR – 1.025, p-value: 0.01). On stratified analysis, among children under five years of age, the association was significant with a lag of zero to two days (IRR0 – 1.028, p-value: 0.03; IRR1 – 1.034, p-value: 0.03; IRR2 – 1.034, p-value: 0.03).

CONCLUSIONS: An increase in PM2.5 levels is associated with an increase in outpatient visits for cardio-respiratory causes with a lag of seven days. The effect was more immediate among children under five years with a lag of up to two days.

Keywords: Particulate Matter, Short term exposure, Health effects

Nutrition, a crucial environmental factor of mental health outcome among nurses

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BACKGROUND AND AIM: Among all the environmental factors, eating habits, implicated nutrients, affect mental health the most. Poor diet quality was found among nurses, as well as prevalence of depression symptoms compared to workers in other industries. The present study aims to examine the dietary habits of nurses and the associated mental health outcome.

METHOD:665 nurses with current night shift work and at least 1 year of working were recruited through Association of Hong Kong nursing staff during 29/3/2022-, 11/1/2023. Participants filled in a structured online questionnaire which collected demographic, dietary habits, and mental health information. Then food frequency questionnaire (FFQ) was used to measure food consumption frequency and proportion. Mental health was measured by The Hospital Anxiety and Depression Scale (HADS) with 14-items. Multivariable linear regression analysis was used to examine types of food, consumption frequency and proportion in correlation to depression and anxiety.

RESULTS: Among 546 (82.1%) females and 119 (17.9%) males, the average age of participants was 33 (SD=7), 13(1.95%) received high school education or below, 126(19%) had post-secondary education, 343(51.6%) and 183 (27.5%) received undergraduate and postgraduate education respectively. After adjusted for the demographic variables, having fresh vegetables 2 or more times per day negatively associated with depression (B=-3.79, p<.01) and anxiety (B=-2.6, p=.01). Having dark green vegetables (B=-2.18, p=.03), meat (B=-2.46, p=.03) and fruit (B=2.64, p=.01) 2 or more times per day are negatively associated with depression. Having salted vegetables 5-6 times per week is positively correlated with depression (B= 5.1, p=.004) and anxiety (B= 4.8, p=.005). Having dark vegetables 1-6 times per year has positive relationship with anxiety (B=7.4, p=.009). CONCLUSIONS: Heathy dietary habits, greeter consumption on unprocessed food with rich nutrients, especially fiber and protein, have positive effect towards mental health.

Keywords: Nutrition, mental health

Maternal Exposure to Potentially Toxic Metals and Birthweight: preliminary results of the DSAN-12M birth cohort in the Recôncavo Baiano, Brazil

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BACKGROUND AND AIM: We investigated i) the determinants of exposure to lead (Pb), cadmium (Cd), and manganese (Mn) in 163 pregnant women ii) and the relationship between maternal exposure to those potentially toxic metals (PTMs) and birthweight (BW).

METHOD:Blood was collected from the pregnant women during their second trimester of pregnancy to determine Pb (PbB) and Cd (CdB), while hair (MnH) and toenails (MnTn) were used for Mn. Metal levels were analyzed by graphite furnace atomic absorption spectrophotometry (GFAAS).

Sociodemographic data were collected using questionnaires while BW information of only 74 newborns was available in the medical records.

RESULTS:Few participants had levels above the reference values for PbB (5.1; 95% CI: 2.1–10.1%), and MnH or MnTn (4.3; 95% CI: 2.3–10.1%). On the other hand, 61.1(95% CI: 52.4–69.3%) had elevated CdB levels. Low socioeconomic status, domestic waste burning, being a passive smoker, multiparity, and renovating the house significantly increased the chances of having high levels of Mn, Pb, and Cd. Considering the 74 dyads of mother-child at the moment, the medians (P25th–P75th) of PbB, CdB, MnH, and MnTn, were, respectively, 0.9 (0.5–1.8) µg/dL; 0.54 (0.1–0.8) µg/L; 0.18 (0.1–0.4) µg/g and 0.65 (0.37–1.22) µg/g. The means (SD) of BW were 3,067 (426.3) and 3,442 (431) grams, respectively, for girls and boys. MnTn presented an inverse correlation with the BW/GA ratio for girls (rho = -0.478; p = 0.018), suggesting the effect of sex modification. Although the BW's correlation with CdB was not statistically significant, hierarchical linear regression (Beta = -2.08; 95%CI -4.58 to 0.41) suggested a fetotoxic effect.

CONCLUSIONS: We detected a worrying situation related to exposure to Cd. We confirmed the threat PTM might represent and contributed to elucidating their role in inadequate fetal growth in developing countries like Brazil.

Keywords: Socio-economic factors, Birth outcomes, Epidemiology, Female

Prenatal exposure to perfluoroalkyl substances and liver injury in 21 year-old adolescents: The Taiwan Maternal and Infant cohort study

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BACKGROUND AND AIM:Non-alcoholic fatty liver disease (NAFLD) is among the most common contributors to the global burden of chronic liver disease. In addition to genetic factors, increasing evidence suggests that environmental exposures play important roles in the development and progression of NAFLD. Perfluoroalkyl substances (PFASs) are synthetic chemicals used for various industrial applications and in consumer products and are widespread persistent compounds which have a half-life of 3-15 years in human bodies. Recent data suggest that PFASs are associated with a higher risk of NAFLD. However, no study examined the association of prenatal exposure of PFASs with liver injury in youth. In this pilot, we aim to examine the association between PFASs exposure and biomarker of liver injury in adolescents.

METHOD:In the Taiwan Maternal and Infant Cohort Study, we collected serum samples from pregnant women during the third trimester and measured concentrations of 9 PFASs using a high performance liquid chromatography system. A subsample of their children was assessed with liver steatosis using FibroScan at age 21 (n=81). We defined NAFLD by controlled attenuation parameter (CAP) scores of \geq 238 dB/M in the absence of excessive alcohol use and viral hepatitis. Both alanine aminotransferase (ALT), and aspartate aminotransferase (AST) were also measured.

RESULTS:We found maternal serum perfluorohexane sulfonic acid (PFHxS) was statistically significantly correlated with AST (r=0.26, p=0.02) and ALT (r=0.29, p=0.01). The mean value of PFHxS were 1.55 (\pm 3.43, ng/mL) and 0.81 (\pm 1.0, ng/mL) for participants with and without NAFLD. CONCLUSIONS:Preliminary results showed cord blood PFASs appear to associate with increased liver injury. Prenatal exposure to PFASs may increase the risk of liver injury later in life.

Keywords: Prenatal exposure to perfluoroalkyl substances, birth cohort, adolescents, liver injury

Analysis of Cardiovascular and Respiratory System Diagnosis Results of Some Secondary Battery Workers in Korea

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BACKGROUND AND AIM: This survey was conducted as a preliminary survey to conduct a health care survey for workers at secondary battery manufacturing and regeneration sites conducted in Korea from 2023-24. In the manufacture of lithium-based secondary batteries, harmful factors to special health diagnosis, such as nickel, cobalt, manganese, and dichloromethane, are used. In addition, various raw materials such as lithium, carbonate, carbon nanotubes, and the like, which are not clearly disclosed, are mixed and used. Organic compounds and dust are feared to be exposed in some manual processes and cardiovascular and respiratory hazards, including night work. METHOD:Six work places were selected in consideration of industries such as anode, cathode material, electrolyte. 652 cases of special health diagnosis data that were not normally judged by the cardiovascular system or respiratory system were analyzed.

RESULTS:The most harmful factors exposed to workers at the surveyed workplace were night work, followed by aluminum and dichloromethane, and more than 60% of workers performed night work. Workers exposed to cardiovascular harmful factors had significantly higher blood pressure, fasting blood sugar, and triglycerides compared to the general population group, but the rate of abdominal circumference exceeding the standard was low. The proportion of workers who were not normal in the respiratory system was similar to or slightly lower than that of the general population group. CONCLUSIONS:Many of the workers are exposed to cardiovascular harmful factors along with night work, which is feared to increase the burden factor. Most of the processes are automated, so the concentration of harmful factors exposed is expected to be low, but it is judged that it is necessary to evaluate workers' health effects during unstructured processes such as maintenance processes. Through a survey on health care status, it will closely grasp the condition of workers and create health care guides for each industry.

Keywords: Secondary battery industry, Cardiovascular disease, Respiratory disease

Exploration of high concentration areas of fine dust and biomonitoring for volatile organic compounds among the residents

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BACKGROUND AND AIM: Busan is the second largest city in Korea, known for the port industry. Due to the high emissions of pollutants from ships and heavy traffics, the concentration of fine dust is high in the city. In this study, air quality data was analyzed to identify areas with high levels of fine dust in Busan and to monitor the exposure of residents in the areas.

METHOD: Air quality data from 31 air pollution monitoring stations in Busan were collected by using the National Ambient Air Quality Monitoring System (Air Korea). The mean concentrations and spatial distribution were analyzed by location and year, and statistical analysis was conducted using SPSS. To determine the concentrations of volatile organic compounds (VOCs) among residents in areas with high levels of fine dust, urine samples were collected and analyzed by LC-MS/MS.

RESULTS:The mean of PM10 fine dust by location for 10 years from 2011 to 2020 were 46.99 μ g/m³ (39.00 μ g/m³ to 63.02 μ g/m³). The spatial distribution showed that the western and central regions had higher concentrations. From 2018 to 2020, the mean of PM10 was particularly high at H location, with 42.50 μ g/m³. The mean of t,t-MA (trans,trans-muconic acid) and BMA (N-Acetyl-S-(benzyl)-L-cysteine) were 71.15 μ g/g creatinine and 7.00 μ g/g creatinine, respectively among the 400 residents near H town, which were higher than the 4th and 5th KoNEHS (Korean National Environmental Health Survey) reference values of 64.60 μ g/g creatinine and 5.02 μ g/g creatinine, respectively. CONCLUSIONS:The western region of Busan showed a higher average concentration of PM10 fine dust and the results of the resident monitoring survey were higher than the nationwide average value. Continuous monitoring for the western region is needed to establish a foundation for efforts to reduce fine dust and to monitor the health impacts on the residents.

Keywords: Long-term exposure, Chemical exposures, Other (volatile organic compounds)

Natural hazards and critical infrastructure in the United States

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BACKGROUND AND AIM: Given that climate change poses a significant threat to critical infrastructure by damaging the quality and continuity of services, and facility capacity, identifying and quantifying the number of infrastructures at risk is needed. This study aims to evaluate the spatial patterns and quantify the percentage of multiple infrastructures at risk of climate change-related natural hazards in the United States.

METHOD: We linked the National Risk Index Score developed by the Federal Emergency Management Agency (FEMA) and the Homeland Infrastructure Foundation-Level Data (HIFLD) for locations of critical infrastructure across 5 sectors including chemicals, communications, education, energy, and public health. The 18 types of natural hazards considered such as avalanche, coastal flooding, cold wave, drought, earthquake, hail, heat wave, hurricane, ice storm, landslide, lightning, riverine flooding, strong wind, tornado, tsunami, volcanic activity, wildfire, and winter weather. The natural hazard risk index rating (from "Very Low" to "Very High") is calculated by multiplying expected annual loss and social vulnerability and dividing by community resilience at the census tract level. We visualized the infrastructure locations and calculated the percentages in the "Very High" and "Relatively High" natural hazard areas.

RESULTS: We analyzed 18 types of climate change-related natural hazards with 5 sectors of critical infrastructures. For example, for public health infrastructures, the number (percentages) of hospitals, nursing homes, and urgent facilities in "Very High" and "Relatively High" coastal flooding tracts were 56 (0.70%), 304 (0.67%), and 45 (0.94%); heatwave tracts were 1556 (19.56%), 7674 (17.00%), and 635 (13.33%); and wildfire tracts were 339 (4.26%), 1476 (3.27%), and 161 (3.38%). We also identified infrastructures at risk of multiple natural hazards. Single- and multiple-hazard risks showed highly variable geographical patterns.

CONCLUSIONS: The identification of critical infrastructures at risk from natural hazards can inform policymakers and public health officials in prioritizing resources for the most vulnerable areas.

Keywords: Wildfires, Spatial statistics

FP-103[Air pollution » Particulate matter]

Associations between Fine Particulate Matter Composition and Sources with Adverse Health Effects: A Systematic Review and Meta-Analysis

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BACKGROUND AND AIM: Associations between fine particulate matter ($PM_{2.5}$) exposure and health outcomes are well established. Constituents and sources of $PM_{2.5}$ that are driving the $PM_{2.5}$ -health associations remain unclear.

METHOD: We performed a systematic literature review of an array of health outcomes (mortality, morbidity, birth outcomes) associated with exposure to fine particulate matter constituents and sources. PubMed, Scopus, and Web of Science were searched for English-language publications using relevant keywords. After screening and assessing the risk of bias for each study, we performed meta-analyses for each health endpoint and constituent/sources combination if the number of studies was at least three.

RESULTS: We grouped studies according to health endpoints (e.g., cardiovascular and respiratory diseases) and exposure length (short-term and long-term). We found that elemental carbon, organic carbon, and sulfates were most consistently associated with health endpoints. The findings indicate that fossil fuel combustion, such as diesel-fueled vehicles and traffic (elemental carbon, organic carbon), as well as coal combustion (sulfates) are particularly associated with adverse human health impacts.

CONCLUSIONS: While more studies of PM_{2.5} constituents and source components are still needed, the available results of both the short- and long-term exposure studies are consistent with the conclusion that PM_{2.5} mass derived from fossil fuel combustion, such as traffic-related and coal combustion pollution, is of particular concern for public health. Our findings indicate a need for clean air and climate action policies to focus on limiting PM_{2.5} pollution from fossil fuel combustion sources to maximize the health benefits of those mitigation efforts.

Keywords: Particle components, Short-term exposure, Long-term exposure, Traffic-related

Long-term PM2.5 exposure and urticaria, allergic conjunctivitis, and allergic rhinitis in national longitudinal cohort

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BACKGROUND AND AIM: Previous studies have suggested that air pollutants are associated with asthma development and exacerbation, but the associations between PM2.5 and the risks of urticaria, allergic conjunctivitis, and allergic rhinitis remain inconsistent. We examined the association of long-term exposure to PM2.5 with the risk of Urticarial Rush (UR), Allergic Conjunctivitis (AC), and Allergic Rhinitis (AR).

METHOD: We utilized the National Health Insurance Service-National Sample Cohort spanning from 2002 to 2019, consisting of one million beneficiaries representative of the entire population in South Korea. The onset of allergic diseases was the first hospital visit record with a primary diagnostic code based on the International Classification of Disease, 10th edition codes. For PM2.5 exposure, we used a machine learning-based ensemble prediction model to achieve a high spatial resolution of 1 km2. We allocated the district-specific annual average concentration of PM2.5 across all 229 districts in South Korea. We estimated the association between PM2.5 and the onset of allergic diseases using a time-varying Cox proportional hazard model adjusted for age, sex, socioeconomic status, region, and community level indicators.

RESULTS: Our study included 571,836 beneficiaries aged 18 and below at enrollment and followed until the first onset of allergic diseases. Among the subjects, 156,577, 137,491, and 277,768 individuals were diagnosed with UR, AC, and AR, respectively. The hazard ratios of development of allergic diseases when annual PM2.5 concentration increased by 5µg/m³ were 1.023 (95% CI 1.011 to 1.036) for UR, 1.035 (95% CI 1.021 to 1.048) for AC, and 1.064 (95% CI 1.055 to 1.074) for AC. CONCLUSIONS:Long-term exposure to PM2.5 was associated with an increased incidence of urticaria,

allergic conjunctivitis, and allergic rhinitis in this national cohort. These findings can provide essential information for preventing allergic diseases in children and adolescents.

Keywords: Air pollution, Allergies, Long-term exposure, Particulate matter

Temperature Variation, Ambient PM2.5, and Allcause Mortality: A Longitudinal Cohort

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BACKGROUND AND AIM:Previous studies showed that impacts of climate change may stem from the increasing temperature variation (TV) rather than the warmer temperature. However, most studies on effects of TV mainly focused on the short-term exposure and they ignored the modifying effect of PM2.5. We therefore investigated the associations of TV and ambient PM2.5 with all-cause mortality in Taiwanese.

METHOD: We included 434,443 Taiwanese recruited during 2000-2016 with 976,913 medical examination records. PM2.5 was estimated at each participant's address using spatial-temporal models. We collected daily ground-level temperature observations from Taiwan Central Weather Bureau. We used the inverse distance weighted method to derive averages of the daily ambient temperature at residential addresses. We used standard deviation (TSD) and range (TR) of temperature as the indicators of TV. A Cox regression model with time-varying covariates was applied to examine effects of PM2.5 and annual and seasonal TV. All variables (except for sex) were treated as time-varying variables. We also tested the interaction of PM2.5 and TV.

RESULTS: Ambient PM2.5, summer TSD, winter TR were significantly associated with all-cause mortality. The hazard ratio (HR) per 10 μ g/m3 increase in annual PM2.5 concentration was 1.264 (95% CI: 1.227, 1.303). The HRs for per 1 °C increase in annual, summer, and winter TSD were 1.013 (0.977, 1.050), 1.086 (1.035, 1.140), and 0.929 (0.886, 0.974), respectively. The HRs for 1 °C increase in annual, summer, and winter TR were 0.999 (0.989, 1.010), 0.998 (0.991, 1.005), and 1.017 (1.008, 1.026), respectively. Larger TV was associated with a lower risk of PM2.5 on all-cause mortality. The long-term TV-mortality association was stronger in low and moderate PM2.5 concentration.

CONCLUSIONS:Long-term exposure to ambient PM2.5 and temperature variations were positively associated with increased risk of mortality. Our results also suggest that temperature variation modified the effects of PM2.5 on mortality in this Taiwan population.

Keywords: Air pollution, Long-term exposure, Temperature variability, Mortality, Risk assessment

A propensity score analysis of the relationship between exposure to RF-EMF during pregnancy and birth outcomes

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BACKGROUND AND AIM: In modern society, exposure to RF-EMF is an unavoidable ubiquitous exposure. It is not yet clear whether the use of mobile phones during pregnancy has a causal adverse effect on birth outcomes.

METHOD: In the Korea Children's Environment and Health Study cohort, information was gathered via a survey on mobile phone usage among 5,213 women who gave birth between 2015 and 2020. In the case of missing mobile phone use information during pregnancy, birth outcome information and multiple births were excluded, 4628 women were finally included in the analysis. Birth outcomes evaluated were birth weight, birth height, ponderal index, and gestation age, preterm birth, low birth weight. Propensity scores(PS) were generated for groups with high and low mobile phone calls during pregnancy based on the 75percentile. Variables for PS calculation were selected using general characteristics and LASSO regression. Ultimately, the effects of RF-EMF on birth outcomes via mobile phone calls were examined through propensity score matching analysis and IPTW analysis. RESULTS: In PS matching analysis, the balances of the general characteristics of the groups with low and high mobile phone calls were similarly distributed, ensuring comparability. The effect in the group with high mobile phone calls compared to low group was β =7.22(p=0.58) for birth weight, β =0.10(p=0.28) for birth height, β =-0.02(p=0.32) for ponderal index, β =-0.05(p=0.40) for gestational age, HR=1.02(0.95-1.10) for gestational age, OR=1.06(0.75-1.51) for preterm birth, and OR=0.97(0.71-1.34) for low birth weight, respectively. There were no significant results in the IPTW analysis results.

CONCLUSIONS: We did not observe evidence that prenatal mobile phone use causally affects birth outcomes. Additional studies using specific absorption rate are needed. This work was supported by Institute of Information & communications Technology Planning & Evaluation (IITP) grant funded by the Korea government (MSIT) (2019-0-00102, A Study on Public Health and Safety in a Complex EMF Environment)

Keywords: RM-EMF, mobile phone calls, birth outcome, propensity score, IPTW

Tall stature and the combination risk on kidney damage with overweight and lifestyle among the diabetic population

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BACKGROUND AND AIM: Height of an individual is influenced by both genetic and environmental factors. The correlation of height with kidney disease and diabetes has been less studied. Different body shapes may have various risks of developing diseases, but most past research has focused on BMI rather than height. In today's society, which is filled with snacking and drinking habits, this study aims to investigate how different height groups of patients with diabetes may be affected differently by their snacking and drinking habits in relation to the progression of kidney function decline. METHOD: This follow-up study was conducted in Japan with participants who underwent health checkups. Diabetic patients' height, weight, and lifestyle information were recorded at baseline. Height was divided into two groups by the median value. Subjects were observed for about three years to detect the progression of kidney damage, which is defined as eGFR less than 60 or developing proteinuria. Cox proportional hazard model was used for statistical analysis.

RESULTS:A total of 2380 subjects were enrolled. Combinations of drinking alcohol with overweight showed risks for kidney damage in both low and high height groups among males (HR=1.95, P-value=0.049 for lower height; HR=3.15, P-value=0.003 for higher height). Among subjects of males with tall stature, the combination of no alcohol consumption and overweight had further significant risk for kidney damage (HR=4.01, P-value=0.001).

CONCLUSIONS: This study found that in male diabetic populations with a tall stature, obesity and unhealthy lifestyle habits may cause a greater decline in kidney function. Although the mechanism underlining this observation is not clear, it may be attributed to the higher levels of growth hormones, such as insulin-like growth factor 1. Further studies are required to examine the relationship between tall stature and kidney function decline among diabetic population.

Keywords: Epidemiology, Obesity and metabolic disorders

Association between particulate matter 2.5 and menopause in Korean women

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BACKGROUND AND AIM:Particulate matter (PM2.5) has become a serious public health issue and affecting women's fertility rates worldwide. Therefore, there is a need to evaluate the risk factors associated with menopause in order to be able to inform women of the health risks. METHOD:We collected data from KHANES (The Korea National Health and Nutrition Examination Survey) linked air pollution concentration data (2010–2020) by Korea Centers for Disease Control and Prevention, Ministry of Health and Welfare. The database of meteorological factors and air quality as sources of exposure data were estimated using the Community Multiscale Air Quality model. The linkage dataset was merged by three ways; administrative district, si-gun-gu (city, county, and district), and geocode (in latitude and longitude coordinate units) based on the participants' residential address. The gross population sample for this study, comprising 88,220 participants was selected between 2010-2020. 40,241 men were excluded from this study population leaving 47,979 women. We employed logistic regression analyses to determine the associations between PM2.5 and menopause after adjusting for covariates.

RESULTS:A total of 46,986 participants were included in the analysis. Additionally, menopause women were 17,164 participants. The mean age (SD) at natural menopause was 49.10 (5.07) years. The prevalence rate of menopause systems was found to be 37%. There was association between PM2.5 and menopause (adjusted odds ratio [aOR]: 1.007, 95% confidence interval [CI]: 1.003-1.011). CONCLUSIONS:Therefore, the findings from this study discovered that person exposed to more Particulate matter 2.5 was strongly related to increased risk of menopause in Korean women.

Keywords: Particulate matter, menopause, environment epidemiology

Projection of Dengue Fever Infection Under Climate Change: A Modelling Study

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BACKGROUND AND AIM: Climate change has accelerated dengue fever (DF) spread worldwide, and projecting DF infection in South and Southeast Asia would help to prevent and control DF spread in advance.

METHOD: Weekly DF cases and meteorological data in Singapore, Selangor, and Chiang Mai from 2012 to 2020 were collected. Projected monthly temperature and rainfall in 2030s, 2050s, 2070s, and 2090s under low, middle, and high greenhouse gas emission scenarios (SSP126, SSP245, and SSP585) were retrieved. The quasi-Poisson generalized additive models (GAMs) were used to assess the association between climate and DF incidence and project DF infection risk.

RESULTS:Under SSP126, the weekly DF incidence would increase from 187 (95% confidence interval [CI]: 170-204) to 203 (95%CI: 187-221), from 748 (95%CI: 708-789) to 754 (95%CI: 719-789), and from 18 (95%CI: 16-20) to 20 (95%CI: 17-22) in 2090s compared to 2030s in Singapore, Selangor, and Chiang Mai, respectively. Projected DF incidence under SSP245 would increase more apparent than under SSP126, while the most significant increase would be under SSP585. The weekly DF incidence would increase from 191 (95% CI: 175-209) in 2030s to 381 (95%CI: 264-497) in 2090s and from 18 (95%CI: 16-20) to 43 (95%CI: 38-49) in Singapore and Chiang Mai under SSP585, while the incidence in Selangor would peak at 2050s and then drop until 2090s. The highest peak weekly DF incidence in a year would be 485 (95%CI: 287-686) and 112 (95%CI: 95-129) in Singapore and Chiang Mai in 2090s under SSP585, and would be 791 (95%CI: 757-824) in 2050s under SSP 585 in Selangor.

CONCLUSIONS: The DF infection risk will increase in the future, especially in the second half of this century and under high emission scenarios. Limiting global warming is urgently needed to reduce a potential increase in DF infection.

Keywords: Modeling, Climate, Infectious diseases

Impact of ambient temperature, air pollutants, and seasonal influenza on febrile seizure in children

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BACKGROUND AND AIM: Febrile seizure is a kind of convulsion that mainly occurs among young children. The effects of various exposome including influenza infection and external environmental factors on febrile seizure have not been well-studied. In this study, we elucidated the relationships between ambient temperature, air pollutants, influenza infection, and febrile seizure using 22-year territory-wide hospitalization data in Hong Kong.

METHOD: The aggregated data were matched with the meteorological records and air pollutant concentrations. All-type and type-specific influenza-like illness positive (ILI+) rates were used as proxies of influenza activity. Distributed lag non-linear model in conjunction with the quasi-poisson generalized additive model was used to examine the associations of interest.

RESULTS:According to the results, all-type influenza infections were significantly associated with an increased risk of hospital admission due to febrile seizure (cumulative adjusted relative risk [ARR]=1.59 at 95th percentile vs 0; 95% CI, 1.51–1.68). The effect of ILI+ A/H3N2 on febrile seizure was more pronounced among the type-specific ILI+ rates. Low mean ambient temperature as a significant risk factor for febrile seizure (cumulative ARR=1.50 at 5th percentile vs median; 95% CI, 1.35–1.66), while redox-weighted oxidant capacity and sulfur dioxide were not associated with febrile seizure.

CONCLUSIONS: In conclusion, our study provided clues about the impacts of different exposome on febrile seizure manifestation. Our results suggested that influenza vaccination for children at eligible age could safeguard their health. Young children should be kept warm during cold weather.

Keywords: Children's environmental health, Environmental epidemiology
Integrating Aerosol Optical Depth, Land Use Regression, and XGBoost to Estimate the Spatial Variation of Ions in PM2.5 across Taiwan

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BACKGROUND AND AIM: This study utilized aerosol optical depth (AOD), land use regression (LUR) and machine learning to estimate the spatial variation of water-soluble ions (WSI) in fine particulate matter (PM2.5).

METHOD: Monthly average PM2.5 WSIs (SO42–, NO3–, NH4+, Cl–, Na+, K+, Ca2+, and Mg2+) were obtained from 31 Taiwan EPA air quality monitoring stations in 2019. Several datasets, including land use, road information, MODIS AOD, Himawari-8 AOD, MODIS Normalized Difference Vegetation Index (NDVI), elevation, stationary emission sources, demographic data, meteorological data, and distribution of temples, were collected to be the predicting variables in the model. The feature selection for each WSI was conducted with LUR. Then, Extreme Gradient Boosting (XGBoost) algorithm was applied to build multiple predicting models with the selected features for each WSI. The model-tuning procedure was processed with Tree Parzen Estimator algorithm.

RESULTS:By incorporating XGBoost algorithm with AOD and LUR, the results demonstrated that these models had good performance on predicting external datasets of SO42- (adjusted R2 = 0.69), NO3– (adjusted R2 = 0.73), NH4+ (adjusted R2 = 0.71), and Na+ (adjusted R2 = 0.62). The other ions, including Cl-, K+, Ca2+, and Mg2+ had the adjusted R2 <0.5.

CONCLUSIONS: This study demonstrates that integrating AOD, LUR, and XGBoost algorithm could be a feasible method to predict the spatial variation of selected WSIs in PM2.5.

Keywords: air pollution, particulate matter, spatial statistics, modeling

Associations of persistent organic pollutants (POPs) with diabetes in women from the Hispanic Community Health Study/ Study of Latinos (HCHS/SOL)

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BACKGROUND AND AIM:Global diabetes prevalence has risen rapidly in recent decades. Exposure to POPs has been identified as a possible risk factor for diabetes, but the impact on diabetes progression and mechanisms of action are unclear. We explored associations of serum POPs with incident prediabetes and diabetes, and changes in diabetes traits in post-menopausal Hispanic/Latino women. METHOD:HCHS/SOL is the largest multiethnic cohort of Hispanics/Latinos in the US. Our sample included 310 normoglycemic and 399 prediabetic women not taking medications related to diabetes or hormones, with an average 6 years of follow-up. The effect of baseline POPs levels on progression from 1) normoglycemia at baseline to prediabetes at follow-up (162/310) and 2) prediabetes at baseline to diabetes at follow-up (195/399) was evaluated using multivariable Poisson regression with robust variance analysis. The association between POPs and change scores for glycemic traits was evaluated using linear regression. All models were adjusted for sampling design, demographic, clinical and acculturation characteristics.

RESULTS:Progression from prediabetes to diabetes was linearly associated with p',p'dichlorodiphenyldichloroethylene (DDE, IRR:1.39;95%CI:(1.07,1.82), hexachlorobenzene (HCB, IRR:1.72;95%CI:(1.17,2.51) and sum polychlorinated biphenyls (PCBs, IRR:2.27;95%CI:(1.54,3.34), and non-monotonically associated with sum dioxin-like PCBs and oxychlordane, while the association with β -hexachlorocyclohexane (β -HCCH) was significant at the highest quartile. Mirex (IRR:0.75;95%CI:(0.59,0.94) and o',p'-dichlorodiphenyltrichloroethylene (DDT,IRR:1.89;95%CI:(1.19,3.01) had significant linear associations for progression to prediabetes from normoglycemia. PCBs, dioxin-like PCBs, β -HCCH, and HCB were positively, and sum polybrominated diphenyl ethers (PBDEs) was negatively, associated with change in glycosylated hemoglobin (HbA1c), but POPs were not related to change in HOMA-IR or HOMA-B. CONCLUSIONS:Our findings confirm positive associations between POPs exposure and risk of diabetes. The positive associations are mainly driven by conversion from prediabetes to diabetes, which suggests that effects of POPs may occur later in disease development. Further studies are needed to identify mechanisms by which POPs affect diabetes.

Keywords: Endocrine disrupting chemicals, Female, Incidence, Pesticides

Gender differences in blood cadmium concentrations of fishers living near thermal power plants

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BACKGROUND AND AIM: Fishers are vulnerable to heavy metal exposure in both their working and living environments. The objective of this study is to measure the blood cadmium concentration (bCd) of fishers living near thermal power plants and to identify gender differences and factors that contribute to elevated bCd.

METHOD: This is a cross-sectional study conducted in 2021 among residents living in the southern part of South Korea. A total of 128 fishers (73 men and 55 women) participated in the survey. The primary outcome was bCd in μ g/L. We used multiple regression models to analyze the association between gender and cadmium exposure. In the statistical analysis, the bCd was log-transformed. The models were adjusted for confounding variables, including age, occupation, fishing-related working period, education level, economic level, smoking status, heavy alcohol use, seafood consumption, compliance score for particulate matter protection, subjective health, and body mass index.

RESULTS:The geometric mean bCd of participants was 1.02 μ g/L (95% confidence interval 0.94, 1.12). The mean difference of log transformed bCd was -0.31 μ g/L (95% CI -0.48, -0.15), which was higher in women (p<0.001). The gender of women had a significant effect on the increase in bCd after adjusting for several potential confounders (β =0.485, p<0.001). St

EP-wise multiple regression analysis revealed that not only gender but also smoking were related to the increase in bCd among fishers. There was no statistically significant relationship between health behaviors such as seafood consumption or compliance score for particulate matter protection and the increase in bCd.

CONCLUSIONS:Our results confirm the gender differences in bCd among fishers. Factors such as women and smoking were found to influence the increase in bCd. In order to protect human health from cadmium exposure, future investigations should focus on sex-specific factors that contribute to gender differences in bCd among fishers, such as gender-specific work or genetic differences.

Keywords: Heavy metals, Occupational exposures, Female

Protocol for cross-sectional study of environment factors and spatial distribution of hypertension control status in Putrajaya

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BACKGROUND AND AIM: Hypertension is a major public health problem in Malaysia, and controlling hypertension is essential to prevent complications and reduce morbidity and mortality. Hypertension control status in urban area like Putrajaya could be influenced by environmental factors, such as the availability and distance of healthcare facilities, public green spaces, and healthy food sources. Putrajaya is a planned city in Malaysia, where the urban environment is well-organized and could provide an opportunity to investigate the association between environmental factors and hypertension control status. This cross-sectional study aims to investigate the association between these factors with the spatial distribution of hypertension control status among hypertensive patients in Putrajaya. METHOD: A cross-sectional study was designed to select at least 108 data from list of hypertensive patients attending primary healthcare clinics in Putrajaya, using a systematic random sampling. Data will be extracted which includes sociodemographic information, residential address, clinical information, and hypertension control status according to protocol by Ministry of Health, Malaysia. The spatial distribution of hypertension control status will be assessed using a geographic information system (GIS) to map the distribution of hypertensive patients and their hypertension control status. The distribution of healthcare facility, public green space, and healthy food sources was mapped using GIS and counter checked using a checklist from the local authority.

RESULTS: Hypertension control status and environmental exposure will be analysed descriptively. Association between healthcare facility, public green space, healthy food and hypertension control status will be measured using Geographical Weighted Regression (GWR).

CONCLUSIONS: The study will help to identify the association between the availability and distance of healthcare facility, public green space, and healthy food sources with the spatial distribution of hypertension control status in Putrajaya. The findings will provide insight and useful information to develop effective strategies to improve hypertension control in other urban areas in Malaysia.

Keywords: Built environment, Cardiovascular diseases, Food/nutrition, Green space

Hourly PM2.5 exposure and ischaemic heart diseases onset in Central Taiwan

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BACKGROUND AND AIM: Ischaemic heart disease (IHD) is a formidable contributor to premature mortality and disability worldwide, intensifying the global health burden. Although studies have shown the positive link between daily PM_{2.5} exposure and acute coronary syndrome, a research gap remains regarding the impact of hourly PM_{2.5} exposure on IHD onset.

METHOD: We gathered measurements encompassing O₃, NO₂, SO₂, CO, PM_{2.5}, temperature, and relative humidity from the Nantou air quality station in central Taiwan, spanning 2011 to 2021. The hourly time-series measurements underwent transferred into 0-24 hour rolling average concentrations. Concurrently, we integrated this dataset with hourly emergency department visits (EDVs) for ischemic heart disease (IHD) from Nantou Hospital. The Quasi-Poisson generalized additive models and non-linear distributed models were used to explore the relationships between hourly rolling average PM_{2.5} concentrations and EDVs for IHD, considering time lags ranging from 0 to 48 hours in both single- and multi-pollutant models.

RESULTS:This study conducted 1507 IHD EDVs, encompassing 55.7% of acute myocardial infractions, 27.9% of other acute or chronic IHD instances, and 16.4% of angina pectoris cases. Chi-square tests revealed significant associations between IHD occurrence and variables such as season, day-night cycles, and days of the week. Hourly rolling average PM_{2.5} exhibited positive correlations with IHD EDVs, particularly at 17 to 22 lag hours. The 6-hour rolling average of PM_{2.5} showed robust links with IHD EDVs. A 10 µg/m3 rise in the 6-hour rolling average of PM_{2.5} was significantly associated with IHD EDVs 17 hours later, resulting in a 2.91% excess risk (95% CI: 2.36-3.46) of IHD onset. CONCLUSIONS:This study highlights a significant link between hourly PM_{2.5} exposure and an increased risk of acute IHD. Remarkably, even a 1-hour PM_{2.5} exposure demonstrated a notable positive correlation with IHD EDVs. These findings emphasize the importance of addressing hourly PM_{2.5} standards to mitigate the risks associated with IHD.

Keywords: Hourly PM2.5 standards, Ischaemic heart disease, Emergency department visits, Quasi-Poisson generalized additive model, Non-linear distributed model

The influence of farming activities of paddy rice cultivation on PM2.5 pollution and the incidence of allergic symptoms

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BACKGROUND AND AIM: This study aims to compare PM2.5 pollution in the school around the rice fields and the incidence of allergic symptoms among school students during different farming activities of paddy rice cultivation.

METHOD:Our study subjects were students in the second and fourth grades of an elementary school around the rice fields from January to November 2022. AS-LUNG sensors were set up both outdoors and indoors in the classrooms to monitor PM2.5 levels. Daily allergic symptoms of students, including symptoms of the respiratory tract, nose, eyes, and skin, were investigated using an eight-day questionnaire. The PM2.5 pollution and the frequency of allergic symptoms were compared over 7 periods, including three fallow periods (no farming activities) and four farming periods (rice transplanting, fertilization, pesticide spraying, and harvesting).

RESULTS:The outdoor to ambient ratios of PM2.5 in the period of fertilization and harvesting were higher than those detected in other farming periods (1.25 - 1.39 vs. 0.64 - 0.71), showing that PM2.5 pollution might be affected by farming activities. However, such influence did not further affect health outcomes because the incidence of 4 kinds of allergic symptoms was not significantly different among farming periods (p>0.05). When three fallow periods were included in the comparison, the fallow period in January had the highest frequency of respiratory symptoms when getting up in the morning as well as symptoms of nose, eyes, and skin (0.77, 0.79, 0.81, 0.82, 0.77, and 0.78 time/period-person)(p<0.05 for all). The level of indoor PM2.5 was also the highest in this period ($21.02 \mu g/m3$ vs. $6.03 - 18.81 \mu g/m3$).

CONCLUSIONS: Farming activities of paddy rice cultivation could affect PM2.5 levels in the surrounding area; PM2.5 pollution during fertilization and harvesting periods increased. However, the increase in PM2.5 pollution during fertilization and harvesting periods might not be large enough to have more frequent allergic symptoms.

Keywords: Allergies, Children's environmental health, Exposure

FP-117[Air pollution » Particulate matter]

The association between long-term exposure to ambient coarse particulate matter and mortality among dialysis patients: a nationwide cohort study

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BACKGROUND AND AIM: Exposure to PM2.5 has been known to be associated with an increased risk of mortality in dialysis patients. Sporadic studies have suggested that coarse particulate matter (PM10) adversely affects kidney health. However, the impact of PM10 on the survival in patients with endstage renal disease remains unclear. We conducted a retrospective cohort study to explore the association of long-term ambient PM10 exposure with the mortality among dialysis patients. METHOD: Data from Taiwan Air Quality-Monitoring Database and the dialysis data extracted from the National Health Insurance Research Database were utilized for evaluation. The two databases were linked using the postcodes of patients' living area. We selected dialysis patients residing in areas with ambient PM10 measurements from January 1st, 2000, and followed them up until their deaths or December 31st, 2013. Cox proportional hazards model was used to estimate the risk of mortality in dialysis patients, with adjustments for demographic, health-related, and socioeconomic factors. RESULTS: A cohort of 34,088 dialysis patients was formed. The adjusted hazard ratio (aHR) for mortality per $10-\mu g/m3$ increase of PM10 was 1.059 (95% confidence interval [CI] = 1.044-1.075). Moreover, restricted cubic spline analysis showed a non-linear concentration-response relationship between PM10 and mortality, with the lowest mortality aHR identified at a mean PM10 of 43 µg/m3, followed by an interval of gradual aHR increase, and finally a remarkable rise of mortality risk when mean PM10 exceeded 63 μ g/m3.

CONCLUSIONS:Our study revealed a significant association between long-term ambient PM10 exposure and mortality risk among dialysis patients. Specifically, every 10- μ g/m3 increase in PM10 causes a 5.9% rise in mortality risk. A non-linear concentration-response relationship between PM10 and mortality was noted, with mortality risk increasing when mean PM10 exceeded 43 μ g/m3. These findings strongly suggest a causal relationship between ambient PM10 and mortality among dialysis patients.

Keywords: coarse particulate matter, dialysis patient, mortality

The Role of Inpatients and Caregivers in a Hospital Falls Prevention Education Program in a Regional Teaching Hospital in Taiwan

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BACKGROUND AND AIM: Falls and fall injuries in hospitals are the most frequently reported adverse event among inpatients. Therefore, fall Prevention was considered as an important task theme of the Joint Commission of Taiwan. The purpose of this study was to evaluate the effectiveness of of a falls prevention program that involve patients and caregivers participation on reducing falls in hospitals. METHOD: This is an interventional study. The subjects were inpatients admitted to a regional teaching hospital in south Tainan between December 2022 and February 2023. Patients were excluded if they had impaired cognitive function or were too ill to provide informed consent. Each participant completed a fall risk questionnaire, a falls prevention educational program, and fall related knowledge tests. The education contained falls prevention knowledge with chart cards and booklets, transferring skills and muscle strengthening training. Pretest of the fall related knowledge was performed when the patient admitted to the hospital, and the posttest was carried out on the day the patient discharged. RESULTS: Total of 217 inpatients were enrolled with an average age of 60.9+20.3 years old and 62.2% of male. Most patients have family or caregiver(86.6%). The fall prevention knowledge score of posttest(96.5+8.6) was significantly higher than the pretest(88.5+14.0) of the patients(p < 0.05), as well as to the caregiver (99.0+3.7 vs 94.0+9.5). Interestingly, the male had higher score than female both in pretest(89.3+13.1 vs 87.0+15.3) and posttest(98.0+6.1 vs 94.0+11.2). One of the reasons might be that the male had higher education level. During the study period, there was only one fall reported and the incidence of fall was reduced to 0.046%.

CONCLUSIONS: The outcomes show that the approach of patients and caregivers participating in a fall prevention program has the potential to be an important aspect to reduce falls and further possibly promote patient safety.

Keywords: Outcomes, Male, Female, Incident

Work-related and personal factors in musculoskeletal disorders among elderly hospital cleaning workers

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BACKGROUND AND AIM: Evidence suggests cleaning workers had high risk of musculoskeletal disorders (MSDs). Investigations on work-related and personal factors for MSDs are limited, especially in elderly hospital cleaning workers. This study aimed to explore their work-related and personal factors associated with MSDs.

METHOD: We conducted a cross-sectional study from five hospitals in northern Taiwan. The MSDs were assessed based on the Nordic questionnaire. Sociodemographic factors and occupational hazards were assessed. The assessment of ergonomic risk factors was based on the Guidelines for Occupational Medical Examinations from DGUV. The logistic regression analysis was used to identify factors associated with MSDs.

RESULTS:A total of 112 hospital cleaning workers completed the study. The majority were females (65.2%), and the average age was 68.7 years. 56.3% had any musculoskeletal symptoms during the last twelve months, and the most prevalent location was the knee (17.3%). The most prevalent ergonomic risk factor was repetition of upper limbs (19.4%), followed by flexion or twist of trunk (19.1%), and forceful movement of upper limbs (16.9%). Except for the ergonomic hazard, the most prevalent occupational hazard was chemical (38.5%). The most prevalent medical history was trauma (18.2%), followed by MSDs (19.1%) or gastrointestinal disorders (11.8% each). For univariable logistic regression, female sex, flexion or twist of trunk, repetition of upper limbs, forceful movement of upper limbs, kneeling or squatting, hand over the shoulder, and histories of musculoskeletal disorders, gastrointestinal disorders were significantly associated with MSDs. Female sex (OR = 10.58, 95% CI = 2.87–39.07), hand over the shoulder (OR = 14.32, 95% CI = 2.85–71.92), history of gastrointestinal disorders (OR = 12.13, 95% CI = 2.60–56.64) were significantly associated with MSDs after adjustment.

CONCLUSIONS: This study implies that female, hand over the shoulder, and history of gastrointestinal disorders were associated with MSDs. Future studies on the plausible mechanisms for associations are warranted.

Keywords: Epidemiology, Female

Significant impacts of humid heat stress on citylevel human mortality

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BACKGROUND AND AIM: The continuing increasing humid heat stress is believed to be a severe threat to human survivability, and many humid heat indicators (HHIs) have been proposed to quantify its severity. However, to date, there is a lack of established epidemiological evidence linking these HHIs to city-level mortality. Here, we aim to examine the suitability of multiple HHIs in modeling/predicting city-level human mortality in addition to the commonly used meteorological exposure variable air temperature (Tair), and quantify the spatial diversity of their performances.

METHOD: To address this gap, we utilized well-established distributed lag non-linear models (DLNMs) to assess the exposure-response associations between multiple HHIs and daily human mortality, and used supervised machine learning methods to identify the key factors influencing the lethal heat stress type (humid vs. dry) experienced at the city level. The analysis is conducted for 739 cities from 43 countries, with state-of-the-art epidemiological and climatological datasets.

RESULTS:Our study revealed notable differences in the long-term trends and timing of hot days among these HHIs. Using HHIs produced a more accurate predictive model for city-level mortality in 521 of the 739 cities, whose most recognizable feature is a positive correlation between the daily air temperature and relative humidity during the warm season. Moreover, significant differences are found in heat-related excess deaths and length of heat stress period when quantified using HHIs. CONCLUSIONS:Our analyses have identified many locations around the world vulnerable to humid heat stress for which HHIs are better predictors of heat-related deaths compared to commonly use Tair. We also found that the correlation between daily Tair and relative humidity during the warm season explains best the type of lethal heat stress experienced at the city level. Our findings provide important insights for climate change health impact studies and the development of early warning systems for urban heat stress.

Keywords: Climate, Mortality, Temperature, Temperature extremes, Exposure assessment

A nationwide analysis of college and university campus wastewater based epidemiology practices in response to coronavirus disease 2019

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BACKGROUND AND AIM: Wastewater-Based Epidemiology (WBE) can be used as a rapid, sensitive, and cost-efficient surveillance system for SARS-CoV-2 in cities, neighborhoods, campuses, and buildings. Throughout natural disasters, public health emergencies, and environmental hazards, colleges and universities have been tasked to continue operations adapting to the changes in social and environmental pressures. The recurring question is whether or not each campus was adequately prepared to address the COVID-19 pandemic. The project examined 176 United States (US) private and public colleges and universities' use of the WBE surveillance tool to monitor the COVID-19 pandemic. The data was gathered from the "COVIDPoops19 Summary of Global SARS-CoV-2 Wastewater Monitoring Efforts," a live GIS dashboard.

METHOD: We developed a WBE scorecard (score 1-5) to measure readiness, response, and adaptability for each academic institution. Nearly half of the institutions discontinued WBE surveillance due to lack of funding at one year of use in 2022, while others decided to stop after 75%+ of the student population became fully vaccinated.

RESULTS: The overall scorecard analysis found that public (71.6%) and private (25.6%) schools had similar frequency results across scoring points. For both public and private schools, 85.2% had an Institution-Wide Goal for WBE. The project further compared the scoring of WBE efforts for regions and states within the U.S. There were similar scores for all regions with the Northeast scoring (2.5) the lowest for effective WBE response. The t

OP-scoring states which scored 4 out of 5 included Delaware, Louisiana, North Dakota, Oklahoma, and Wisconsin.

CONCLUSIONS:WBE was successfully implemented in about 85% of colleges and universities as a surveillance technique and approximately 60% had defined follow-up actions. This public health measure is worth considering outside of declared emergencies as it can also serve as a prevention tool to monitor other pathogens of concern such as viral hepatitis and pox viruses.

Keywords: infectious disease, epidemiology, wastewater, surveillance, SARS-CoV-2

EC/OC-Analysis coupled to Photoionization Mass Spectrometry: A novel approach to the composition of particular matter for epidemiological studies

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BACKGROUND AND AIM: The Elemental-Carbon (EC) and Organic-Carbon (OC) content of ambient particulate matter (PM) are important parameters in air pollution-oriented environmental health studies (epidemiology). However, the OC-fractions characterization need to be improved for modern epidemiological studies. The novel instrumental approach Photo Ionization Mass Spectrometry (PIMS) enables the rapid characterization of highly health relevant organic compounds such as Polycyclic Aromatic Hydrocarbons (PAH). In this contribution a new approach for a parallel analysis of important chemical air-toxicants during standard EC/OC-analysis of PM-loaded filters by PIMS is presented. METHOD: For epidemiological studies, carbonaceous matter in PM often is described by their organic/elemental carbon content (OC/EC), as measured by Thermal-Optical Carbon Analysis (TOCA with e.g. IMPROVE-A protocol). A PIMS-system (Photonion GmbH, PhotoTOF) is hyphenated to a TOCA-system (Magee Inc., DRI Model 2015/2). The TOCA-PIMS combination largely extends the obtainable information and result in a fast and simple molecular analysis of the different thermal fractions. In particular, the profile of the important, highly health-relevant, carcinogenic Polycyclic Aromatic Hydrocarbons (PAH) is detected by Resonance-Enhanced MultiPhoton-Ionization (REMPI) mass spectrometry (Diab et al., AMT 2015; Miersch et al. STOTEN 2019). Furthermore, the health relevant PM-oxidation state of the OC-fractions is measured in parallel by Electron Ionization (EI). RESULTS: The new hyphenated TOCA-PIMS instrument is applied to many different PM sources (ship-, jet- and gasoline car- engines, biomass combustion) as well to ambient air samples. Furthermore model-aerosols and photochemically aged emissions are investigated. The improvement of the source apportionment-capability and the toxicant-detectability as well as the applicability foe epidemiology is discussed. The toxicity/carcinogenicity of the PM caused by the PAH content can be evaluated by the Toxicity Equivalent Factor-approach..

CONCLUSIONS: A novel TOCA-PIMS analyzer for rapid and sensitive description of health-relevant parameters in the carbonaceous fractions of PM has been developed. The system is now commercially available, enabling improved epidemiological- and exposure characterization-studies.

Keywords: Air pollution, Exposure assessment, Mixtures analysis, Environmental epidemiology, Cancer and cancer precursors

Mixture analysis of serum organochlorine pesticides concentrations and breast cancer in women from Northern Mexico

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BACKGROUND AND AIM: We aimed to evaluate the association between breast cancer (BC) and serum concentrations of organochlorine pesticide (OCP) mixtures, and to identify the main OCP contributors within the mixtures.

METHOD: We included 767 histopathologically confirmed incident BC cases and 908 controls from a population-based case-control study conducted from 2007 to 2011 in Northern Mexico. We obtained information about sociodemographic, lifestyle and reproductive characteristics by in-person interviews. Blood samples were collected from women at moment of recruitment to analyze 24 OCPs using gas chromatography/mass spectrometry. We used Weighted Quantile Sum (WQS) regression to assess the association of BC and the exposure to multiple lipid corrected serum concentrations of OCPs (ng/g total lipid), and the contribution of each compound within the mixture. Models were adjusted by age, body mass index, years exposed to endogenous estrogens, education and total serum lipids. RESULTS:We found a positive association between a OCP mixture and BC (OR: 2.14, 95%CI: 1.54 – 2.95), where the primary contribution came from hexachlorocyclohexane (42%), endosulfan (18%) and endosulfan sulfate (15%). On the other hand, we also identified a mixture negatively associated (OR: 0.12, 95%CI: 0.08 – 0.17), characterized by p,p'-DDE (38%), o,p'-DDE (13%), nonachlor (13%) and p,p'-DDD (13%).

CONCLUSIONS:To our knowledge, this is the first epidemiological report that evaluates the association between serum concentrations of OCP mixtures and BC, in which we identified two OCP mixtures contrastingly associated with this tumor. Further research is needed on the biological mechanisms of the OCPs within the mixtures and their BC relationship. This study was supported by CONACyT (2019 – 137732).

Keywords: pesticides, cancer, female, mixtures analysis

Seasonal Variations in Mortality Risk Associated with Ozone Concentrations in Tokyo, Japan

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BACKGROUND AND AIM:Ozone concentrations and their health impacts can vary throughout the year due to various factors such as meteorological conditions and human activities. The aim of this study was to investigate the seasonal variations in the risk of mortality associated with increases in ozone concentrations in Tokyo, Japan (2009–2015), where current WHO regulatory standards and guidelines are met.

METHOD: We performed time-series analyses using generalized linear models with a quasi-Poisson family. We assessed short-term ozone-mortality associations using distributed lag linear models to account for delayed effects of time-varying exposures and quantify net effects over a lag period. We controlled for time trends and utilized distributed lag non-linear models to impose more rigorous temperature control. We explored exposure-response curves and conducted stratified analyses by season, i.e., spring (March–May), summer (June–August), fall (September–November), and winter (December–February).

RESULTS:Ozone concentrations were highest in spring and lowest in winter. The study found that ozone was significantly and positively associated with increased mortality risk throughout all seasons above the threshold concentration point. Specifically, the mortality risks for ozone showed a clear pattern with positive associations during spring and summer, but no significant associations during fall and winter.

CONCLUSIONS: Based on the findings, ozone-related health effects can be prevented by maintaining standards substantially lower than the WHO guidelines. Furthermore, the study highlights the importance of considering the season when implementing effective public policies to further reduce adverse health effects.

Keywords: Ozone, Seasonality, Mortality, Time series, Health effects

Seasonal Differences in Indoor Exposure to PM2.5 and Household Characteristics in Patients with Idiopathic Pulmonary Fibrosis

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BACKGROUND AND AIM:Adverse health effects of PM2.5 could be greater in susceptible populations such as patients with chronic lung diseases, who stay long indoors for long periods of time. In addition, indoor PM2.5 concentrations are affected by household characteristics that may vary with the season. However, few studies have focused on indoor exposure in these patients, and even fewer have paid attention to seasonal differences. This study aims to compare the relationships between household characteristics and indoor PM2.5 concentrations across four seasons in patients with idiopathic pulmonary fibrosis (IPF).

METHOD: We monitored indoor PM2.5 level in the homes of 110 patients with IPF for 5days in each of the four seasons from September, 2021 to August, 2022. We measured PM2.5 concentrations using the MicroPEM (RTI, USA) and interviewed each patient to obtain household characteristics, including demographics, home environments, lifestyles, and perception to indoor air pollution. To investigate the relationships between each household characteristic and PM2.5 concentrations by season, we applied T-test and one-way ANOVA.

RESULTS:Although we did not find statistically significant differences in PM2.5 concentrations across most household characteristics, possibly because of small sample sizes, some characteristics showed differences in autumn and winter. In winter, PM2.5 concentrations were higher with multi-household housing (42.2 [multi] vs. 10.2 μ g/m3 [single]), floors lower than five (27.6 [<5] vs. 11.2 μ g/m3 [5≥]) and housing prices less than 7.6 million US dollars (56.7 [<7.6] vs. 12.9 μ g/m3 [7.6≥]), compared with those without. Among all seasons, patients tended to have a positive perception for both indoor and outdoor air pollution in autumn (60.6% [autumn] vs. 18.1% [summer] vs. 11.5% [winter] vs. 9.8% [spring]; however, average PM2.5 concentrations were higher in autumn (17.1 μ g/m3) than in spring (15.3 μ g/m3) and summer (11.2 μ g/m3).

CONCLUSIONS:Our findings on the first-year monitoring suggest seasonal differences in PM2.5 concentrations according to some household characteristics.

Keywords: Particulate matter, Exposure assessment-air pollution, Long-term exposure, Internal exposome, Socio-economic factors

Analysis of the mortality rate of pancreatic cancer under multiple exposures to air pollution and diet

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BACKGROUND AND AIM:Until now, the cause of pancreatic cancer is unknown. It is only known that smoking, chronic pancreatitis, obesity, long-term diabetes, family history of pancreatic cancer, and a diet of red meats and processed meats will increase the risk of pancreatic cancer. In terms of gender, it is the eighth and fifth leading cause of cancer death for men and women respectively. Therefore, we would like to explore the correlation between air pollution, diet, and pancreatic cancer. METHOD:A retrospective cohort study was used to analyze the mortality rate of pancreatic cancer under multiple exposures to air pollution and diet in each county in Taiwan from 2005 to 2018. RESULTS:For pancreatic cancer mortality analysis, the single pollutant model showed a significant adverse effect in females including O3 only; in males, including PM2.5 and O3. For the model of two pollutants, only O3 showed a significant effect on the mortality of pancreatic cancer for both genders. For consumption data, red meat and processed meat showed no significant effect. Furthermore, when considering multiple environmental exposures, it was found that the interaction terms of air pollutants (PM2.5 and O3) and food intake are related to increasing pancreatic cancer mortality rate in females, but not in males.

CONCLUSIONS: For pancreatic cancer mortality analyses, multiple exposures to air pollution and diet can be important to be considered individually and together in gender-specific way. Further study is suggested.

Keywords: pancreatic cancer, air pollution, diet

The impact of indoor microbiome on allergic diseases in preschool children

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BACKGROUND AND AIM: In recent years, the prevalence of allergic diseases has continued to rise globally, affecting many populations. Studies have indicated that indoor bacteria and fungi are associated with childhood allergic rhinitis and atopic dermatitis, but few studies simultaneously investigated the effects of indoor bacteria and fungi on allergic diseases in children. The aim of this study is to characterize the distributions of bacteria and fungi in children's homes and explore the correlation between indoor microbiome and allergic diseases in children.

METHOD: The study subjects were recruited from a pediatric clinic at a medical center in Taipei City and consisted of children under the age of seven. Environmental sampling was conducted in children's homes to measure indoor pollutants. Next-generation sequencing was used to analyze the bacterial and fungal microbiome in children's bed dust. Information on allergic diseases (i.e., allergic rhinitis and atopic dermatitis), demographic data, and home environmental characteristics were collected through questionnaires.

RESULTS: Forty percent of children have doctor-diagnosed allergic rhinitis, and 30% have doctordiagnosed atopic dermatitis. Over half of the children's bedrooms feel damp, and 70% of the households have visible mold. The predominant bacteria found in dust on children's beds was *Staphylococcus*, and the predominant fungi was *Malassezia*. According to the preliminary analysis, the levels of ozone and formaldehyde were associated with children's allergic diseases. The relationship between microbiome and allergic diseases will be further analyzed.

CONCLUSIONS: The damp bedrooms and mold inside homes could contribute to the development of respiratory and skin-related conditions. The presence of microbiome in children's bed dust is a potential source of allergens or irritants affecting children's health. Overall, the findings suggest a need to improve indoor environmental quality and hygiene to reduce the health risk of preschool children.

Keywords: Microbiome, Allergies

Causal association of particulate matter air pollution (pm10) on liver cancer: Using Multivariable Mendelian Randomization

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BACKGROUND AND AIM:Particulate matter air pollution (PM10) is known to increase the risk of various cancer including liver cancer. In addition, both body mass index (BMI) and serum gamma-glutamyl transferase (GGT) have been reported to be associated with liver cancer risk. However, but most of them are observational studies and no causal conclusions can be drawn. Multivariable Mendelian randomization (MVMR) was performed to investigate the causal relationship between PM10 on liver cancer.

METHOD:Two-sample MR analysis was performed using genetic markers of BMI and liver cancer identified in the Genome Wide Association Study (GWAS) at the GIANT Consortium and UKB, respectively. The genetic markers of serum GGT were sampled from the biobank of Japan and the genetic markers of PM10 were sampled from the UKB. The MR-Base platform was used for analysis. Finally, multivariable MR was performed to examine the mediating effect of PM10 on liver cancer. RESULTS:In the univariable two-sample MR analysis, three factors which were 1) PM10 (OR=0.9995, 95% CI=0.9972-1.0018), 2) GGT (OR=1.0002, 95% CI=0.9998-1.0005), and 3) BMI (OR=1.0001, 95% CI=0.9996 -1.0006) showed a non-significant association with liver cancer. Outliers were detected and removed through radial MR analysis, but the results of univariate two sample MR were similar to those before outlier removal. Finally, in the MVMR analysis that controlled for BMI and GGT, PM10 did not show a significant causal relationship with liver cancer.

CONCLUSIONS: This study suggests that pm10 does not have a significant causal relationship with the risk of liver cancer. In the future, it seems that there should be continuous research through various and precise data of individual exposure.

Keywords: particulate matter air pollution (PM10), body mass index, Mendelian randomization, liver cancer

FP-129[Air pollution » Other (to be specified with keywords in the keywords section)]

Cooking fuel during pregnancy, PM2.5 Exposures and birth outcomes of babies in Kalutara Children's Health Study

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BACKGROUND AND AIM: Exposure to indoor air pollution from biomass fuels is a major health burden in developing countries. Birth outcomes determine the health status in later life. Aim of the study is to compare birth outcomes among female residents in households using a mixture of cooking fuels during pregnancy.

METHOD:Pregnant mothers (n = 475) in the third trimester of the pregnancy were recruited and followed up. Birth weight, occipitofrontal circumference (OFC), and length of the newborn babies were ascertained from the Child Health Development Record. The study sample was categorized into two groups based on the cleanliness of cooking fuel (e.g., clean fuel - electricity, liquid petroleum gas vs. unclean fuel – wood, kerosene). The kitchen PM2.5 were monitored for 24 hours in a subsample of households, every six months over the two years since the birth of the child.

RESULTS:Primary cooking fuel in 167 (35.2%) households were clean fuel. Secondary cooking fuel was used by 380 (80.0%) households and tertiary cooking fuel was used by 161 (33.9%) households. There were 446 (95.1%) term babies and 23 (4.9%) pre-term babies. There were 17 (10.2%) Low Birth weight(<2500g) babies in clean energy-using households and 44 (14.3%) in unclean clean energy-using households as primary cooking fuel. Prematurity was less among mothers in households using a clean primary cooking fuel (3.6%) as compared to mothers in households using an unclean primary cooking fuel (4.9%). PM2.5 monitoring every six months and four times in a sample of households (n = 81) showed that the PM2.5 concentration is 2-3 times higher in the unclean primary fuel-using households.

CONCLUSIONS: Majority of the households use more than one cooking fuel (i.e., unclean or clean). Using a mixture of fuel types reduces exposures and improves birth outcomes, but relying on 100% clean energy would improve the birth outcomes further.

Keywords: biomass fuel, indoor air pollution, birth outcomes, low birth weight

Effect of Ambient Air Pollution on Years of Life Lost from Deaths due to External Causes in Seoul, South Korea

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BACKGROUND AND AIM: We aimed to investigate the association between short-term exposure to ambient air pollution and years of life lost (YLLs) from deaths due to external causes. METHOD: Data on daily YLLs for 2002-2021 were obtained from the Death Statistics Database of Korean National Statistical Office. This study estimated short-term exposure to particles <10µm (PM10), particles <2.5µm (PM2.5), sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), and ozone (O3). This time-series study was conducted using a generalized additive model (GAM) assuming a Gaussian distribution. We also evaluated delayed effects of ambient air pollution by constructing lag structures up to 7 days. To explore effect modification by demographic factors (sex and age) and intention/mechanism of injury (unintentional [traffic accident, fall, others] injury and intentional injury [self-harm, assault]), we conducted stratified subgroup analyses. RESULTS: During the study period, 78,175 deaths by external causes occurred, and the average daily YLLs by external causes was 315.2 years. In the intentional injuries, PM2.5 (2.76; 95% CI: 0.06-5.46; lag4), NO2 (7.25; 95% CI: 3.48-11.01; lag7), CO (3.38; 95% CI: 0.20-6.56; lag7), and O3 (5.74; 95% CI: 1.29-10.18; lag3) were associated with a significant increase of the YLLs. In the fall, PM10 (0.90; 95% CI: 0.15-1.65; lag04) and O3 (1.60; 95% CI: 0.32-2.89; lag0) were associated with a significant increase of YLLs from external causes. In the other unintentional injuries, PM10 (0.97; 95% CI: 0.11-1.82; lag01) and PM2.5 (1.07; 95% CI: 0.06-2.08; lag1) were associated with a significant increase of the YLLs. In the case of traffic accidents, all air pollutants showed negative association with the YLLs. CONCLUSIONS: Our results suggest that ambient air pollutants can cause death by external causes,

and these findings could contribute to the establishment of public health policies to manage accidental death and reduce ambient air pollutants concentration. (No. 2022R1C1010045)

Keywords: Air pollution, Particulate matter, Oxides of nitrogen, Ozone, Short-term exposure

short-term effects of air pollution on Acute Exacerbations of Chronic Obstructive Pulmonary Disease (AECOPD) in a population-based cohort

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BACKGROUND AND AIM:Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) describe the condition of sudden deterioration in airway function and respiratory symptoms in COPD patients, requiring a change in treatment. Short-term exposure to high levels of air pollution is one of major impacts on respiratory illness. The purpose of this study is to reduce health care costs and improve end-of-life care by managing short-term air pollution factors associated with AECOPD in patients with COPD.

METHOD: This study used data that linked national population data from the National Health Insurance Service-National Sample Cohort and Air Korea data managed by the Ministry of Environment. All subjects were adult patients who were first diagnosed with COPD between 2015 and 2019. To evaluate the short-term effects of exposure to air pollution (SO2, CO, NO2, PM10, PM2.5) on the AECOPD, a nested case-control study was conducted utilizing 2,114 patients and 4,228 control subjects who were matched at a 1:2 ratio by age group, sex, smoking type, and income. Data were analysed using generalized additive models (GAM).

RESULTS: We observed strong associations of CO, NO2, and PM10, PM2.5 with AECOPD on lag days 0, 1, 2, 3, and 4. The overall relative risk (95% CI) for AECOPD from exposure to four air pollutant were as follows: 1.012 (1.003–1.023) for CO, 1.015 (1.005–1.026) for NO2, 1.015 (1.006–1.026) for PM10, and 1.012 (1.003–1.023) for PM2.5. The similar results were obtained as in average lag (0–1, 0–2, 0–3, 0–4, 0-5 days). Additional analyzes of COPD-related disease exacerbation (pneumonia, dyspnea, etc.) were also showed some significant.

CONCLUSIONS:Our results showed that hospital visits for AECOPD were associated with the measured concentrations of ambient air pollutants NO2, CO, PM10, and PM2.5. Further studies are required to confirm these associations and find their mechanisms. The indoor air measurement for the management of COPD patients will be needed.

Keywords: air pollutant, Chronic Obstructive Pulmonary Disease, short-term effect, predictor

FP-132[Air pollution » Long-term exposure]

: Associations of long-term exposure to PM2.5 and risk of cognitive impairment or dementia in English Longitudinal Study of Ageing

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BACKGROUND AND AIM:Although many studies have found associations between exposure to fine particulate matter (PM2.5) and increased risk of cognitive impairment or dementia, most only considered air pollution at one point in time. In this study, we evaluate associations between long-term exposure to PM2.5 and cognitive functioning.

METHOD: We used data from the English Longitudinal Study of Ageing, a nationally representative sample of people aged 50 and older, living in England. The sample analysed consists of 6,331 participants successfully interviewed in 2018-2019 when cognitive functioning was evaluated and with individual-level exposure to annual mean concentration of PM2.5 between 2010 and 2016. PM2.5 was estimated by the Data Integration Model for Air Quality at 0.1°×0.1° spatial resolution at each respondent's residential address. Logistic regression models were used to estimate the association between average exposure to PM2.5 and having either mild cognitive impairment or dementia vs no impairment, adjusting for demographic and socioeconomic characteristics as well as area-level deprivation, urbanicity, and region.

RESULTS: In models adjusted only for age and sex, PM2.5 averaged between 2010 and 2016 was associated with an increased odds of cognitive impairment or dementia (OR: 1.30, 95%CI: 1.06, 1.59) per 5 μ g/m3. However, this association disappeared when adjusting for additional confounding variables (OR: 0.90, 95%CI 0.65, 1.24).

CONCLUSIONS: Further analyses using latent profile analysis to identify different trajectories of exposure to PM2.5 are expected to shed more light on the extent to which prolonged exposures to different levels of PM2.5 relate with cognitive functioning.

Keywords: Air pollution, Particulate matter, Neurodegenerative outcomes, Long-term exposure, Epidemiology

Air pollution and mental health in mid to older age: results from the MRC National Survey of Health and Development

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BACKGROUND AND AIM: Existing evidence on associations between exposure to air pollution and mental health symptoms in middle to older age is limited by short exposure periods or cross-sectional designs. We examined this association over a 25-year period in later adulthood.

METHOD: This prospective study utilised data from the MRC National Survey of Health and Development (NSHD: the British 1946 birth cohort) (N=2123, 49% Male). Land-use regression models estimated exposure to specific air pollutants using household addresses at age 43 (NO2, Black Smoke, SO2), at age 55 (PM10, NO2), and at age 60-64 years (PM2.5, PM10, NO2, NOx, PMabs, PMcoarse). Mental health was based on the self-reported 28-item General Health Questionnaire (GHQ28) at ages 53, 60-64 and 69, and presence of depression defined by anti-depressant medication use and self-

reported diagnosis at ages 53, 60-64 and 69 years.

Regression models examined the association between inter-quartile levels of air pollution exposure at ages 43, 55 and 60-64 with mental health at age 69 for each pollutant separately. Longitudinal multi-level models examined associations over 25 years for NO2 and 15 years for PM10. All models controlled for social class, area deprivation, smoking at closest timepoint to exposure, historical air pollution exposure, and history of mental health problems.

RESULTS:None of the air pollutants showed any association with depression or continuous GHQ28 score in prospective models. In fully adjusted longitudinal models, NO2 did not have any association with GHQ28 (β =0.008; 95% CI: -0.006-0.023) or depression (OR=0.96; 95% CI: 0.85-1.07) nor did PM10 (GHQ28: β =0.012; 95% CI: -0.004-0.027; depression: OR=1.05, 95% CI: 0.91-1.21). CONCLUSIONS:There was no evidence in this cohort of an association between exposure to air pollution in middle to older age and mental health outcomes. This may be due to bias in the sample from loss to follow-up or challenges in exposure modelling over time.

Keywords: Air pollution, Environmental epidemiology, Long-term exposure

Associations between residential distance to green or blue space and hospitalization for cardiovascular disease: a Danish Nurse Cohort study

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BACKGROUND AND AIM: Evidence on the associations between natural surroundings and cardiovascular disease (CVD) is inconsistent. Our longitudinal study aimed to explore the associations of residential distance to green or blue space with hospitalization for CVD using the Danish Nurse Cohort.

METHOD: We followed 19,070 female nurses residing in Denmark from 1993/1999 to 2018. We calculated the shortest Euclidian distance from each residential address to seven natural surrounding (zone) exposures (three green space [i.e., park, woodland, heathland] and four blue space [i.e., lake, river, coast, wetland] variables) at 2005 using GeoDanmark Vektor. We estimated associations of the log-transformed distance with the first hospitalization of total CVD as well as stroke using Cox proportional hazards models adjusted for potential covariates including individual-level lifestyle factors and socioeconomic status. Additionally, we explored potential effect modification by age, smoking status, occupational status, household income, and urbanicity level.

RESULTS:A total of 8,179 CVD incident cases over 344,084 person-years occurred. In our main model, a 2.72-fold increase in distance to woodland was associated with a higher risk of stroke incidence (HR: 1.153; 95% CI: 1.029-1.293); meanwhile, a 2.72-fold increase in distance to heathland was associated with a lower risk of incident CVD (HR: 0.975; 95% CI: 0.955-0.996). Individuals living in the 1st quartile of proximity to a lake (distance <253 meters) experienced the lowest risk of CVD incidence among all quartiles. We observed no associations between proximity to parks, woodland, rivers, coast, or wetlands and CVD incidence. Younger individuals showed greater benefits from proximity to natural zones.

CONCLUSIONS:Living closer to some types of green and blue space, studied for the first time by using geographical zoning and Euclidian distance, is suggested to protect against CVD hospitalization although the strength of association depends on specific types of natural zones and specific CVD outcomes, warranting more research on the mechanistic pathways.

Keywords: cardiovascular diseases, green space, incidence, long-term exposure

Relationships among exposure to phthalates and renal function in Taiwanese adults

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BACKGROUND AND AIM: Epidemiologic studies on the association between phthalate exposure and renal function in the general population have been heterogeneous. Therefore, the aim of this study was to investigate the associations between phthalate exposure and biomarkers of renal function in the adult population.

METHOD: This is a cross-sectional study. We analyzed data (n=919) from a community-based arm of Taiwan Biobank (TWB). Urinary phthalate metabolites including mono-ethylhexyl phthalate, mono-(2ethyl-5-oxo-hexyl) phthalate (MEOHP), mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono-(2ethyl-5-carboxypentyl) phthalate (MECPP), mono-(2-carboxymethylhexyl) phthalate (MCMHP), monobutyl phthalate, mono-iso-butyl phthalate (MiBP), mono-benzyl phthalate (MBzP), monoethyl phthalate (MEP), and monomethyl phthalate (MMP), as well as the sum of dibutyl phthalate (DBP) metabolite ($\Sigma DBPm$) and di(2-ethylhexyl) phthalate (DEHP) metabolite ($\Sigma DEHPm$) molar concentrations were calculated. Biomarkers of renal function including blood urea nitrogen (BUN), uric acid, and albumin/creatinine ratio (ACR) were assessed and estimated glomerular filtration rate (eGFR) was evaluated using the age-adjusted creatinine CKD-EPI equation (CKD-EPI40), Generalized linear models and logistic regression models were used to examine the associations between individual phthalate exposures and renal function biomarkers. We also used Bayesian Kernel Machine Regression (BKMR) to analyze the relationships between mixtures of phthalate exposure and renal function. RESULTS: We found that urinary DEHP metabolites were significantly positively associated with BUN and ACR. Urinary MEHHP, MECPP, MiBP and MEP levels were positively associated with uric acid levels. Urinary MBzP, MEP, DDBPm and DDEHPm were negatively associated with eGFR. In addition, DDEHPm levels were significantly associated with increasing odds of impaired renal function. In the BKMR regression model, the mixture of 10 phthalate metabolites was significantly associated with BUN, uric acid, eGFR, and impaired renal function.

CONCLUSIONS:Our results suggest that exposure to environmental phthalates may be associated with adverse kidney function in the Taiwanese adult population.

Keywords: environmental epidemiology, public health, mixtures analysis

Ambient PM2.5, inflammation, and prostaglandin synthesis: Evidence from a pregnancy cohort in Puerto Rico

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BACKGROUND AND AIM:Prostaglandin synthesis and production is an important part of normal physiology during pregnancy. $PGF2\alpha$ is a potent vasoconstrictor and regulates uterine activation protein expression, while Prostaglandin E2 (PGE2) is involved in promoting labor. Both are also downstream products of the arachidonic acid inflammatory pathway and are byproducts of the arachidonic acid cascade, resulting from cell membrane injury. While PM2.5 is known to impact health through systemic inflammation and has been associated with adverse pregnancy outcomes, how and to what extent it perturbs prostaglandin synthesis during pregnancy is unclear.

METHOD: We used linear models and generalized estimating equations to investigate associations between PM2.5 and maternal levels of PGE2, PGF2-alpha and arachidonic acid (AA) in a cohort of 1,117 pregnant women living in Puerto Rico. Participant-specific 30-day moving average PM2.5 exposures were estimated using inverse distance weighting from Air Quality System monitors. Biomeasures were analyzed in blood collected at study visits. Models were adjusted for gestational age at blood draw, parity, adverse pregnancy history, age, race, education, employment status, income, marital status, exercise, pre-pregnancy body mass index, and seasonality.

RESULTS:30-day moving average PM2.5 exposure was 9.1ug/m3. Mean PGF2-alpha levels were 3.1, 3.1, and 3.9ng/mg, respectively, while mean AA level was 13.8umol/L and mean PGE2 level was 3. nmol/L. A 10 ug/m3 increase in the 30-day moving average PM2.5 exposure was associated with an increase in AA of 33.8% (95% CI:4.9,70.6). The same exposure was associated with an increase in PGE2 of 53.6% (95% CI:14.7,105.6) and a decrease in PGF2-alpha of 14.7% (95% CI:-25.5,-2.3). Statistically significant dose response relationships were observed. Mediation of the effect of PGE2 or PGF2a was not identified through AA.

CONCLUSIONS:Our findings suggest that ambient PM2.5 is associated with elevated biomarkers of cell membrane injury and inflammation, as well as perturbed prostaglandin synthesis during pregnancy.

Keywords: PM2.5, pregnancy, prostaglandin, inflammation

FP-137[Outcomes » Infectious diseases]

Airborne influenza virus in daycare centers

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BACKGROUND AND AIM: This study investigated the concentration of airborne influenza virus in daycare centers and influence factors, such as common colds prevalence, air pollutants, meteorological factors.

METHOD:A total of 209 air samples were collected from daycare centers in Kaohsiung and influenza virus was analyzed using real-time quantitative polymerase chain reaction. Air pollutants and metrological factors were measured using real-time monitoring equipment.

RESULTS: Winter had the highest positive rates of airborne influenza virus and the highest prevalence of the common cold, followed by summer and autumn. The concentration of CO was significantly positively correlated with airborne influenza virus. Daycare center A with natural ventilation and air condition systems had the higher concentration of airborne influenza A virus, airborne fungi, and airborne bacteria, as well as prevalence of the common cold than those in daycare center B with a mechanical ventilation system and air purifiers, while the concentrations of CO2, CO, UFPs in daycare center A were lower than those in daycare center B.

CONCLUSIONS: We successfully detected airborne influenza virus in daycare centers, demonstrating that aerosol sampling for influenza can provide novel epidemiological insights and inform the management of influenza in daycare centers.

Keywords: daycare centers, infectious bioaerosols

Impact of air pollutants from night markets on nearby households

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BACKGROUND AND AIM:Night markets—a unique element of Asian culture—involve various cooking methods and combustion, producing air pollutants with adverse health effects. No study examined whether air pollutants from night markets affect indoor air quality and the lung functions of children living in nearby households. Accordingly, we measured air pollutant concentrations and children's lung functions in households located near a night market. We evaluated factors influencing indoor air quality and children's lung functions, including market opening hours and household distance from the market.

METHOD: We measured concentrations of particulate matter (PM)1, PM_{2.5}, PM10, carbon dioxide (CO₂), carbon monoxide (CO), nitrogen dioxide, sulfur dioxide (SO₂), ozone, total volatile organic compound (TVOC), airborne bacteria, and fungi in 58 households near the night market by using realtime monitoring equipment; we assessed the lung functions of children in these households. The PM1, PM_{2.5}, and PM10 concentrations were significantly higher during opening hours than during nonopening hours. The lung function values for children were significantly higher in households located >595 m (median distance) from the market than in those located \leq 595 m from the market (near group). Higher CO₂, CO, SO₂, TVOCs, and PM10 concentrations and poor lung functions in children were observed in the near group.

RESULTS: The predicted values of VC%, FVC%, FEV1%, and FEV₃% were significantly lower in the near group than in the far group. The concentrations of PM1, PM_{2.5}, and PM10 during opening hours were significantly higher than those during non-opening hours.

CONCLUSIONS: In conclusion, this study is the first to evaluate indoor air quality in households located near a night market and the lung functions of children living in such households. Furthermore, small particles (PM1) had the highest proportion during the opening hours in both the near and far groups, indicating the possible influence of combustion in night markets on air quality.

Keywords: night markets, particulate matter, opening hours, distance, households

FP-139[Air pollution » Long-term exposure]

The Association Between Long-term Exposure to Ambient PM2.5 and Incident Dementia: A Nationwide Longitudinal Cohort Study

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BACKGROUND AND AIM:Long-term exposure to ambient air pollution may not only lead to an increased risk of cardiopulmonary disease, but also associate with neurotoxicity. We aimed to investigate the associations between long-term exposure to PM2.5 and risk of incident dementia in Taiwan.

METHOD:A nationally representative cohort of Taiwanese participants who participated in the National Health Interview Surveys (NHIS) 2001, 2005, 2009, and 2013 was followed until 2020 to identify any onset of dementia. Exposure to PM2.5 was estimated using a widespread monitoring network of air quality monitoring stations and microsensors. The study used time-dependent Cox regression models to examine the associations between PM2.5 exposure and dementia, while adjusting for individual characteristics and ecological covariates.

RESULTS:This study enrolled 62,694 adults from 353 towns, with a median follow-up period of 10.5 years (IQR: 7.5-14.5) and 2,935 incident cases of dementia diagnosed was during that time. Each 10 μ g/m3 increase in 5-year average exposure to PM2.5 was associated with a 7.9% increased risk of incident dementia (95% CI: 2.8, 13.4). In the effect modification analysis, vulnerable subpopulations were identified, including those who were younger than 65 years, male, non-smokers, or without comorbidities; they have higher hazard ratios (HRs) for the risk of dementia (p value for effect modification <0.05). Significant geographic heterogeneity was also observed, with individuals living in northern and western areas having a higher hazard of dementia compared to those living in the eastern area (adjusted HRs ranged from 1.11 to 1.22 for northern and western areas vs. 1.03 for the eastern area).

CONCLUSIONS: This nationwide study revealed that long-term exposure to intermediate level of ambient PM2.5 was associated with a higher risk of dementia. Our findings suggest that ambient air pollution should be considered when attempting to reduce the burden of dementia in the aging population of Taiwan.

Keywords: air pollution, long-term exposure, dementia

Lung Adenocarcinoma Among Non-smokers is Linked to Visibility Degradation

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BACKGROUND AND AIM:Studies on association between lung cancer and long-term exposure to air pollution are limited due to the unavailability of air pollution data. The study aims to investigate association of visibility degradation with lung adenocarcinoma among non-smokers. METHOD:Our study area, southern Taiwan, with 3.5 million people in 5.7 thousand km², was transformed from an agricultural to an industrialized society from 1960s to 2020s. Our study data include annual lung cancer incidence data identified using ICD-O-3 codes from C34.0-C34.9 in Taiwan Cancer Registry (TCR) and visibility data from Taiwan Weather Bureau. Our study outcomes are incidence of lung adenocarcinoma among non-smokers between 1997 and 2020. Our exposure for lung adenocarcinoma cases was 30-year cumulative visibility before they are identified in TCR. We estimate exposure and outcomes by simple and multiple linear regression models at community level by adjusting age, gender, and EGFR mutation.

RESULTS:From 1997 to 2020, a total of 21,901 lung adenocarcinoma patients were registered in southern Taiwan. Lung adenocarcinoma incidence increased from 8.91 to 26.94 per 100,000 population from 1997 to 2020 in our study area. Their exposures of 30-years averaged visibility declined from 14.90 to 7.39 km in the same period. Non-smokers' lung adenocarcinoma incidence increased from 11.32 to 17.85 per 100,000 population from 2011 to 2020. Estimates of 3.39 per 100,000 population (95% CI: 2.71-4.07, adjusted R2: 0.94) increase in lung adenocarcinoma incidence among non-smokers are significantly associated with 1 km decrease in visibility during this period. Such associations exist by using cumulative days with visibility lower than 5 km over 30-years exposures. After controlling gender and EGFR mutation status, aggravation of visibility is significantly associated with increase of non-smokers' lung adenocarcinoma incidence.

CONCLUSIONS:Long-term visibility reduction is associated with increases in lung adenocarcinoma incidence among non-smokers. Female and EGFR-mutated individuals are susceptible population to air pollution-related lung adenocarcinoma.

Keywords: Cancer and cancer precursors, Incidence, Exposure assessment-air pollution

Physical activity modifies the association between long-term exposure to air pollution and depression in adults

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BACKGROUND AND AIM: Mounting evidence suggests the effect of long-term air pollution exposure on depression. However, it is unclear if physical activity modifies this effect. Therefore, this study aimed to examine whether the association between exposure to air pollution and depression differs by physical activity intensity in adults.

METHOD:This study included a total of 1,454 individual (556 men and 898 women) dwelling in for cities (Seoul, Incheon, Wonju and Pyeongchang) in the Republic of Korea. Depression was defined as the Korean version of the Geriatric Depression Scale score \geq 8. Long-term concentrations of particulate matter with diameter \leq 10 µm (PM10) and \leq 2.5 µm (PM2.5), and nitrogen dioxide (NO2) at each participant's residential address were estimated. Physical activity intensity was categorized as inactive, minimally active, and health enhancing physical activity (HEPA) based on metabolic equivalents (METs). Using a multivariable logistic regression model, we estimated the associations of PM10, PM2.5, and NO2 with depression after stratification by the METs group.

RESULTS:A 1-ppb increase in NO2 was associated with an increased risk of depression in the inactive group (odds ratio, 1.03; 95% confidence interval, 1.00-1.05), the minimally active group (1.09; 1.05-1.13), and the HEPA group (1.09; 1.03-1.15). The risk of depression associated with NO2 was significantly higher in the minimally active group than in the inactive group (p for interaction=0.006). Difference in the association between the inactive and HEPA groups was not statistically significant (p for interaction=0.06). In men, the risk of depression associated with NO2 was significantly higher in the minimally active group (p for interaction=0.047). In women, the risk of depression associated with NO2 did not significantly differ by the METs group.

CONCLUSIONS: We found that physical activity intensity modified the association between NO2 exposure and depression.

Keywords: Air pollution, depression, physical activity, metabolic equivalents (METs)
FP-142[Exposures » Food/nutrition]

Associations of serum vitamins with multiple blood pressure among adults in NHANES, 2017– 2018

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BACKGROUND AND AIM: In recent years, systemic arterial hypertension has been regarded as one of the most substantial risk factors for all causes of mobility and mortality worldwide. Previous research has found some correlations between single serum vitamins and blood pressure. However individual vitamins cannot account for the occurrence and progression of the disease, it is worthwhile to study vitamin co-exposure status and its overall effect on blood pressure.

METHOD:Therefore, we estimated the relationship between 13 vitamins and blood pressre status from 1107 U.S. adults based on the National Health and Nutrition Examination Survey (NHANES), 2017–2018. We used single exposure model, weighted quintile sum (WQS) regression, and g-computation to build linear models, finding the overall effect of the vitamin mixture and the relatively important components of the mixture. Furthermore, we also built nonlinear regression models using Bayesian kernel machine regression (BKMR) to estimate the functional correlation between multiple vitamins exposure and blood pressure.

RESULTS: Single expsore model showed that caroteine, crypotoxanthin, vitamin C and vitamin D had negative effect on blood pressure, while vitamin A and vitamin E have positive effect. For overall effect estimation, among three different models, the vitamin mixture showed significant reducing effect of sysyolic blood pressre by incresing percentile, while it had no significant effect on diastolic blood pressure. The WQS model also demonstrated that cis and trans beta caroteine and vitamin D played a significant role in the systolic blood pressure reduction impact. Furthermore, the dose-response relationship between multiple vitamins and blood pressure was confirmed by the BKMR model. Same results as the WQS models, a combined impact of the 13 vitamins was seen on blood pressure; the risk decreased with mixture levels from the 25th to the 75th percentiles.

CONCLUSIONS:Our findings demonstrated a non-linear relationship and non-additive effects between the 13 joined vitamins and the reduction in systolic blood pressure.

Keywords: Food and nutrition; Cardiovascular diseases

Segmentectomy versus Wedge Resection for stage IA Lung Adenocarcinoma – A Populationbased Study

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BACKGROUND AND AIM: Based on the existing studies, sublobar resection for early lung cancer was not inferior to lobectomy with respect to cancer-specific survival. However, the clinical benefits and risks of sublobar resection including segmentectomy and wedge resection have not been investigated comprehensively. The objective of this population-based study was to investigate whether wedge resection is comparable to segmentectomy in patients with stage IA lung adenocarcinoma. METHOD: The clinical stage IA lung adenocarcinoma patients were collected from Taiwan Cancer Registry database between 2011 to 2018. The primary endpoint was lung cancer-specific survival. Further subgroup survival analyses were conducted based on tumor size. Propensity score matching was used to balance the baseline differences between the two groups. Survival predictors other than the surgical procedure were also analyzed using regression model.

RESULTS:Totally, 6598 stage IA lung adenocarcinoma patients who underwent sublobar resection between 2011 and 2018 were enrolled in this study. Of these, 2061 received segmentectomy and 4537 received wedge resection. The mean age was 60.3 ± 11.7 , and 66.2% were female. Most (81.5%) were never smokers. After propensity matching, segmentectomy was associated with better lung cancer-specific survival then wedge resection especially for 2 cm or larger in tumor size. Except for the choice of segmentectomy, 75 year old or less, good differentiation, smaller tumor size and no nodal metastasis were also associated with better lung cancer-specific survival.

CONCLUSIONS:Segmentectomy was linked to better lung cancer-specific survival than wedge resection, particularly for tumors 2 cm or larger. Being 75 or younger, having good differentiation, smaller tumor size, and no nodal metastasis were also associated with better survival.

Keywords: Sublobar resection, Segmentectomy, Wedge resection, Populationa-based, Early lung adenocarcinoma

Cancer incidence in relation to residential proximity to coal-fired power plants in Korea

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BACKGROUND AND AIM: Cancer is one of the main causes of death worldwide, seriously threatening human health and life expectancy. This study aimed to investigate the relationship between cancer incidence and living near coal-fired power plants in Korea.

METHOD: We defined the exposed group as individuals who lived within 2 km of coal-fired power plants, while the control group consisted of those who had no residential history within 2 km of such plants. Standardized incidence ratios (SIR) were calculated using the frequency of cancer cases in National Health Insurance System data from 2007 to 2017. We created a retrospective cohort using NHIS data from 2007 to 2019, and estimated hazard ratios (HRs) and 95% confidence intervals (CIs) using the Cox proportional hazard model, adjusted for age and health insurance fee.

RESULTS: The ecological study found that the risk of all cancers and all cancers excluding thyroid cancer in exposed males was 1.11 and 1.15 times higher than in control males, respectively. For exposed females, the risk of all cancers and all cancers excluding thyroid cancer was 1.05 and 1.06 times higher than in control females, respectively. However, in the retrospective cohort, after adjusting for confounding factors, the risk of all cancers and all cancers excluding thyroid cancer among exposed males was only 1.05 and 1.04 times higher than in control males, respectively. Among females, the risk of all cancers and all cancers excluding thyroid cancer was not significantly higher in the exposed group compared to the control group.

CONCLUSIONS: The SIR of cancer was significantly higher in the exposed group than the control group, but this was not the case in a cohort study that adjusted for socio-economic status. Therefore, it is crucial to consider both residential proximity to power plants and socio-economic status when investigating cancer risk factors to ensure accurate conclusions.

Keywords: Cancer, SIR, HR, SES

Impact of pregnancy on severity of injury in women involved in motor vehicle crashes

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BACKGROUND AND AIM:Although some studies suggest that pregnant women are at higher risk of injury and may suffer from irreparable consequences, the impact of pregnancy on the severity of injuries following motor vehicle crashes (MVCs) remains unclear. This study aimed to investigate the potential impact of pregnancy on the severity of injuries from MVCs.

METHOD: We conducted a retrospective cohort study in Taiwan between 2006 and 2017 and identified 23,559 women victims who encountered MVC during pregnancy and 94,236 age- and calendar yearat MVC matched non-pregnant women victims also involved in MVCs. Injury severity was assessed using the Maximum Abbreviated Injury Scale (MAIS), as determined by the International Classification of Diseases Programs for Injury Categorization in R (ICDPIC-R) program, based on the diagnosis of medical claims within three days after MVCs. Multinomial logistic regression models were used to estimate the odds ratio and corresponding 95% CI of injury severity levels associated with pregnancy among MVC victims.

RESULTS:Compared to non-pregnant women victims, those who were pregnant had a significantly higher risk of both severe (aOR=1.79, 95% CI=1.54-2.08) and mild injuries (aOR=8.63, 95% CI=8.21-9.07) following MVCs. The increased risk of severe injury was particularly evident among pregnant women who were riding scooters (aOR=4.25, 95% CI=3.58-5.04). Additionally, pregnant women who experienced MVC but without any injury were more likely to visit a clinic than non-pregnant MVC victims.

CONCLUSIONS: Pregnant women victims, particularly those riding scooters, who are involved in MVCs have a higher risk of severe injury compared their non-pregnant counterparts. Our findings suggest that women should consider avoiding riding a scooter and must use restrictive devices during pregnancy, which would help reduce the severity of injuries sustained in the event of an MVC.

Keywords: Big data, Female, Epidemiology, Outcome, Risk assessment

Socioeconomic Disparity in Associations of Exposure to NO2 with Hypertension, Diabetes and Multimorbidity in the Floating Population

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BACKGROUND AND AIM:Previous studies on the associations between air pollution exposure and chronic disease multimorbidity are limited and there is a dearth of evidence on socioeconomic differences in the relationships among floating people. This study aims to examine the associations of exposure to ambient NO2 with diabetes, hypertension, and multimorbidity in the floating population in China.

METHOD:The study used the China Migrants Dynamic Survey data in 2017, including information on socio-demographic characteristics, temperature, humidity, air pollution and other related meteorological data. The multivariable logistic regression models were performed to examine the association between NO2 and chronic diseases in the floating population after adjusting for covariates. Stratified analyses were also performed to identify whether the association varied across subgroups. RESULTS:Overall, every 10 ug/m3 increase in annual average of NO2 exposure was associated with increased odds of hypertension (OR=1.043, 95%CI: 1.007-1.081) and multimorbidity (OR=1.204, 95%CI: 1.094-1.324) in the floating population in China. The results suggested that there was no significant association between NO2 and diabetes. The stratified analysis showed that there was a high health risk of NO2 in older adults, males, low education status and people living in the region with low economic development in China.

CONCLUSIONS: This study suggests that NO2 exposure was associated with an increased risk of hypertension and multimorbidity in the floating population, particularly among older people and residents in the less-developed provinces in China. Air pollution reduction strategies should be considered by local policymakers for improving the migrants' health status.

Keywords: Socioeconomic disparity, Floating population, Air pollution, Multimorbidity, NO2

Long-Term Exposure to Air Pollution and the Occurrence of Nonalcoholic Fatty Liver Disease in Taiwan

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BACKGROUND AND AIM: This study examined the association between long-term exposure to air pollutants and the occurrence of nonalcoholic fatty liver disease (NAFLD) by using a longitudinal cohort.

METHOD: The MJ Health Research Foundation is a medical institute that conducts regular physical examinations. The development of NAFLD was based on liver ultrasonography, and medical history was obtained from the questionnaire of an MJ cohort of 44,501 participants who were enrolled between 2007 and 2016, having 2 or more examinations, compared with cumulative exposure to air pollutants. The exposure levels to particulate matter with a ≤ 2.5 -µm diameter (PM2.5) and nitrogen dioxide (NO2) in the participants' residential areas at a 50 × 50 m grid resolution, were estimated using a hybrid Kriging/land-use regression (LUR) model executed using the XGBoost algorithm and a hybrid Kriging/LUR model, respectively. Cox regression with time-dependent covariates was conducted to estimate the effects of annual air pollutant exposure on NAFLD.

RESULTS:During the average follow-up period of 3.6 years, the incidence of NAFLD was 62.1 per 1,000 person-years. After mutual adjustment and adjustments for potential covariates (e.g., age, sex, diet, regular exercise), the result of two-pollutant model indicated that increased risk of NAFLD was associated with every 10 μ g/m3 increase in annual PM2.5 concentration (adjusted hazard ratio [aHR] = 1.07, 95% confidence interval [CI] = 1.02, 1.12) and every 10-ppb increase in annual NO2 concentration (aHR = 1.18, CI = 1.10, 1.25). PM2.5 and NO2 were further classified as low and high concentrations by median, and the combination of high PM2.5 (>29.8 μ g/m3) and high NO2 (>18.7 ppb) was associated with incident NAFLD (aHR = 1.45, CI = 1.34, 1.56).

CONCLUSIONS: Our findings suggest that exposure to PM2.5 and NO2 might be associated with the occurrence of NAFLD.

Keywords: Long-term exposure, Particulate matter, Oxides of nitrogen, fatty liver

Results of Improvement of Work Environment in Indium Handling Workplaces in Korea Confirmed by Biological Monitoring

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BACKGROUND AND AIM:Indium is a key material used in display manufacturing. After indium lung disease was reported in Japan in 2003, a study was conducted in Korea in 2012 to confirm lung disease of indium handling workers. A number of workers with interstitial lung disease were identified, and based on the research results, the concentration limit of serum indium was suggested as $1.2 \mu g/L$. Continuous improvement of the workplace has been carried out, and from 2021, indium handling workers must undergo medical checkups prescribed by the law. Through the comparison of serum indium concentration, we tried to compare the results of improvement in the working environment of indium handling workplaces.

METHOD:After institutionalization, workers' serum indium concentrations were compared with those at the time of the first survey in 2012. The serum indium concentrations of 3 target manufacturers, 3 display manufacturers, and 4 indium recyclers that participated in the 2012 survey were compared with those in 2022.

RESULTS: The average concentration of the entire comparative workplace in 2012 and 2022 was 4.8 μ g/L and 0.7 μ g/L, confirming that the serum indium concentration decreased after the improvement of the working environment. By industry, the indium recyclers showed the largest decline from 14.3 μ g/L to 4.1 μ g/L, and the target manufacturer decreased from 4.2 μ g/L to 2.1 μ g/L. Display manufacturer did not show any significant change. In some workplaces or in some workers who participated in the 2012 survey, the serum indium concentration was higher than in 2012. CONCLUSIONS:Since the 2012 survey, until 2021 when work environment evaluation and medical checkup were mandatory, each manufacturer has made a lot of efforts to improve the working environment and believes that the desired results have been achieved. However, some of the small companies still need improvement.

Keywords: Indium, Improvement of Work Environment

The Effect of Trauma and Age on Prisoner Disposition and Time Spent in the Emergency Department

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BACKGROUND AND AIM: In Singapore, epidemiological information about the health of inmates is limited. A description of inmates who present in the emergency department will serve as valuable epidemiological knowledge. This will elucidate their impact on the healthcare system and identify potential gaps and challenges in their treatment for further future studies.

METHOD: This study is a retrospective analysis of data from the Singapore Changi General Hospital emergency department between 1 January 2019 and 31 December 2019. All data extracted is deidentified. The duration spent in the emergency department and rate of admission are the two outcome variables that assessed for significant associations with characteristics of the inmate population at presentation, which include age, gender, vital signs (heart rate, systolic blood pressure, diastolic blood pressure, temperature, blood oxygen saturation), presence of blood-borne infections, involvement of trauma at presentation, and body system involved at presentation.

RESULTS: The factors found with significant associations to disposition are as follows: age, body system involved at presentation, presence of blood borne illnesses, vital signs, and the MEWS. There were significant associations to duration spent in the ED with: body system involved at presentation and the involvement of trauma at presentation. In subgroup analysis based on the presence of trauma for the associations between the body systems involved at presentation and disposition, the absence of trauma yielded more significant associations to disposition. In a similar subgroup analysis to duration, similar associations were seen.

CONCLUSIONS: As a preliminary retrospective cross sectional study, this study suggests that there are associations viable for further investigation. Namely, between the clinical outcomes of disposition and duration spent at ED and the presentation factors of presence of trauma and the body system involved.

Keywords: Epidemiology, Policy and practice

Associations of phthalate exposure with glucose and lipid metabolism in Taiwanese adults

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BACKGROUND AND AIM:Previous studies regarding relationships between phthalate exposure and metabolic effects, including glucose and lipid metabolism, were inconsistent. Therefore, we aimed to investigate the relationships between phthalate exposure and indicators of glucose and lipid metabolism in the Taiwanese adult population.

METHOD:Study participants were recruited from the community-based arm of the Taiwan Biobank (n= 934). Participants' daily intake (DI) and hazard index (HI) of phthalates were calculated based on their urinary concentrations of phthalate metabolites, and the reference limit value adopted by the US EPA for hepatotoxicity of phthalates. Indicators of glucose and lipid metabolism, including fasting glucose, triglyceride-glucose (TyG) index, total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol, were evaluated. Generalized linear models were used to examine the associations between DI, HI of phthalate exposure with metabolic indicators after adjustment for covariates.

RESULTS:There were three subjects whose HI_EPA exceeded 1, representing 0.4% of the total. We found that the TyG and TG levels in the fourth quarter (Q4) group of DI_DiBP were significantly higher than those in the first quarter (Q1) group ($\beta = 0.071$, 95% CI = 0.020, 0.121, p for trend = 0.016 for TyG; $\beta = 0.131$, 95% CI = 0.035, 0.226, p for trend = 0.007 for TG). The TC levels in the Q4 group of HI_EPA were significantly lower than those in the Q1 group ($\beta = -0.042$, 95% CI = -0.073, -0.010, p for trend = 0.004 for HI_EPA). Furthermore, the HDL-C levels in the Q4 group of HI_EPA were significantly lower than those in the Q1 group ($\beta = -0.046$, 95% CI = -0.090, -0.002, p for trend = 0.027 for HI_EPA).

CONCLUSIONS: Exposure to environmental phthalates may affect the homeostasis of glucose and lipid metabolism in the adult population.

Keywords: Environmental epidemiology, Risk assessment

Ambient air pollution and Years of Life Lost (YLL) in Taiwan - a seasonal spatial risk analysis

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BACKGROUND AND AIM: The level of air pollution in Taiwan varies greatly in different seasons. The reason is that the high temperature in summer in Taiwan makes the mixed layer height higher and the air convection is strong, which helps the air pollutants to diffuse. Moreover, the southwest monsoon brings rainfall, which achieves rain removal and effectively improves air quality; while the weather conditions in winter are opposite to those in summer, and the height of the mixed layer is lower, resulting in a smaller diffusion range and higher concentration of pollutants. Understanding changes in pollutant concentrations and how they affect health is an important issue of public health. METHOD: A retrospective study design used Taiwan National Health Insurance Research Database and the Taiwan Air Quality Monitoring Database from 2015 to 2020. The major outcome of interest was to compare years of life lost (YLL) by area (North, Central, South, and East Taiwan). This study presented five air pollution-related causes of death (all causes of death, malignant tumors, stroke, chronic lower respiratory diseases, and lung cancer) with trends by season. In addition to estimating the trends of PM2.5 exposure and YLL.

RESULTS: We found the all-cause death YLL was higher in the North area, followed by the South, Central and East area due to the distributions of population size and age. In addition, this study found YLL was higher in cooler seasons among different regions, which was consistent with the concentration distribution of PM2.5, showing the correlation.

CONCLUSIONS: This study provides evidence that YLL in Taiwan is significantly associated with exposure to ambient air pollutants and seasonal distribution. Policies may need to vary seasonally or regionally to have a positive impact on public health.

Keywords: PM2.5, Years of life lost (YLL), Taiwan National Health Insurance Research Database (NHIRD), Air pollution, Environmental exposure

Longitudinal assessment of oxidative stress markers and their relationship with exposure to PM2.5 and its bound metals in healthy participants

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BACKGROUND AND AIM: Biomonitoring of exposure to ambient PM2.5 and its bound metals is important in assessing the risk with better precision. We evaluated, longitudinally, a battery of oxidative stress markers and their relationship with the exposure of PM2.5 and PM2.5-bound metals in a panel of healthy participants.

METHOD:Residence- and personal-based ambient air PM2.5 and its bound metals, as well as of lung function parameters, were assessed in 58 individuals (male, 39.7%). Levels of urinary oxidative stress markers [Nɛ-(hexanoyl)-lysine (HEL; an early lipid peroxidation product), 4-hydroxynonenal (4-HNE), N7-methylguanine (N7-meG), and 8-hydroxy-2-deoxyguanosine (8-OHdG)], plasma antioxidants [superoxide dismutase (SOD) and glutathione peroxidase (GPx)], as well as urinary metals were measured by ELISA and ICP-MS, respectively, and three repeated measurements in two-month intervals were analyzed by Generalized Estimating Equation (GEE).

RESULTS:The study participants were never smokers (mean age, 24.3 years; mean BMI, 23.0 kg/m2). After adjusting for age, BMI, sampling site, time, and vitamin supplement, levels of residence- and personal-based ambient air PM2.5 (β HEL=0.22, β N7-meG=0.22; β HEL=0.29; β N7-meG=0.20) and its bound metals, especially V (β HEL=0.13; β N7-meG=0.12), Mn (β HEL=0.10; β N7-meG=0.07) and Pb (β HEL=0.17; β N7-meG=0.10), were positively associated with HEL and N7-meG, respectively, while the levels of urinary V (β HEL=0.12), Cr (β HEL=0.13), and Ni (β HEL=0.16) were positively correlated with HEL, but the levels of urinary Cr (β N7-meG=-0.05) was negatively associated with N7-meG. Although the lung function parameters in the study panel were within the normal range, negative association of interaction (pollutant*time) was noted for PM2.5-bound As (β FEV1=-4.99, β FVC=-9.04), V (β FEV1=-4.32, β FVC=-7.40), Co (β MMF=-3.31, β PEFR=-3.29), Ni (β FVC=-6.22, β PEFR=-6.46), Pb (β FEV1=-6.47, β FVC=-7.69). In addition, negative association of interaction was observed for N7-meG (β FEV1=-21.35, β FVC=-18.77; β PEFR=-23.86) and SOD (β FEV1=-26.56; β FVC=-26.18; β PEFR=-16.48).

CONCLUSIONS: These results suggested that HEL and N7-meG may serve as the potential biomarkers for the exposure to PM2.5 and its bound metals in healthy subjects.

Keywords: Air pollution, PM2.5, oxidative stress, HEL, N7-meG

An Exposure-Wide Association Study (ExWAS) on Erectile Dysfunction

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BACKGROUND AND AIM: Male sexual dysfunction, such as erectile dysfunction, is one of the important aspects of reproductive health among men. Exposure to chemicals, including endocrine-disrupting chemicals, was suggested to be an environmental determinant of the risk of erectile dysfunction; however, the number of chemicals targeted in previous studies was limited. This study aims to conduct the Exposure-Wide Association Study (ExWAS) on erectile dysfunction in a nationally representative U.S. data sample.

METHOD: We performed multiple cross-sectional analyses of male adult participants in the 2001–2004 National Health and Nutrition Examination Survey. The study participants were categorized into two groups based on the data collected by the questionnaire survey ("normal" and "erectile dysfunction"). We primally targeted environmental chemicals as exposures in the ExWAS analysis of erectile dysfunction. Logistic regression models adjusted for age, body mass index, and ethnicity were performed to examine associations between erectile dysfunction and each biomarker of chemical exposure, calculating false discovery rate for multiple testing.

RESULTS:Odds ratios significantly greater than one were observed in the associations between erectile dysfunction and some biomarkers of exposure to chemicals, e.g., perfluorobutane sulfonic acid (poly-fluoroalkyl chemicals), methamidophos (pesticides), etc. In contrast, we found several inverse associations between erectile dysfunction and biomarkers of exposure to chemicals, including various pesticides.

CONCLUSIONS: The current ExWAS systematically found associations between erectile dysfunction and exposure to various chemicals, including ones not previously studied. Further studies are needed to reveal the biological mechanisms of the associations discovered in this study, including investigating the impact of co-exposure to multiple chemicals on erectile dysfunction.

Keywords: Exposome, External exposome, Exposures, Environmental epidemiology

FP-154[Other » Other (to be specified with keywords in the keywords section)]

A descriptive study of employed older people in Japan

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BACKGROUND AND AIM: Japan is the highest aging society in the world, and older people involved in the active labor force to maintain the economy during the last decade. The aging workforce as a highrisk population, health-related characteristics should be described. The characteristics will be compared between retirees to working older people.

METHOD: We conducted a cross-sectional study targeting the whole community-dwelling older adults aged \geq 60 years in a town, Tochigi, Japan. Employment status was simply asked a yes/no question. The health-related characteristics and demographic information were corrected using a selfadministered questionnaire. Differences between retirees to working older people were examined using chi-squared tests.

RESULTS:Of 1,921 community-dwelling older people, 1,018 completed the questionnaire (53% female, 25% working, and 49% aged between 70 to 79). 23% of working participants were also experiencing caring for an older family member. Chi-squared tests revealed that people in the workforce were significantly associated with good subjective health (p = 0.004). The retirees were significantly associated with depressive mood (p < 0.01) and regular exercise (p < 0.01), whereas no significant differences were found for having medical conditions that required treatment (p = 0.44). CONCLUSIONS:The working population of the elderly is expected to increase in the future. While working is a way to stay connected to society and live an active life, public health must take care to ensure that the elderly can continue to work under the management of their health and illnesses. Indepth research concerning life satisfaction, occupations, and working type such as full-time/part-timers should explore the aging workforce.

Keywords: Occupational epidemiology, Socio-economic factors, Community outreach

Association between oil spill clean-up work and thyroid cancer: 11 years follow-up after the Hebei Spirit oil spill

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BACKGROUND AND AIM:On December 7, 2007, an unprecedented oil spill occurred in Taean, South Korea. Although crude oil contains chemicals that could biologically increase the risk of thyroid cancer, there are scant reports on the association of chronic oil spill exposure with the incidence of thyroid cancer. Therefore, we aimed to follow up on the long-term incidence of thyroid cancer due to the oil spill exposure among participants who engaged in the clean-up.

METHOD:A total of 1,798 participants who were a part of at least two surveys from the baseline survey were tracked every two years from 2008 to 2018. At baseline, participants responded about the number of days they participated in an oil purification operation and subsequently reported about their cancer diagnosis. We used time-varying interval-censored proportional hazard models to estimate the hazard ratios (HRs) and 95% confidence interval (CI) between the duration of oil clean-up work and thyroid cancer.

RESULTS:During the 11-year follow-up period, 135 new all-cause cancer and 30 new thyroid cancer patients were diagnosed. After adjusting all potential covariates, a positive association between the oil clean-up work duration and all cancer (hazard ratio (HR) and 95% confidence interval (CI) = 1.10 (1.02, 1.19)) and thyroid cancer (HR (95% CI) = 1.17 (1.00, 1.37)) were found.

CONCLUSIONS: The results of this study suggest that a longer duration of exposure to oil spill can increase the risk of thyroid cancer.

Keywords: clean-up working, cohort study, Hebei Spirit, oil spill, thyroid cancer

Lead exposure and increased blood pressure and hypertension: A systematic review and meta-analysis

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BACKGROUND AND AIM: Exposure to lead (Pb) in the environment can occur through multiple media. On average, blood Pb levels (BLL) have been declining over the past 50 years, but concerns remain given that evidence indicates potential adverse health effects among those with low BLL. This analysis aims to critically review the current epidemiologic literature and conduct a meta-analysis to provide a summary estimate of the relationship between BLL and blood pressure or hypertension incidence in children and adult populations.

METHOD: Following the Conduct of Systematic Reviews in Toxicology and Environmental health Research (COSTER) guidelines, relevant articles will be identified by searching multiple databases using citation mapping and keyword search strings. Following a pre-defined Population, Exposure, Comparator, Outcome, and Study design (PECOS) framework, title and abstract screening will be completed with the assistance of machine learning software to select relevant references. Full text screening will follow. Included articles will be further evaluated will be analyzed in a meta-analysis. RESULTS:The preliminary search identified 61 articles, including 30 studies on BLL and blood pressure, and 18 on BLL and hypertension incidence or prevalence among adults. Additionally, 13 studies were identified that evaluated the association between BLL or cord blood Pb and blood pressure changes or hypertension incidence among children.

CONCLUSIONS: Taken together the evidence suggests consistent positive relationships between increasing BLL and blood pressure. Evidence is less consistent when considering BLL and hypertension prevalence; however, there is evidence that BLL are associated with hypertension incidence. In contrast, there is very limited evidence of an effect of BLL or cord blood Pb and blood pressure or hypertension in children. The results of the meta-analysis will help to summarize the effect BLL has on changes to blood pressure and hypertension.

Keywords: Heavy metals, Other (Systematic review), Other (Lead)

COVID-19 Contact Tracing in Casablanca Region 2020-2022: Review of a Moroccan Experience and Lessons Learned

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BACKGROUND AND AIM:During the management of the COVID pandemic in Morocco, containing the spread of COVID-19 through case investigation and contact tracing has revealed itself early as an essential non pharmaceutical intervention to reduce mortality and morbidity during the pandemic. Our objective is to assess the completeness and timeliness of COVID-19 contact tracing from 2020 to 2022.

METHOD: This cross-sectional study examined routinely collected COVID-19 case investigation and contact tracing data from Regional Health Department surveillance database as defined at the national level. We focused on monitoring key process Indicators along the case investigation and contact tracing process.

RESULTS: The capacity to conduct contact tracing varied with time, majorly impacted by contact tracer's caseloads. Therefore, incomplete case investigation and poor follow up of contacts affected negatively the ability to break the chain of COVID-19 transmission.

The application Wiqaytna launched on May 11, 2020, as an optional tool has helped to widen contact identification circle, accelerate medical intervention, and optimize the testing.

CONCLUSIONS: We learned that the enhancement of contact tracers' capacity, ability and improving community engagement as well as the incorporation of digital technology is essential to minimize the risk of transmission.

Keywords: Infectious diseases, Public health, Policy and practice.

Hippo signaling pathway regulated branching morphogenesis of fetal lung under hypoxia

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BACKGROUND AND AIM: Hypoxia is one of the factors that cause many pathological conditions, and it also affects embryonic development, leading to increased neonatal mortality or causing many complications. Hippo pathway is crucial in lung morphogenesis, but how hypoxia impacts lung development through this pathway remains unknown. The aim is to explore hypoxia's effects on fetal lung branching via Hippo pathway.

METHOD: Fetal lungs from 11.5 embryonic days ICR pregnant mice were cultured ex vivo under normoxia or hypoxia (1% O2) for 3 days. Lung branching morphogenesis was assessed every 24 hours, and RNA-sequencing was performed on mouse fetal whole lungs. Normal human fetal lung fibroblast IMR-90 cells were also cultured under normoxia or hypoxia for 24 hours. We measured biochemical analysis, including Sulforhodamine B assay, lactate dehydrogenase assay, and Interleukin 6. Also, we used western blot to determine the expression of YAP, TAZ, SOX2, SOX9, FGF10, and FGFR2.

RESULTS:Under hypoxic conditions, ex vivo mouse fetal lung branching morphogenesis was inhibited, resulting in significantly lower terminal bronchiole numbers and lung area compared to the control group after 72 hours. RNA-sequencing analysis revealed a decrease in "in utero embryonic development" and "response to growth factor stimulus" in hypoxic fetal lungs compared to the control group. Additionally, LDH and IL-6 increased in the hypoxic fetal lungs and IMR-90 cells. Western blot analysis indicated that Hippo pathway was turned on after hypoxia exposure.

CONCLUSIONS:Hypoxia impairs fetal lung branching and increases inflammation and cell death in fetal lungs and IMR-90 cells. Hypoxia may also affect YAP/TAZ and downstream signaling molecules, delaying development and reducing regulation of cellular senescence. Pregnant women should be cautious of hypoxia exposure due to its potential to cause fetal lung impairment.

Keywords: hypoxia, lung morphogenesis, hippo signaling pathway, branching morphogenesis, alveolarization

The Benefit of NASA's Atmosphere Observing System (AOS) Mission Lidar and Polarimeter Observations for Health and Air Quality Applications

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BACKGROUND AND AIM: The Atmosphere Observing System (AOS) seeks to explore fundamental questions of how interconnections between aerosols, clouds and precipitation impact our weather and climate, addressing real-world challenges to benefit society. AOS will provide key information to enhance the communities' ability to improve weather and air quality forecasting today, seasonal to sub-seasonal changes in the near future, and societal challenges resulting from climate change in the decades to come. A fundamental component of the AOS mission is ensuring that health and air quality applications are considered to the greatest extent possible in mission design. As a result, the Applications Impact Team (AIT) was implemented to address this objective.

METHOD: We seek to maximize AOS benefit to impact decisions through early engagement in the mission development phase in order to prepare stakeholders to apply observations as soon as AOS mission data becomes available. The unique synergy between lidar and polarimeter instruments onboard the AOS constellation, as well as diurnally varying observations of aerosol profiles, will provide new opportunities to engage health and air quality stakeholders for forecasting, monitoring, and warning of hazardous events that impact human health. Engaging with existing missions helps identify and understand data needs, gaps and opportunities for current and future stakeholders, determine what aerosol data products are of highest value and use, and helps connect stakeholders with current mission data that can serve as AOS proxy data.

RESULTS:We provide an overview of AOS aerosol observations relevant for health and air quality applications, AIT activities and initiatives and how existing aerosol satellite missions and their applications activities can play a critical role in AOS applications development during mission design. CONCLUSIONS:The overarching goal of the AIT is to help improve the capacity for transitioning science to applications to make it possible to more quickly and effectively inform decisions that directly benefit society.

Keywords: Air pollution, particulate matter, community outreach

Associations of racial residential segregation and air pollution exposure with cardiovascular disease and cardiovascular disease-related mortality

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BACKGROUND AND AIM:Both air pollution exposure and racial residential segregation (RRS) increase cardiovascular disease (CVD) risk, with communities of color experiencing a disproportionate burden of air pollution exposure. However, scant research exists on the potential interaction between RRS and air pollution in shaping CVD risk.

METHOD: We analyzed data of Black and White participants of the Multi-Ethnic Study of Atherosclerosis (MESA), a prospective cohort study, from 2000-2017 (N=4,464). We predicted annual average exposure to ambient PM2.5 and NO2 at participant residence from 2000-2016 using national spatiotemporal models and used interpolated Decennial Census data to create annual single-race spatial isolation metrics of Census-tract-level RRS. We fit multilevel Cox proportional hazards models (adjusting for sex, age, income, employment, education, marital status, smoking, MESA site, and region) to estimate hazard ratios for stroke (136 events), myocardial infarction (MI, 179 events), and CVD-related mortality (115 events) associated with time-varying a.) RRS alone, b.) RRS and PM2.5 jointly, and c.) RRS and NO2 jointly. Joint exposures were assessed using interaction terms. RESULTS: For Black participants, 1 standard deviation increase in Black isolation was linked to 6% higher risk of CVD-related mortality while, for White participants, 1 standard deviation increase in White isolation was linked to 39% lower risk of CVD-related mortality (95% CI: 0.88-1.28; 95% CI: 0.45-0.83, respectively). We observed similar findings for stroke (Black isolation aHR: 1.24, 95% CI: 1.05-1.46; White isolation aHR: 0.89, 95% CI: 0.68-1.10). All RRS-MI results were null. Among White participants, for each 1-unit increase in PM2.5 exposure, White isolation was less strongly associated with CVD-related mortality (p-value<0.05). All other interaction results were null. CONCLUSIONS: Findings suggest that greater RRS is associated with greater CVD risk among Black populations yet lower CVD risk among White populations. However, PM2.5 exposure may attenuate

Keywords: Built environment, Air pollution, Environmental epidemiology, Environmental disparities

the association among White populations. Additional research is needed.

Impact of Pesticide Exposure on Affective Wellbeing: A Study on Agricultural Workers in Chile's Maule Region

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BACKGROUND AND AIM:Pesticide use is widespread in global agriculture to manage pests, with organophosphate pesticides (OP) dominating in Chile's Maule region. Concerns about the mental wellbeing of agricultural laborers exposed to these chemicals have prompted investigations into their potential impact on affective states and neurobehavioral patterns. This study aimed to evaluate the association between pesticide exposure and affectivity and depressive symptoms in workers from the Maule region.

METHOD:A quantitative, cross-sectional approach was adopted, involving an exposed group (E) and a non-exposed group (NE) to pesticides. Agricultural laborers were randomly sampled from an agricultural development database, while non-exposed individuals were selected from transportation, cleaning, and construction company databases. The study included 80 participants, with matching based on age, sex, and educational level. Survey instruments used were the Pesticide Exposure Questionnaire, a sociodemographic and health-related questionnaire, the Positive and Negative Affects Questionnaire (PANAS), and the Depression Scale of the Center for Epidemiological Studies (CES-D). Data collection occurred during the pesticide application period from August to December 2022. Data analysis involved exploratory analysis, U Mann Whitney tests, chi-square analysis, and multiple linear regression.

RESULTS: The study found that the exposed group exhibited a significantly lower positive affect score and fewer anxiety symptoms compared to the non-exposed group. However, no statistically significant differences in depression symptoms were observed. The multiple linear regression model demonstrated that the highest positive affect score was associated with non-exposure to pesticides and higher cigarette consumption, with adjustment for educational level.

CONCLUSIONS: The study concludes that there are no substantial depression disparities, highlighting the complex relationship between pesticide exposure and mental health. Continued investigation is essential to develop interventions that safeguard the mental well-being of agricultural workers exposed to pesticides, providing valuable insights to address their specific challenges and uphold their mental health protection.

Keywords: Pesticides, occupational exposure, mental health

Associations of Pesticide Exposure with Depression and Anxiety in Ecuadorian Adolescents, and Effect Modification by Social Determinants of Health

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BACKGROUND AND AIM:Pesticide exposure has been associated with elevated depression and anxiety in occupational populations but limited studies exist in adolescents. Socioeconomic status (SES) has attenuated adverse effects of certain environmental exposures; assessment in agricultural settings is needed. We tested pesticide-mental health associations in adolescents and explored effect modification by SES.

METHOD:We assessed 531 Ecuadorian 11-to-17-year-olds (50.3% female) for depression (CDI-2) and anxiety (MASC-2) symptoms. Specific urinary metabolites of organophosphates, pyrethroids, herbicides, neonicotinoids and DEET were measured; a summary score for each class was created. We used logistic regression to calculate odds ratios (OR) of elevated depression (T-score \geq 60) or anxiety (T-score \geq 65) symptoms in relation to exposures, and linear regression measured percent increase (β) of anxiety and depression scores per 50% increase of chemical concentrations. Interaction by parental education, income and housing quality was assessed. Models adjusted for demographic and anthropometric measures.

RESULTS:Increased odds of elevated depression symptoms were observed with pyrethroid summary score (OR per unit increase [95% CI]=1.50 [1.15, 1.95]), 3-phenoxybenzoic acid (3-PBA [pyrethroid]) (OR=1.21 [1.01, 1.44]), trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid (trans-DCCA [pyrethroid]) (OR=1.23 [1.01, 1.50]), and 3,5,6-Trichloro-2-pyridinol (TCPy

[organophosphate]) (OR=1.10 [1.03, 1.16]). Some significant interactions (p<0.05) with parental education and income were observed. Participants in the lower median of parental education had a positive association between 2,4-Dichlorophenoxyacetic acid (2,4-D [herbicide]) and depression score (β =0.31% [0.04%, 0.58%]), but no association was observed among those in the upper median. Stratifying by monthly income, there was no association between para-Nitrophenol (PAR [pyrethroid]) and anxiety in the lower median, but there was a negative association in the upper median (β =-0.65% [-1.16%, -0.14%]).

CONCLUSIONS: Pyrethroid and organophosphate metabolite concentrations were associated with elevated depression and anxiety scores. Education and monthly income were modest effect modifiers: Lower education strengthened the association between 2,4-D and depression, while higher monthly income was protective for the PAR-anxiety association.

Keywords: Pesticides, Mental Health Outcomes, Environmental Epidemiology

Ambient Air Pollution and Dementia Risks in Taiwan - A Spatial Risk Analysis

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BACKGROUND AND AIM: The proportion of Taiwan's rapidly aging population has increased from 7% in 1993 to 16.2%. It is projected to surpass 20% in 2026, which has escalated the prevalence and incidence of dementia. Meanwhile, urbanization and energy consumption have accelerated, leading to a worsening problem of air pollution. Air pollutants infiltrate the brain via the bloodstream and damage neurons and neural networks, affecting cognitive and memory functions. Therefore, this study conducts a spatial risk analysis examining the relationship between ambient air pollution and dementia risks.

METHOD: We conducted a retrospective cross-sectional study using nationwide National Health Insurance administrative claims in Taiwan and the Taiwan Air Quality Monitoring Database from 2009 to 2018. The primary outcome of interest was comparing the standardized prevalence rate (SPR) of dementia and air pollution trends in urban and rural areas for those older than 65. We calculated the total prevalence per 100 persons for each patient. The SPR was calculated by weighting the proportions of people in the corresponding age groups of the WHO standard population in 2000. RESULTS: We found that the SPR trend of dementia in people older than 65 years is higher in urban areas than in rural areas. The trend of ambient air pollution is higher in urban areas than in rural areas. Air pollution increases dementia risk. The risk of developing dementia in urban areas is higher than in rural areas after controlling ambient air pollution.

CONCLUSIONS:Our findings show that from 2009 to 2018, dementia SPR and ambient air pollution in the elderly population are higher in urban areas than rural areas. Reducing air pollution can prevent dementia, and policies may need to vary between urban and rural areas to impact public health positively.

Keywords: Air pollution, PM2.5, Dementia, Taiwan National Health Insurance Research Database

Polygenic risk score is associated with the risk of oral cancer among the male Taiwanese population

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BACKGROUND AND AIM:Many studies have focus on the risk of oral cancer with environmental factors or a few genetic polymorphisms. However, few studies have recruited more significant singlenucleotide polymorphisms (SNPs) to test the risk of oral cancer. Therefore, we selected 15 SNPs from previous genome-wide association study to establish a polygenic risk score (PRS) and to investigate the risk of oral cancer.

METHOD: We conducted a case-control study which included 500 male oral cancer patients from the Head and Neck Surgery Department at Chang Gung Memorial Hospital and 2,321 male healthy controls from Taiwan Biobank. Genotypes were determined by the technology platform developed by Affymetrix using the Axiom Genome-Wide Array Plate. Multivariate logistic regressions were used to analysis individual SNP and PRS associated with the risk of oral cancer by estimating odds ratio (OR) and 95% confidence intervals (CI). The SNPs significantly associated with oral cancer risk were selected to calculate the PRS.

RESULTS: Among the 15 SNPs, *CLPTM1L* (rs10462706) CC genotype (OR=1.39, 95% CI=1.03-1.86), *HLA-DQA1* (rs34518860) GG genotype (OR=1.60, 95% CI=1.07-2.39),

and ZSWIM4 (rs3745455) GG+GT genotype (OR=1.96, 95% CI=1.29-2.97) significantly increased the risk of oral cancer (all *P* values < 0.05). For PRS, subjects with 0.8527~1.0584 points (OR=1.64, 95% CI=1.08-2.49) and over 1.0584 points (OR=2.45, 95% CI=1.64-3.66) had significantly increased risk of oral cancer, compared to subjects with below 0.8527 point.

CONCLUSIONS:Our results suggest that individuals with higher PRS are predisposed to oral cancer. These high-risk groups are suitable for oral mucosal examinations for early diagnosis and treatment of oral cancer.

Keywords: Molecular epidemiology, Male

Legacy and Alternative Per- and Polyfluoroalkyl Substances in Paired Serum-Urine Data from the 2009-2012 Taiwan Birth Panel Study

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BACKGROUND AND AIM:Scientists have discovered possible relationships between levels of per- and polyfluoroalkyl substances (PFAS) in blood and harmful health effects in people. Because of the health concern of PFAS, manufacturers have replaced select chemistries ("legacy" PFAS) with PFAS with shorter biological half-lives (e.g., perfluorobutanoate [PFBA]). While most of the studies mentioned above use serum concentration of PFAS for assessment of PFAS exposure, information on urinary concentrations of PFAS is limited. It may be important topic since current studies show that short-chain PFAS mainly eliminate through kidney. We hope to evaluate the relationship between urine and serum concentration of PFOS and the possibility to us urine as a biomonitoring matrix for assessment of PFAS exposure.

METHOD: We use the urinary and serum concentrations of 17 legacy and alternative short-chain PFAS in 595 children in Taiwan Birth Panel Study (TBPS) II. Concentration below LOD was replaced by LOD/2 and urine concentration was adjust by urine creatinine. We use Pearson correlation test to evaluated the relationship between log serum and log urine PFAS concentration when the detection rate is above 70%.

RESULTS:In 2018, 595 urine-serum sample were collected.17 kinds of PFAS were elevated. Concentrations of PFBS in serum and urine were median correlated (r = 0.45) with p-value<0.05. Concentrations of PFOA in serum and urine were median correlated (r = 0.41) in male with p-value<0.05. Other PFAS did not show low positive or negative correlation between urine and serum concentration.

CONCLUSIONS: There is no strong linear correlation between PFAS urine and serum concentration. It may because there is other pathway to eliminate PFAS in human body. Serum may still be a more appropriate way to measure the exposure of PFAS. But urine concentration of PFAS is still important since it will give us more information to elimination half-life and the metabolic pathway.

Keywords: PFAS, Exposure assessment, Children's environmental health

Environmental health and safety climate and one's emotional status in non-healthcare workplace during pandemic: A cross-sectional study in Hong Kong

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BACKGROUND AND AIM:Occupational settings have involved potential risks to get infected during pandemic, even some could pose higher risks in transmissions between workers. While a number of employees could work from home, others cannot have the chance because of their occupational characteristics, for example, construction workers. Even though occupational settings cannot be changed easily, organisations could initiate effective implements to mitigate the infection rates in terms of environmental safety and health climates. Meanwhile, the enduring high infection rates of COVID-19 lead to restricted outdoor events and worries about one's own infection risks. This might impair their psychological health in the long run. Since working accounts for a large portion in one's lives, one may wonder whether a secure safety climate could alleviate mental burden during pandemic. This study, therefore, aims for examining the association between one's safety and health climate in workplace and psychological status during COVID-19.

METHOD: This is a cross-sectional study where workers were enrolled in various work settings. An online questionnaire was used to collect their current work industry, Safety climate index (SCI), vaccination of SARS-CoV-2, infection, and DASS-21 etc. Occupational SCI was measured from the shared perception of workers regarding the significance of environmental health and safety within an organization. Spearman rank correlation was used to compare correlations between different variables.

RESULTS:A total of 327 participants finished the survey. There were more female (58.5%) than male (41.5%). Around 90% of them completed their high school education. There is a weak negative association between SCI and mental concerns (r = -0.115). Additionally, SCI was negatively associated with stress concerns (r = -0.110). However, it isn't associated with depression and anxiety. CONCLUSIONS:This study showed that environmental health and safety climate in occupational settings is negatively associated with stress. But there is no correlation with depression and anxiety.

Keywords: occupational settings, safety climate, emotional (or psychological) status, COVID-19

The impacts of reduction in ambient fine particulate (PM2.5) air pollution on life expectancy in Taiwan

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BACKGROUND AND AIM: Fine particulate matter, particles less than 2.5 um in diameter (PM2.5), is an important environmental human health factor to consider. The long- and short-term influence of PM2.5 on health has been extensively studied in relation to many health outcomes, although few investigations examined the consequences of chronic ambient PM2.5 on life expectancy, which constitutes an important gauge of public human health status. Therefore, the aim of this study was to investigate the effects of reducing ambient PM2.5 levels in Taiwan on life expectancy there from 2000 to 2020.

METHOD:Officially reported island-wide annually average concentrations of ambient PM2.5, countylevel life expectancies, and demographic and socioeconomic and proxy variable were collected for the prevalence of smoking from various national public agencies and organizations, since variables these might potentially confound life expectancy results. The relationship between changes in ambient PM2.5 levels and life expectancy were determined using linear regression.

RESULTS:Data demonstrated that counties with greater reductions in ambient PM2.5 concentrations were associated with higher life expectancies. Adjusting for alterations in demographic and socioeconomic variables and proxy parameter, the prevalence of smoking data from a multiple regression model, it was found that a 0.3-year rise in life expectancy was noted for each 10 ug/m3 decrease in PM2.5 in those counties.

CONCLUSIONS: Our findings show that reducing ambient PM2.5 levels play an important role for prolongation of life expectancy in Taiwan.

Keywords: PM2.5, air pollution, life expectancy

Exposure to Persistent Organic Pollutants and Diabetes Mellitus of Residents Living Near a Nonferrous Metal Smelter Area

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BACKGROUND AND AIM:Nonferrous metal smelters are known to emit unintentionally persistent organic pollutants (POPs). This study investigated POPs exposure levels and experience of diagnosis of several chronic diseases such as diabetes mellitus, hypertension, myocardial infarction, and hyperlipidemia of residents in a region where a nonferrous metal smelter has been operating for a long time.

METHOD:A total of 121 serum samples were collected from residents living near a nonferrous metal smelter in Korea, and 25 congeners of POPs were analyzed using high-resolution gas-chromatography mass spectrometry. We used lipid-adjusted POPs concentrations. Also, the residents were self-reported whether they have been diagnosed or taking medications with diabetes mellitus and others. Lastly, logistic regression was done to investigate the associations between POPs exposure and diabetes mellitus.

RESULTS: Among the congeners, geometric mean and arithmetic mean of beta-Hexachlorocyclohexane (beta-HCH) were 10.196, 16.877 ng/g lipid. Those were higher than the geometric mean of reference value of US population [National Health and Nutrition Examination Survey, 7.89 ng/g lipid (N=1,370)) and arithmetic mean of a previous study in Korean adults [8.8 ng/g lipid (N=185)], respectively. The odds ratio of beta-HCH for diabetes mellitus was 1.022 (95% confidence interval: 1.000-1.045). Besides, polychlorinated biphenyls (PCB) 74, PCB 118, and PCB 167 showed significant increases of odds ratio (OR 1.795 for PCB 74; OR 1.247 for PCB 118; OR 3.358 for PCB 167) as well, although their means were not higher than reference values.

CONCLUSIONS: This study suggests that POPs exposures may increase the risk of diabetes mellitus in residents living near nonferrous metal smelters.

FUNDING: The Korea Environment Industry and Technology Institute through the Core Technology Development Project for Environmental Disease Prevention and Management, funded by the Korea Ministry of Environment (grant number 2021003320003).

Keywords: Exposure assessment, Obesity and metabolic disorders

Association Between Iron Concentrarion in PM10 and Alzheimer's disease in Lima, Peru: An Ecological Study

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BACKGROUND AND AIM:Alzheimer's Disease (AD) is characterized by impairment of memory, thinking skills, and inability to perform simple tasks. Air pollution has been found to be associated with AD. Higher iron deposits in the brain have been found in AD patients. PM10 is composed of different chemical compounds, including iron-related ones. It is possible that iron exposure through inhalation of PM10 might contribute to the development or symptoms. Thus, the aim of the study is to evaluate the association between iron concentration in PM10 and proportion of AD in Lima, Peru. METHOD:Ecological study. Monthly average of iron concentration in PM10 of six different districts of Lima was obtained from DIGESA, while monthly cases of AD in these districts were obtained from the Peruvian Ministry of Health. Only data from 2017 – 2019 and 2022 were available. Proportion of cases x 100,000 inhabitants was calculated using the general population, or the population aged 60 years or

higher. Iron concentration was log-transformed. Generalized Linear Model (GLM) of gaussian and negative binomial family were constructed. Since in Lima downtown is located the country main Neurology Institute, we did a sensitivity analysis without this district data.

RESULTS: Mean iron concentration was $1.16 \pm 0.66 \ \mu g/m3$, with Comas and San Juan de Miraflores showing the highest levels. Lima downtown had the highest proportion of AD with 11.90 based in the general population and 68.90 based in the 60-over population. In the complete model, no significant association was found in the gaussian and negative binomial GLM. In the sensitivity analysis it was found that iron concentration increased the proportion in the 60-over (β =7.41 95%CI 1.80 - 13.03, p=0.010), with an IRR of 1.69 (95%CI 1.03 - 2.79, p=0.038).

CONCLUSIONS: Iron concentration was associated with a higher proportion of AD cases in Lima but might be influenced by a potential sub-diagnosis.

Keywords: Particulate matter, Particle components, Neurodegenerative outcomes

Urinary triclosan and prevalence of metabolic syndrome among adults in Southern China

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BACKGROUND AND AIM:Triclosan (TCS) is widely applied in personal care products (PCPs) as an antimicrobial preservative. Due to its toxicity and potential risk to human health, TCS has attracted mounting concerns in recent years. However, the health effect TCS on metabolic disease remains limited in China.

METHOD: This is a cross-sectional with 1,159 adults recruited in 2013 from Southern China. Modified Adult Treatment Panel III criteria were used to identify the cases of MetS. Urinary triclosan concentration was assessed using high-performance liquid chromatography-tandem mass spectrometry, and it was categorized into three subgroups by tertiles (low, middle, and high) to obtain the adjusted odds ratios (OR) and 95% CI using logistic regression model.

RESULTS:TCS was detected from 99.6% of urine samples, indicating ubique exposure in the study population. Urinary concentrations of TCS ranged from below the limit of detection (LOD) to 270 μ g/L, with a median value of 3.66 μ g/L. The prevalence of metabolic syndrome was 2.1%, 5.2%, and 2.6% for low, middle, and high groups of urinary triclosan, respectively. The adjusted OR increased by the increase of urinary concentration (OR 1.32, 95%CI 0.50-3.51 for middle group; and OR 2.14, 95%CI 0.96-4.75), although there was no statistic significance.

CONCLUSIONS: Urinary triclosan might associate with the occurrence of metabolic syndrome which need further investigation.

Keywords: Phenols, Obesity and metabolic disorders

FP-171[Air pollution » General]

Estimating years of life lost from suicide mortality due to air pollution in Seoul, South Korea

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BACKGROUND AND AIM:According to the World Health Organization (WHO), suicide is a leading cause of death among people aged 15–29 years worldwide. Recently, limited studies have found a significant role of air pollution in suicide. It is necessary to estimate the burden of air pollution-induced premature mortality from suicide using an analytical measure of disease burden, such as the years of life lost (YLLs). The YLLs from suicide attributable to air pollution has not been examined to date. METHOD:This study examined the YLLs from suicide mortality due to air pollution in Seoul, South Korea, during 2002-2021. We applied a generalized additive model (GAM) assuming a Gaussian distribution to estimate the effects of particles <10 μ m (PM10), particles <2.5 μ m (PM2.5), sulfur dioxide (SO2), nitrogen dioxide (NO2), ozone (O3), and carbon monoxide (CO) on the YLLs from suicide. We also considered a maximum lag of 7 days to study single and cumulative effects of air pollution on the YLLs.

RESULTS:During the study period, 43,642 completed suicide cases occurred, and the average daily YLLs from suicide was 194 years. Among six pollutants, NO2 had an immediate effect on significant increase of YLLs from suicide (6.6 years [95% CI, 2.5-10.6 years, lag 0]) and O3 had cumulative effect on significant increase of YLLs from suicide (8.9 years [95% CI, 1.5-16.4 years, lag 0-4). Two pollutants analyses showed similar finding with single pollutants analyses.

CONCLUSIONS:Our study showed significant associations of exposure to O3 and NO2 with the YLLs from suicide. These findings suggest that O3 and NO2 could be an important environmental risk affecting premature mortality from suicide. Our findings contribute to the basis for suicide prevention strategies associated with air pollution. (No.2022R1C1010045)

Keywords: Air pollution, Ozone, Oxides of nitrogen

Prevalence and risk factors of post-acute sequelae of COVID-19 (PASC) among adults in South Korea

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BACKGROUND AND AIM: Many people continue to experience symptoms even after the acute phase of COVID-19, and the World Health Organization defines cases where symptoms persist beyond three months after the onset of COVID-19 as Post COVID-19 condition. The previous studies conducted in South Korea so far have been limited by the lack of representativeness of the sample. We aimed to identify the prevalence and risk factors of post-acute sequelae of COVID-19 (PASC), the pre-stage of Post COVID-19 condition, using a representative sample.

METHOD: This study was conducted an online survey at 4 weeks after the diagnosis of COVID-19, using systematic sampling of 1,648 out of 4,779 total confirmed cases of COVID-19 aged 19-64 reported in a public health center over a period of 5 weeks. Of the 1,398 participants who agreed to participate, 1,047 completed the survey. The survey consisted of questions on persistence of COVID-19 symptoms, vaccination status, underlying conditions, and other related factors. PASC was defined by the National Institutes of Health as the persistence of one or more symptoms for 4-12 weeks after diagnosis of COVID-19.

RESULTS:The prevalence at 4 weeks among males was 40.9% (178/435), while among females it was 62.3% (381/612). By age group, the prevalence was 46.2% (103/223) for aged 19-29, 60.1% (131/218) for aged 30-39, 58.3% (148/254) for aged 40-49, and 50.3% (177/352) for aged 50-64. The prevalence by vaccination status was 49.1% (28/57) for unvaccinated individuals, 46.2% (6/13) and 56.0% (139/248) for those who received one and two doses, 53.3% (342/642) for those who received three doses, and 50.6% (44/87) for those who received four or more doses. CONCLUSIONS:We identified the prevalence of PASC at 4 weeks after COVID-19 diagnosis, and plan to conduct a follow-up survey at 12 and 24 weeks in the future.

Keywords: Epidemiology, Community-engaged research
Urine concentration of endocrine disrupting chemicals and premature puberty: findings from the 4th Korean National Environmental Health Survey

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BACKGROUND AND AIM: Several studies explored the association between exposure to EDCs and timing of puberty which are mostly about menarche. Using a data of population-based sample of young girls, we analyzed the association of urine level of EDCs with premature thelarche (breast budding before age of 9) and early menarche (menarche before age of 11).

METHOD: We utilized data from the 4th Korean National Environmental Health Survey (KoNEHS) conducted from 2018 to 2020. To identify girls at risk of premature thelarche and early menarche, and estimate recent EDC exposures, our analysis restricted to those aged 10-11 years. To estimate exposure to EDCs, we utilized the urinary concentrations of 23 EDCs including phthalate metabolites (mono(n-butyl) phthalate [MnBP], mono (2-ethyl-5-hydroxyhexyl), phthalate [MEHHP], and mono (2-ethyl-5-oxohexyl) phthalate [MEOHP]), and environmental phenols (bisphenol A [BPA] and triclosan [TCS]). Urinary EDC levels were log-transformed and compared between normal and premature/early puberty groups. Least square means of EDCs were calculated from multivariable regression models including covariates.

RESULTS:Of 134 girls aged 10-11 years, premature thelarche occurred in 10.5% and early menarche was observed in 14.2%. When log-transformed urinary concentration of 23 EDCs were compared according to premature thelarche, there was no significant difference between normal and premature thelarche groups. For early menarche, levels of TCS (mean log[TCA] = -1.29, 95% confidence interval [CI]: -0.94, -0.6 for normal vs -1.81, 95% CI: -1.46, -1.1 for early menarche) and BPA (-0.01, 95% CI: 0.43, 0.87 vs -1.08, 95% CI: -0.44, 0.20) of normal group were higher than those of girls with early menarche which did not reach statistical significance. Comparing least square means of 23 EDCs yielded similar results.

CONCLUSIONS: We observed no difference in the exposure to common EDCs between girls with premature or early puberty and their counterparts. Our finding would need to be confirmed with other studies with different settings.

Keywords: Menarche, Thelarche, Endocrine Disruptors, Girls

Application of National Food Consumption Database: Risk Assessment of Cadmium in curstaceans food between 2005 to 2016

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BACKGROUND AND AIM:Risk Assessment of Cadmium in crustaceans food is an important issue. According to the data from The International Agency for Research on Cancer (IARC), cadmium compounds are carcinogenic to humans (Group 1). Our study aims to focus on the systemic risk assessment and exposure assessment of cadmium related to curstaceans consumption in Taiwan METHOD:Intakes of the Nutrition and Health Survey in Taiwan (NAHSIT) from 2005-2012 and 2013-2016 were included and data were combined according to the food description and classification system of the National Food Consumption Database (NFCD). The participants of our study were included all age of national representative survey. Hazard Quotient (HQ) was calculated for risk and If HQ was lower than 1, it means within acceptable range from dietary exposure. We also calculated the systemic risk by life-time average daily dose (LADD).

RESULTS:Intakes in consumer only participant showed that 19-65 years old male had the highest intakes (Mean \pm SD grams: 49.21 \pm 61.22 grams) and with max consumption of curstaceans (488.59 grams, 43.14) in 2005-2012. In 2013-2016, 19-65 years old male also had the highest intakes (Mean \pm SD grams: 621.63 \pm 36.14 grams), but 16-18 years old male with max consumption of curstaceans (43.14 grams). The HQ of all age groups were in the acceptable range. The LADD of >65 year old male who had max dose of curstaceans (2005-2012:0.000614 mg/kg-day; 2013-2016:0.001578 mg/kg-day) was in the acceptable range.

CONCLUSIONS: Food description and classification system of NFCD could provide useful intakes to analyze the systemic risk assessment of cadmium in curstaceans. The HQ was within the acceptable exposure range in 2005-2013.

Keywords: Consumption database, Food risk assessment, Cadmium

Application of National Food Consumption Database: Risk Assessment of Cadmium in crustacean food in 2005-2016

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RESULTS:Intake in consumers only participants showed that 19-65 years old men had the highest intake (mean \pm SD: 49.21 \pm 61.22 grams) and with maximum consumption of curstacean food (488.59 grams) in 2005-2012. In 2013-2016, 19-65 years old males also had the highest intake (mean \pm SD: 621.63 \pm 36.14 grams), but 16-18 years old males with max consumption of curstacean food (43.14 grams). The HQ of all age groups were in the acceptable range. The LADD of >65 years old male who had max dose of curstacean food (2005-2012:0.000614 mg/kg-day; 2013-2016:0.001578 mg/kg-day) was in the acceptable range.

CONCLUSIONS: The food description and classification system of the NFCD could provide useful intakes to analyze the systemic risk assessment of cadmium in crustacean food. The HQ was within the acceptable exposure range in 2005-2016.

Keywords: Consumption database, Food risk assessment, Cadmium

Differentiating Benign Pulmonary Lesions from Suspected Lung Cancer in Never Smokers: Based on a Comprehensive Questionnaire

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BACKGROUND AND AIM: With the widely use of lung cancer screening, there is a growing concern that benign lung lesions are frequently misidentified as lung cancer. Distinguishing between benign and malignant lung lesions with precision is still a crucial challenge. This study aimed to characterize pulmonary lesions that were initially suspected to be lung cancer, but were later confirmed as benign following surgical resection.

METHOD: Between November 2021 and October 2022, a total of 391 never-smoker patients presenting with focal pulmonary lesions, and who had been suspected by surgeons with lung cancer, were included in this study. Prior to undergoing the operation, patients were required to complete a comprehensive questionnaire. The diagnoses of the patients were subsequently confirmed by expert pathologists after resection. Multivariable logistic regression models were employed to differentiate patients with benign lung diseases from lung cancer patients.

RESULTS:Out of the 391 cases reviewed, 309 were confirmed with malignant pathology, while 82 were benign. After adjusted by age and gender, the odds ratios (OR) for five risk factors in favored of misidentifying benign lesions as lung cancer were statistically significant, including comorbidity of diabetes mellitus (OR 2.92, p = 0.018), higher household income (OR 2.06, p = 0.022), living in a newer house (OR 1.98, p = 0.021), living in a house never painted (OR 2.33, p = 0.011) and self-reported unusual odor near home (OR 2.12, p = 0.008).

CONCLUSIONS: Diabetes mellitus, household income and home environment were factors influencing on the diagnosis of lung cancer. A questionnaire before operation could help distinguishing patients with high risk on misidentification.

Keywords: Environmental epidemiology, Modeling

FP-177[Climate » Natural disasters]

Impact of Extreme Heat Event and Wildfire-Related PM2.5 Exposure on the Risk of Hospitalization and Mortality among Hemodialysis Patients

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BACKGROUND AND AIM:Ongoing climate change is leading to increases in frequency and severity of wildfires and extreme heat events. Such exposures may disproportionately impact hemodialysis patients, increasing their risk of hospitalization and mortality. We investigated the effect of wildfire-related PM2.5 on hospitalization and mortality risk among hemodialysis patients and examined how this association is modified by extreme heat events.

METHOD: We estimated wildfire-related PM2.5 for each of the Fresenius Kidney Care clinics in California, Oregon, and Washington during 2005-2009 period using satellite-derived smoke polygons and ground-based EPA monitors. Likewise, we identified extreme heat events for each clinic location during the same time period using 95th percentile maximum temperature thresholds determined using the Global Historical Climatology Network database. Currently we are in the process of linking individual dialysis patient records with the wildfire-related PM2.5 and extreme heat event metric. We will conduct a time-stratified case-crossover analysis with a conditional Poisson model to investigate the effect of exposure to wildfire-related PM2.5 on hospitalization and mortality risk. We will additionally assess how this association was modified by extreme heat events.

RESULTS:This study included a total of 131 hemodialysis clinics. The daily PM2.5 concentration during the study period ranged from 0 to 485.8 μ g/m³ with the average of 10.8 μ g/m³ (SD=8.9 μ g/m³). The average PM2.5 concentration during wildfire events (16.8 μ g/m³) was higher than those days without wildfire smoke (10.6 μ g/m³). We will present results depicting association between wildfire related PM2.5 exposure and risk of hospitalization and mortality. We will further show how this risk is further exacerbated by extreme heat events.

CONCLUSIONS: Our findings highlight the need for enhanced readiness for wildfires and extreme heat

events targeting vulnerable populations, such as hemodialysis patients, within the context of ongoing climate change.

Keywords: Temperature extremes and variability, Natural disasters, Mortality

FP-178[Neurologic and mental health outcomes » Mental health outcomes]

Prenatal maternal mobile phone use and depressive and anxiety symptoms in 10-year-old children

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BACKGROUND AND AIM: In recent years, with the rapid technological development of wireless communication, it has been important to study possible negative health effects of mobile phone exposure. One of the concerns is a possible relation between prenatal mobile phone exposures and various mental health problems in their children.

METHOD: A prospective cohort data from Mother and Children's Environmental Health Study was used, which had examined various environmental exposure and health outcomes with repeated measurements in mothers and their children. The depression and anxiety of 10-years-old children were assessed by using the Children's Depression Inventory(CDI), State Anxiety Inventory of Children(SAIC) and Trait Anxiety Inventory of Children(TAIC). Pregnant women before 20 weeks of pregnancy were enrolled and the number of participants was 1,751 mother-child pairs. After excluding participants who were not responded to mobile phone questionnaire or not assessed the depression and anxiety, 215 pairs were included in the present study. Multiple generalized linear model was applied to examine the association between prenatal maternal mobile phone usage and children's depression and anxiety symptoms, adjusted for children's own mobile phone use, residential area, maternal age at childbirth, household income, and secondhand smoke exposure. RESULTS: The mean and standard deviation of CDI, SAIC and TAIC score were 7.45 \pm 5.76, 27.80 \pm 6.95 and 28.74 \pm 7.07, respectively. CDI and TAIC score in girls were significantly 5.72-point (p=0.002) and 6.69- point (p=0.003) higher in group of 30 minutes or more prenatal calling a day than those of less than 30 minutes, respectively. No significant results showed in boys. CONCLUSIONS: This study showed that prenatal maternal mobile phone use for longer time affect the 10-years old girls' symptoms of depression and traits of anxiety.

Keywords: mobile phone use, depressive symptoms, anxiety symptoms

Particulate matters and the risk of depression: analysis of the Korean Longitudinal Study of Aging (KLoSA) 2016-2020 in South Korea

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BACKGROUND AND AIM: There is a growing concern that particulate matter (PM) such as PM2.5 and PM10 has contributed to exacerbating psychological disorders, in particular, depression. However, little is known about the roles of these air pollutants on depression in elderly. Therefore, this study aimed to examine the association between two types of particulate matter and depression in the elderly population in South Korea.

METHOD: We used panel survey data, the Korean Longitudinal Study of Aging (KLoSA), administered by the Labor Institute during the study period of 2016, 2018, and 2020 covering 217 districts in South Korea (n=7,674). Annual district-specific PM2.5 and PM10 concentrations were calculated for the study period from the monthly prediction concentrations produced by a machine-learning-based ensemble model (cross-validated R²: 0.87), then linked to the individuals matching with year and their residential district. Depression was defined by the CES-D 10 questionnaire (10 items with a 4point Likert scale), with a cut-off score of 22 points. We constructed a generalized estimating equation (GEE) model to identify the associations between each of the long-term PM2.5 and PM10 exposures and depression after adjusting for individual and regional factors as confounders. Estimates for the odds ratio (OR) per 10 μ g/m³ increment of concentration level and 95% confidence interval (95% CI) were calculated.

RESULTS:We found that long-term 10 μ g/m³ increments in PM2.5 (OR 2.83, 95% CI 2.18-3.67) and PM10 (OR 2.36, 95% CI 1.99-2.79) were associated with depression in the elderly. Associations were consistent after adjusting for other air pollutants (NO2, O3, and CO) in two-pollutant models. In addition, the impacts substantially differed by regions grouped by the tertile of the population density. CONCLUSIONS:Long-term exposure to PM2.5 and PM10 was associated with a higher risk of developing depression in elderly people. The impact was modified by the population density level of the region where they reside.

Keywords: Air pollution, Particulate matter, Long-term exposure, Mental health outcomes

Mapping the key characteristics of carcinogens for glyphosate and its formulations: A systematic review

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BACKGROUND AND AIM:Glyphosate was classified as a probable human carcinogen by the International Agency for Research on Cancer partially due to strong mechanistic evidence in 2015. Since then, numerous studies of glyphosate and its formulations (GBF) have emerged. These studies can be evaluated for cancer hazard identification with the ten key characteristics (KC) of carcinogens approach. We aimed to assess all *in vivo*, *ex vivo*, and *in vitro* mechanistic studies of human and experimental animals (mammals) comparing exposure to glyphosate/GBF with low/no exposure counterparts for evidence of the ten KCs.

METHOD:Two blinded reviewers screened studies available in PubMed before August 2021 for inclusion criteria (protocol: INPLASY202180045). Data extraction was conducted in duplicate for each KC outcome reported along with key aspects of internal/external validity, results, and reference information. These data formed a matrix analyzed in R to conduct strength of evidence and quality assessments.

RESULTS:Of 2537 articles screened, 175 met inclusion criteria, from which >50,000 KC-related data points were extracted. Data analysis revealed strong evidence for KC2, KC4, KC5, KC6, KC8, limited evidence for KC1 and KC3, and inadequate evidence for KC7, KC9, and KC10. For KC2, we found studies conducted in humans and human cells provided stronger evidence than animal models; GBF elicited a stronger effect in both human and animal systems compared to glyphosate alone; and the highest quality studies in humans and human cells consistently revealed strong evidence of genotoxicity. KC8 analyses revealed glyphosate's ability to modulate hormone levels and estrogen receptor activity is sensitive to exposure concentration and formulation, and provided clear evidence that glyphosate interacts with receptors, alters receptor activation, and modulates the levels and effects of endogenous ligands (including hormones).

CONCLUSIONS:Our findings strengthen the mechanistic evidence that glyphosate is a probable human carcinogen and provide biological plausibility for reported human cancer associations, such as non-Hodgkin lymphoma.

Keywords: big data, occupational exposures, causal inference, pesticides, risk assessment

Long-term exposure of bis(2-ethylhexyl) phthalate causes neurobehavioral disorders by disrupting glutamate-glutamine homeostasis in the mPFC

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BACKGROUND AND AIM:Bis(2-ethylhexyl) phthalate (DEHP) is the most used phthalate and its extensive use allows daily exposure to humans via various routes. Although a positive relationship between DEHP exposure and neurobehavioral disorders is suspected, there are insufficient data on the harmfulness of neurobehavioral disorders caused by DEHP exposure, particularly at daily exposure levels. We try to identify the relationship between DEHP and neurobehavioral disorders, and explain the underlying mechanism.

METHOD: We assessed the consequences of DEHP ingestion including daily exposure concentration in male mice for 30 (short-term) and 100 (long-term) days and examined its effects on neuronal functions associated with neurobehavioral disorders, such as depression and cognitive decline. RESULTS: We found the noticeable depressive behaviors and decline of learning and memory function in the DEHP-ingestion groups, and that biomarkers related to chronic stress such as corticosterone and ROS/RNS were elevated in plasma and brain tissues. DEHP ingestion induced collapse of glutamate (Glu) and glutamine (Gln) homeostasis as a result of disruption of the Glu-Gln cycle in the medial prefrontal cortex and hippocampus. The electrophysiological approach demonstrated that DEHP ingestion lowered the glutamatergic neurotransmission activity involved in emotional and cognitive functions in the brain.

CONCLUSIONS:Our research revealed that the long-term exposure of environment-relevant DEHP, even levels of exposure lower than the tolerable daily intake (TDI), have the strong potential to cause neurobehavioral disorders. Further, since the developing and commercializing a safe substance to replace DEHP is a time-consuming process, it is necessary to prepare stricter regulations and to develop and implement a method to prevent neurobehavioral disorders caused by daily exposure to DEHP to protect the human mental health from this hazardous material.

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Keywords: bis(2-ethylhexyl) phthalate, neurobehavioral disorders, medial prefrontal cortex,

glutamate-glutamine homeostasis, neuro-hazardous substance

FP-182[Neurologic and mental health outcomes » Neurodegenerative outcomes]

Differential impact of subjective perceptions of workplace interactional demands on cognitive function according to occupations: A longitudinal study

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BACKGROUND AND AIM: Interpersonal interactions are known to be positively associated with cognitive function. However, subjective demands of interpersonal interactions may lead to negative mental health (emotional labor) in workers with limited autonomy. We examined whether the level of subjective perceptions of workplace interactional demands (WID) was associated with cognitive function and how this association varied according to occupations.

METHOD:A nationally representative sample of 4,693 middle-aged and older workers underwent longitudinal measurement of the Mini Mental Status Examination (MMSE), with 2-year intervals (yielding 15,657 observations). A change in cognitive function was calculated as MMSE score at each measurement minus MMSE score at the previous measurement. Nine categories of the Korean Standard Classification of Occupation were used. Subjective perception of WID was defined as the extent to which workers were required to have skills to deal with co-workers and clients, and its level was classified as low and high WID. We used generalized estimating equations, adjusting for demographics and socioeconomic status.

RESULTS: The proportion of high WID was 51.5%. In the overall sample, high WID was significantly associated with an increased cognitive function (β =0.22, 95% CI: 0.13 to 0.30). In occupation-stratified analyses, this protective effect of high WID remained significant in professionals (β =0.82 [95% CI: 0.48 to 1.17]), agricultural, forestry, and fishery workers (0.38 [0.10 to 0.65]), craft and related trades workers (0.28 [0.06 to 0.50]), plant and machine operators and assemblers (0.27 [0.03 to 0.51]), and elementary workers (0.18 [0.00 to 0.51]). By contrast, high WID was not significantly associated with a change in cognitive function in clerks, service workers, and sales workers. CONCLUSIONS:Our study suggests differential impacts of subjective percerceptions of WID on cognitive function between occupations among middle-aged and older individuals. Subjective perceptions of WID may protect against cognitive decline in professionals, but not in service and sales workers.

Keywords: Occupational exposures, Occupational epidemiology, cognitive function, repeated measures analysis

FP-183[Climate » Other (to be specified with keywords in the keywords section)]

Temperature modifies the association between air pollution and respiratory disease hospitalisation an industrial area of South Africa

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BACKGROUND AND AIM: Despite epidemiological studies reporting distinct effects of air pollution and temperature on human health, these two exposures are frequently considered as separate risk factors. There have been limited investigations into the modifying effects of temperature on the health impacts of air pollution in Africa, and no studies have explored the effects of black carbon on respiratory disease (RD) hospitalisations. The aim of this study was to assess whether the association between RD hospitalisations and air pollution in the Vaal Triangle Air Pollution Priority Area was modified by apparent temperature (Tapp) between January 2013 and February 2020.

METHOD:RD admission data (ICD10 J00-J99) were obtained from two hospitals located in Vanderbijlpark and Vereeniging. Ambient PM10, PM2.5, BC, NO2, SO2 and O3, temperature and relative humidity data were obtained from six monitoring stations. A case-crossover epidemiological study design was applied. Lag0-1 was investigated, i.e. the average air pollutant level on the day and the day before hospitalisation. Regression models were adjusted for public holidays and Tapp. Effect modification was investigated by stratifying days into low, moderate and high Tapp days. Susceptibility by age and sex was investigated.

RESULTS:Out of a total of 43386 hospital admissions, 50.9% were females and 51.4% were children aged 0-14 years. Air pollutants exceeded the World Health Organization's (WHO) daily air quality guidelines on more than 50% of the days. Moderate Tapp, in general, exacerbated the adverse effects of PM2.5, PM10, SO2, and BC, while high Tapp amplified the effects of NO2 and O3. The elderly and females were more susceptible to the effects of air pollution, particularly on days with moderate Tapp. CONCLUSIONS:The findings suggest that the risk of hospitalisation for RD due to exposure to ambient air pollution varies on days with low, moderate and high Tapp in Vanderbijlpark and Vereeniging.

Keywords: Effect modification, air pollution, temperature, respiratory disease, industrial area, South Africa

FP-184[Air pollution » Long-term exposure]

Association of outdoor air pollution and breast cancer: A systematic review of longitudinal study

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BACKGROUND AND AIM: Breast cancer is the most prevalent malignancy among women. Certain air pollutants have carcinogenic and estrogenic properties that promote breast cancer development. In this systemic review, we explore the association between air pollution and breast cancer using epidemiological evidence

METHOD:Articles published between 2013-2022 from Scopus and PubMed databases were systematically reviewed. We included articles that primarily emphasized on cohort and nested case-control in cohort studies, and outdoor air pollution and breast cancer. In the end, 26 papers were retained for analysis; Most of articles from America and Europe. Studies were reviewed in accordance with the Preferred Reporting Items for Systematic review and Meta-Analyses (PRISMA) guidelines. RESULTS:Most of the study focused on old adults and over. Total of 11 out-door pollutants have been analyzed in this study, 6 pollutants were associated with breast cancer risk, All of black carbon and Benzo[a]pyrene(BaP) studies were associated with breast cancer risk with OR=1.03, 95%CI = 1.00 - 1.07, 1.15; 95%CI= 1.04 - 1.27, respectively, 52.63% of PM2.5 studies were associated with breast cancer (HR=1.03 - 1.86; 95%CI = 1.01 - 3.10), while 50% of NO2, NOx found an association with HR= 1.03 - 1.44; 95%CI=1.00 - 1.99 and 1.35; 95%CI = 1.02 - 1.79, respectively. In contrast, 66.67% of PM10 studies found no association while 100% of NO, SO2, ultra-fine particle, O3 and Cadmium studies were found no association with breast cancer risk.

CONCLUSIONS: This study indicated that various outdoor air pollutant was associated with breast cancer risk. Causal nature of the association needs to be further investigated. Future research should investigate the mechanisms that could relate the carcinogenic effects of environmental pollutants to an epigenetic pathway that contributes to the advancement of breast cancer.

Keywords: Outdoor Air pollution, Breast cancer, Incident

Effects of abdominal fat on the association between ambient air pollution and thyroid function in Korean

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BACKGROUND AND AIM: We investigated the association between exposure to air pollution and thyroid function, and whether this association are modified by abdominal fat distribution such as waist circumference, visceral adipose tissue (VAT), and subcutaneous adipose tissue (SAT) in Korean adults METHOD: We included 4704 adults in the final analysis and used each person's annual average exposure to 4 air pollutants, namely, particulate matter with an aerodynamic diameter less than or equal to 10 μ m (PM10), nitrogen dioxide (NO2), sulfur dioxide, and carbon monoxide (CO). We measured serum thyrotropin (TSH) and free thyroxine (FT4) concentrations as indicators of thyroid function according to abdominal fat distribution.

RESULTS:The annual average exposure of air pollution was significantly associated with an elevated TSH and reduced FT4 concentration after adjusting for possible confounding factors. In stratified analysis by abdominal fat traits, we found that exposure to air pollutants was significantly associated with an increased TSH or decreased FT4 level and showed stronger effects of PM10 exposure in TSH and CO exposure in FT4 (all P <.05). In addition, air pollution including PM10, NO2 and CO was significantly associated with both TSH and FT4 levels in the high-VSR group (all P <.05)., but not in those of normal group.

CONCLUSIONS: This study provides the first evidence that association between air pollution exposure and thyroid function is different by abdominal fat distribution.

Keywords: air pollution, thyroid function, abdominal fat distribution, general adults

Early and late onset of acute otitis media (AOM) according to long term PM2.5 exposure: national longitudinal cohort

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BACKGROUND AND AIM: Experimental studies have reported that air pollution could make the middle ear more susceptible to infections, but the associations between particulate matter 2.5 (PM2.5) and acute otitis media (AOM) were inconsistent. We examined the association of long-term exposure to PM2.5 with the risk of AOM.

METHOD: We used the National Health Insurance Service-National Sample Cohort spanning from 2002 to 2019, which consists of one million beneficiaries representative of the entire population in South Korea. The onset of AOM was defined as the first hospital visit record with a primary diagnostic code based on the International Classification of Disease, 10th edition codes. For PM2.5 exposures, we used a machine learning-based ensemble prediction model with a spatial resolution of 1 km2 and allocated the district-specific annual average concentration of PM2.5 across all 229 districts in South Korea. We estimated the association between PM2.5 and the onset of AOM using a time-varying Cox proportional hazard model adjusted for age, sex, socioeconomic status, region, and community level indicators. RESULTS:Our study included 379,585 beneficiaries aged 0-18 years at enrollment and followed until the first onset of AOM. We identified 196,762 cases of AOM and found a positive association between exposure to PM2.5 and the development of AOM, with a hazard ratio of 1.064 (95% CI 1.053 to 1.076) for every 5µg/m³ increase in annual PM2.5. In the subgroup analysis, the highest HR was observed in beneficiaries in the 0-5 year age (1.078; 1.065 to 1.092), low-income (1.079; 1.042 to 1.118), and rural area (1.119; 1.093 to 1.144).

CONCLUSIONS: In this nationwide, population-based cohort study, long-term childhood exposure to PM2.5 was associated with an increased incidence of AOM. These results indicate plausible

mechanisms of air pollution and AOM, and our findings could provide important fundamental data for preventing AOM in children.

Keywords: Particulate matter, Air pollution, Infectious diseases, Long-term exposure

One Year Progress summary of Children's Environmental Health Clinic in Korea (CHECK)

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BACKGROUND AND AIM:Since the 1990s, Pediatric Environmental Health Specialty Units (PEHSUs) in the United States have provided rigorous research, clinical care, and public health interventions. However, this systematic network is scarce globally, particularly throughout Asia. In 2022, we established the children's environmental health clinic in South Korea. This is the first-year progress report.

METHOD: We structured the questionnaires divided into five pediatric periods, namely infant, toddler, preschool age, school age, and adolescents, and established an examination system for our outpatient clinic. Following institutional review board (IRB) approval, we examined pediatric patients for allergic, renal, and immunologic diseases, and precocious puberty by checking their laboratory tests (including heavy metals, volatile organic compounds, and endocrine-disrupting chemicals) from blood and urine samples through integrated system of Seoul Clinical Laboratories. At the same time, we performed a physical examination of the patients and provided specialized counseling and education for patients and their parents to reduce the exposure to high levels of environmental pollutants in blood and urine, and followed up their environmental pollutant levels every 6 months. RESULTS: Since August 2022, thirty-two patents, with ratio of female to male 1:1, visited our CEH clinic. Through the structured pediatric environment questionnaire, living and educational environment, food intake, past medical history, and children's sleep status were identified. Particularly, pediatric patients with allergic skin diseases showed high bisphenol A, paraben, and phthalate levels in urine. In addition, elevated levels of these chemicals were seen in the environments with frequent food delivery and use of plastic containers. We will follow up the children's health and their environmental pollutant levels every 6 months.

CONCLUSIONS: CHECK is the first pediatric environmental health clinic in Korea. We will provide a model of pediatric environmental health care as a standardized and specialized clinic with laboratories.

Keywords: Children's environmental health, Endocrine disrupting chemicals, Outcomes

Indoor carbon monoxide and sulfur dioxide were associated with schoolchildren's asthma and lung function in an industrial city

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BACKGROUND AND AIM: The prevalence of childhood asthma has increased annually. Indoor air pollutants were one of the most important risk factors because children spend most of their time at home. To our knowledge, no study discussed the difference in indoor pollutants between the households of children with and without asthma in an industrial city, and evaluate the effects of indoor CO, CO2, SO2, and O3 in households on schoolchildren's lung function.

METHOD: Between April 2010 and October 2010, a case-control study of 30 healthy children and 30 asthmatic children was conducted. The indoor air pollutants samples in children's households were measured by real-time monitoring equipment for 24 hours, and children's lung function values were also assessed in the beginning of and at the end of environmental sampling dates.

RESULTS: We observed the concentrations of indoor CO2, SO2, PM10, and PM2.5 in households of asthmatic children were significantly higher than those of non-asthmatic children. In both the stepwise regression models and in the multiple regression models, the acute effects of indoor CO, and SO2 on changes in children's lung function values were observed with statistical significance, and indoor CO2 had a significant positive association with children's lung function in this study.

CONCLUSIONS: This is the first study to investigate the difference in indoor pollutants especially for SO2 between the households of children with and without asthma in an industrial city, and evaluate the effects of indoor CO, CO2, SO2, and O3 exposure on schoolchildren's lung function. In our finding, the indoor CO and SO2 affect the children's lung function, indicating that indoor air in households and schoolchildren's lung function should be more concerned.

Keywords: Household, Sulfur dioxide, Carbon monoxide, Lung function, Industrial city

The effect of financial performance indicators in financial statements on the incidence of occupational injuries and diseases in South Korea

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BACKGROUND AND AIM:By examining the effect of the numbers in specific accounts of financial statements on the incidence of occupational injuries and diseases, the author and readers could understand how a specific operating characteristic affects the occupational safety and health of the company.

METHOD: For the Workplace Panel Survey (WPS) datasets, a multilevel Poisson regression or multilevel linear regression was applied.

RESULTS: For the number of workers who acquired occupational injuries and diseases during the fiscal year, the average number of workers at the workplace, interest income, interest expense, and valueadded per person showed an increased relative risk with statistical significance. On the contrary, lease expense, depreciation and amortization, and industrial property right both at the start and end of the fiscal year showed a decreased relative risk with statistical significance. For whether or not there is any worker who acquired occupational injuries and diseases during the fiscal year, taxes and duties and welfare and benefits expense showed an increased risk with statistical significance. On the contrary, severance pay, depreciation and amortization, and the average number of workers at the workplace showed a decreased relative risk with statistical significance.

CONCLUSIONS:All statistically significant results were interpreted based on the general operating characteristics of each workplace. In general, as the financial status of the workplace was worse, the incidence of occupational injuries and diseases increased. On the contrary, as the number of workers, operating profit, and the magnitude of physical assets (subject to depreciation and amortization) increased, the incidence of occupational injuries and diseases decreased. The results about vehicles/transport devices might be associated to a special consignment subcontract in South Korea between cargo truck owners and shipping companies.

Keywords: Financial Performance, Occupational Injuries and Diseases, South Korea, Workplace Panel Survey, Operating Characteristics

A propensity score analysis on the effect of mobile phone use during pregnancy on birth outcomes in Ko-CHENS

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BACKGROUND AND AIM: In modern society, exposure to electromagnetic waves is an unavoidable ubiquitous exposure. It is not yet clear whether the use of mobile phones during pregnancy has a causal adverse effect on birth outcomes.

METHOD: In the Korea Children's Environment and Health Study cohort, information was gathered via a questionnaire on mobile phone usage among 5,213 women who was recruited before 20 weeks of pregnancy and gave birth between 2015 and 2020. Participants with missing information of cell phone use or birth outcome and with multiple births were excluded, and finally 4628 women-child pair were analyzed in the present study. Birth outcomes evaluated were birth weight and height, Ponderal index, gestation age, preterm birth, and low birth weight. Propensity scores(PS) were generated for groups with high and low mobile phone usage during pregnancy classified at the 75percentile of average daily call time distribution. Variables for PS calculation were selected using general characteristics and LASSO regression. Ultimately, the effects of prenatal mobile phone use on birth outcomes were examined through PS matching(PSM) and Inverse Probability of Treatment Weighting(IPTW) analysis. RESULTS: The balances of the general characteristics of the groups with low and high call time were similarly distributed, ensuring comparability. The high call time group compared to low group showed 7.22 and 5.70 g more birth weight, 0.10 and 0.11 cm more birth height, 0.02 and 0.01 less ponderal index, in PSM and IPTW analysis, respectively, although all were not statistically significant. The risks was HR=1.02(0.95-1.10) and 1.05(0.99-1.12) for reduction of gestation age, OR=1.06(0.75-1.51) and 0.97(0.70-1.36) for preterm birth, and OR=0.97(0.71-1.34) and 0.96(0.64-1.45) for low birth weight, respectively, in PSM and IPTW analysis.

CONCLUSIONS: We did not observe evidence that prenatal mobile phone use causally affects birth outcomes. Additional studies using more advanced RF exposure assessment such as applying specific absorption rate are needed.

Keywords: RM-EMF, mobile phone calls, birth outcome, propensity score, IPTW

Critical Windows of Greenness Exposure during Preconception and Gestational Periods and their Association with Birthweight Outcomes

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BACKGROUND AND AIM: Few studies have been conducted to examine the association between greenness exposure and adverse birth outcomes. This study aims to identify critical exposure time windows during pregnancy for the association between greenness exposure and birth weight outcomes.

METHOD:A preconception cohort of 13,890 pregnant women and newborns in Shanghai, China from 2016-2019 were included in the study. We assessed greenness exposure using Normalized Difference Vegetation Index (NDVI) during the preconception and gestational periods, and evaluated the association with term birthweight, birthweight z-score, small-for-gestational age (SGA), and large-for-gestational age (LGA) using linear and logistic regressions. We also controlled for meteorological variables of ambient temperature and relative humidity, and air pollution levels of PM2.5 and NO2 of the same period for sensitivity analysis. Furthermore, we explored the effects of urbanicity and park accessibility through stratified analysis.

RESULTS: We found that higher greenness exposure, as quantified via NDVI, during the second trimester and the whole pregnancy was associated with higher birthweight and birthweight Z-score. Specifically, a 0.1 unit increase in second trimester averaged NDVI value was associated with an increase in birthweight of 10.2 g (95% CI: 1.8 g to 18.5 g) and in birthweight Z-score of 0.024 (0.003 to 0.045). Averaged NDVI during the entire pregnancy was associated with 10.1 g (95% CI: 1.0 g to 19.2 g) increase in birthweight and 0.025 (0.001 to 0.048) increase in birthweight Z-score. Moreover, the associations of greenness exposure were larger among participants living in urban areas compared to the suburban areas and in areas without park accessibility within 500 m compared to with park accessibility within 500 m, particularly during the second trimester.

CONCLUSIONS:Our findings suggest that increased greenness exposure, particularly during the second trimester, may be beneficial to increase in birth weight towards normal levels in an intra-urban environment.

Keywords: Greenness, NDVI, Air Pollutant; Small for Gestational Age; Large for Gestational age; Preconception; Pregnancy; Birthweight

Toxicity of Boron Carbide (B4C) Nanomaterials on Caenorhabditis elegans Models

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BACKGROUND AND AIM:Boron carbide (B4C) is a widely known ceramic material composed of boron and carbon. It is known for its toughness, high melting point, low density, and good mechanical property. Due to its diverse properties, it is widely used in industrial applications such as cutting tools grinding wheels, ballistic armor, and neutron absorbers in nuclear power. Despite the various advantages of B4C, constant exposure to boron carbide nanoparticles (B4C NPs) may induce adverse effects on the human body via inhalation, skin contact, or consumption.

METHOD:In this study, B4C NPs were investigated using Caenorhabditis elegans (C. elegans) as invivo model to determine the different toxicological endpoints including reproductive (brood size), growth measurement (body length), locomotion (head thrashing and body bending), lifespan, and oxidative stress (gene expression of sod-1, sod-3, ctl-2, and cyp35a2) and metal detoxification (gene expression of mtl-2). The

RESULTS: The L1 nematodes were exposed to B4C NPs concentrations of 320, 160, 80, 40 mg/L until the nematodes attained the L4 stage. The reproductive and locomotion assay revealed a significant decrease in brood size and body bending in 80 to 320 mg/L B4C NPs concentration which indicates B4C NPs can induce reproductive toxicity and reduce motor function. The exposed nematodes exposed at high concentration of B4C NP showed decrease in survival rate compared to the control group. With regards to the growth measurement assay, there were no significant changes in the body length of the exposed nematodes.

CONCLUSIONS: The genes responsible for regulating the oxidative stress and metal detoxification were found to be downregulated resulting to affected biological system of nematodes. These findings indicate that B4C NPs can cause adverse effects on C. elegans and further observation of other physiological changes in nematodes can done in future studies.

Keywords: Exposure assessment, Long-term exposure

FP-193[Exposures » Water quality]

Characteristics, Pollution and Health Risk Assessment of Metals and Metalloid in Drinking Water of Yangtze River and Taihu Lake

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BACKGROUND AND AIM:Metal pollution in drinking water pose multiple risks, thus have drawn the public attention worldwide. Yangtze River delta is the most economically vigorous region in China. However, metal pollution condition of the main water source remains systematic study. Therefore, this study characterized the 21 elements distribution, and then the pollution index and health risk assessment were conducted to evaluate the potential risk of metal exposure through oral and dermal ingestion to local resident.

METHOD:120 drinking water samples were collected in four main cities of Yangtze River Delta from Dec, 2015 to Dec, 2016, and inductively coupled plasma-mass spectrometry was employed to analyze 21 common elements. then Heavy metal pollution index method and health risk assessment process combined Monte Carlo simulation uncertainty analysis were applied to assess the pollution level, health risk and main risk factors.

RESULTS:The most abundant element was Sr, and significant spatial distribution difference was found. B and Mo presented strong positive correlation both in Yangtze River(R2=0.847) and Taihu Lake(R2=0.807). the median Heavy Metal Pollution Index values were 8.93 and 4.40 of Yangtze River and Taihu Lake respectively. For non-carcinogenic, the medians hazard index of Yangtze River for adult, children, Taihu Lake for adult and children were 3.14E-01, 1.09E-01, 2.61E-01 and 9.04E-02respectively. Exposure duration(r=0.7931) and ingestion rate(r=0.4897) played dominated role in health risk prediction. The total carcinogenic risks were 1.44E-05 and 1.75E-05 of Taihu Lake and Yangtze River, which means the non-carcinogenic and carcinogenic risks were all within the acceptable range. However, As and Ni were the leading factors and its pollution could not be neglected for human health.

CONCLUSIONS: In summary, our findings provide detailed data of water metal distribution characteristics and health risks caused by metal ingestion through drinking water in Yangtze River Delta, Baseline information and risk factors were provided for drinking-water safety and governance.

Keywords: metal pollution, drinking water, health risk assessment, Monte Carlo analysis

Association between exposure to PM2.5 and blood pressure among participants of the globally conducted May Measurement Month 2018-2019

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BACKGROUND AND AIM: Evidence on link between short and long-term air pollution exposure with raised blood pressure (BP) and hypertension is concentrated in high income settings. Low-middle income countries face most of the burden of both air pollution and increasing incidence and mortality from increased BP, yet there is a paucity of studies conducted in such areas. We aim to extend the spatial coverage of the evidence by including a variety of countries with different income and air pollution levels. We investigated the cross-sectional associations between exposure to short (1-month, 3-month average) and long-term (6-month, 1-year average) ambient PM2.5 and BP in 125,198 participants from 29 countries during May Measurement Month (MMM) BP screening campaigns in 2018 and 2019.

METHOD: We used satellite derived data on monthly average PM2.5 and assigned exposure (averaged for 1-month, 3-months, 6-months, and 1-year) to participants for the month in which the BP measurement was recorded based on the coordinates of the MMM screening site. Generalized additive models with penalized splines were used while accounting for potential confounders and country-level clustering effects.

RESULTS:Short and long-term exposure to ambient PM2.5 was associated with increases in SBP and DBP at an individual level but not at the country level globally. We found the relationship to be nonlinear with significantly higher effects beyond 70ug/m3. Stratified analysis showed that individuals with high BMI, hypertensives specifically those not on antihypertensive medication and participants with comorbidities were more susceptible to the effect of air pollution on BP.

CONCLUSIONS: More high-quality data are required linking individual air pollution exposure (using robust and granular data) with cardiovascular risk factors such as BP and major adverse

cardiovascular events. Meanwhile, health policies which promote the reduction of air pollution are needed, particularly for those at highest risk.

Keywords: Air pollution, Particulate matter, Long-term exposure, Cardiovascular diseases

Urinary Phthalates Esters in Nationwide Representative Samples of Taiwan in 2019

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BACKGROUND AND AIM: Since 2011, there was an incident involving phthalate-tainted food that di-(2ethylhexyl) phthalate (DEHP) and di-isononyl phthalate (DiNP) were illegally added to foodstuffs and medications. DEHP and DiNP, as widespread plasticizers, are considered endocrine disrupting chemicals (EDCs) with main toxicological effects on reproductive and metabolic systems. Nationwide human biomonitoring (HBM) surveys have been conducted in many countries long time ago. Like the United States beginning in the early 1960s, which call the National Health and Nutrition Examination Survey (NHANES); and German Environmental Survey (GerES) started in 1985; other like Korean National Environmental Health Survey (KoNEHS), which began in 2005; and the other is Canada, they conducted Canadian Health Measures Survey (CHMS) beginning in 2007. However, there is no nationwide human biomonitoring survey had been conducted in Taiwan recent years. METHOD: We aimed to establish the urinary levels and reference values (RVs) of phthalate metabolites and identify exposure characteristics among Taiwan's population. We enrolled 1748 participants 7 years of age and older from the Nutrition and Health Survey in Taiwan (NAHSIT) conducted in 2019 by using probability proportional to size (PPS) and primary sampling unit (PSU) sampling covering 20 cities or counties of Taiwan. Each township was classified into one of two groups according to its population density and urbanization level. We collected participant's urine, blood, and environmental and lifestyle questionnaires.

RESULTS: Levels of 12 different phthalate metabolites in participants' urine samples were determined by Ultra Performance Liquid Chromatography-tandem mass spectrometry (UPLC-MS/MS) for analysis. The results of phthalate esters distribution in Taiwan were compared with other national representative samples that provide national estimates on various health-related topics. CONCLUSIONS: We used our RVs of urinary phthalate metabolites compared with HBM guidance values (HBM-GVs) announced from Human biomonitoring initiative (HBM4EU). In order to make sure general population in Taiwan keep in a safe living environment.

Keywords: Biomarkers of exposure, Endocrine disrupting chemicals

National representative prevalence survey on idiopathic environmental intolerance attributed to electromagnetic fields in Taiwan

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BACKGROUND AND AIM: The prevalence rate of idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF), also known as electromagnetic hypersensitivity, was 13.3% in 2007 in Taiwan, which is most likely the highest that has been reported globally. The prevalence of IEI-EMF seems to decline during the last decade, and it decreased dramatically to 4.6% in 2012 in Taiwan. We conducted a survey that aimed to assess the prevalence rate of IEI-EMF in 2019 in Taiwan and compare the results to those of previous surveys.

METHOD: We adopted a cross-sectional study design. For comparison, we applied the same method as used by the previous surveys in Taiwan. Specifically, we conducted a nationwide random digital dialing (RDD) telephone survey and utilized two-stage stratified sampling according to the administrative division. Households were randomly selected in each administrative division in proportion to the population size. In addition, a post-stratification method was applied to transform the raw data into weighted data based on the distribution of the national population in 2018 in Taiwan.

RESULTS:A total of 1,355 participants were included, yielding a response rate of 13.0%--lower than the 23.6% in the 2012 survey but higher than the 11.6% in the 2007 survey. The contact rate of landline phone users has decreased gradually over time, from 52.3% in 2007 to 46.9% in 2012, and then to 31.7% in 2019, which might have been influenced by changes in the use of landline phones in Taiwan—more and more people use cell phone for personal communications and so the proportion of business numbers becomes larger. The weighted prevalence rate of IEI-EMF was 4.6%, which was the same as in the 2012 survey.

CONCLUSIONS: The prevalence rate of self-reported IEI-EMF did not change remarkably during the period from 2012 to 2019 in Taiwan.

Keywords: Epidemiology, Long-term exposure

Exposure to air pollutants and prevalence of myopia: a nationwide cross-sectional study in Korean males

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BACKGROUND AND AIM: While the cause of myopia is primarily explained by genetic factors, recently, the possibility of corneal inflammation due to air pollution has been raised as a potential risk factor for myopia. Some epidemiological studies showed a significant relationship between air pollutants and myopia, but there were limitations in representativeness. We aim to identify the association between prevalence of myopia and air pollutants targeting the whole male population in Korea. METHOD: We linked the military physical examination data from 2010 to 2019 and air pollution

information from the Korea Environment Corporation were I based on the address of the subjects. We analyzed the correlation between air pollutant concentration and the prevalence of myopia using a multivariate logistic regression model. Education, urbanization, regional prevalence of atopic dermatitis, and regional income were used as covariates for adjustments.

RESULTS: When analyzed in connection with the air pollution concentration for one year immediately before the physical examination, PM10 did not show a significant association with the prevalence of myopia in the multiple logistic regression model corrected for covariates (odds ratio [OR] 0.986, 95% confidence interval [CI] 0.985-0.987) and NO2 showed a significant association (OR 1.022, 95% CI 1.022-1.023). Similarly, when analyzed in connection with the average air pollution concentration for the previous three years, PM10 did not show a significant association with the prevalence of myopia in the covariate-corrected model (OR 0.981, 95% CI 0.980-0.982), but NO2 showed a significant association (OR 1.021, 95% CI 1.021-1.022).

CONCLUSIONS: This study is representative by using the whole male population in Korea, and it also has the strength of using the objective myopia prevalence data obtained from the visual acuity test conducted at the age of 19, when myopia does not progress any further. Our findings imply the evidence to support that air pollutants is associated with the prevalence of myopia.

Keywords: myopia, air pollutant, particulate matter, inflammation

12-Year Trend of PM2.5 Air Pollution and Suicide Deaths in Kaohsiung City and Taiwan

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BACKGROUND AND AIM:Air pollution is the most important environmental factor which is harmful to human health. Existing studies have investigated the association between air pollution and suicide rates. However, very few studies compared the suicide rate in heavy industrial cities with greater air pollution, and in Taiwan generally. This study aimed to compare the trend of the concentration of airborne particulate matters (PM2.5) and the suicide death rate in Kaohsiung city and Taiwan. METHOD:This study used the national death registry and the Taiwan Air Quality Monitoring Database from 2008 to 2019. Three-periods (2008-2011, 2012-2015, 2016-2019) age-standardized mortality rate for suicide death by gender (male and female) were calculated based on the WHO 2000 population distribution. Ordinal least squares regression was used to analyze the association between the trends of PM2.5 exposure and the suicide death rate.

RESULTS:Our study found that both the age-standardized suicide rate and level of PM2.5 had showed a decreasing trend in Taiwan and Kaohsiung city. The overall suicide death rate and level of PM2.5 were greater in Kaohsiung city than in Taiwan. The changes of PM2.5 from 2008 to 2019 were about 50.97% in Kaohsiung and 48.60% in Taiwan, while the percentage decrease in the suicide rate in Kaohsiung (12.48%) is higher than that in Taiwan (10.86%).

CONCLUSIONS:Our finding suggests that air pollution is associated with an increased risk of suicide. Given that air pollution can have negative effects on mental health and may increase the risk of depression and anxiety, which in turn leads to suicidal behavior. As a result, our study considers that it is necessary for further research to focus on the influence of environmental exposure on susceptible populations.

Keywords: Air pollution, Particulate matter, Age-standardized mortality rate, Suicide

Umbilical cord serum elementomics of 52 trace elements and early childhood neurodevelopment

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BACKGROUND AND AIM:Prenatal exposures to neurotoxic metals and trace elements are associated with early childhood neurodevelopmental outcomes. However, consequences of simultaneous exposure to mixtures of elements remain unclear. We aim to examine individual and joint effects of prenatal trace element exposure on early childhood neurodevelopment.

METHOD:Using a well-established Bangladesh prospective birth cohort (2008-2011), we measured concentrations of 52 trace elements in umbilical cord serum of 569 mother-infant pairs using inductively coupled plasma mass spectrometry. Neurodevelopment was evaluated at 20-40 months of age using Bayley Scales of Infant and Toddler Development, Third Edition. Stability elastic net (ENET) was used to screen elements individually associated with the outcome; candidate exposures were combined by weighted linear combination to form a risk score representing their mixture effect on early childhood neurodevelopment.

RESULTS:Stability ENET identified 15 trace elements associated with cognitive composite score and 14 associated with motor composite score, which were linearly combined to form the element risk score (ERS). Children with higher ERScognitive had lower probability of cognitive developmental delay (ORhighest vs lowest: 0.21; 95 %CI: 0.10, 0.40; P < 0.001; Ptrend < 0.001). Children with ERSmotor in the top quintile had a significantly lower risk of motor developmental delay (OR: 0.16; 95 %CI: 0.09, 0.31; P < 0.001; Ptrend < 0.001) versus the lowest quintile. In Bayesian kernel machine regression analyses, lithium [conditional posterior inclusion probability (cPIP) = 0.68], aluminum (cPIP = 0.83) and iron (cPIP = 1.00) contributed most to the lower cognitive composite score; zinc (cPIP = 1.00), silver (cPIP = 0.81), and antimony (cPIP = 0.65) mainly contributed to the change of motor composite score.

CONCLUSIONS:Co-exposure to lithium/aluminum/iron or zinc/silver/antimony appears to impact children's neurodevelopment. ERS score reflecting maternal exposure could indicate children's risk of neurodevelopmental delay, warranting further studies to explore the underlying mechanism.

Keywords: Bangladesh, Early childhood neurodevelopment, Elementomics, Umbilical cord serum

Climate change-related exposures and risk of pediatric hospitalization in New York State, 2005-2019

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BACKGROUND AND AIM: The Understanding Pediatric Susceptibility Across Temperature and Environment in New York (UPStATE NY) Study will characterize relationships between climate changerelated exposures and pediatric health in NY State and identify community assets and stressors shaping these relationships. Here, we link all NY pediatric hospitalizations with residential minimum temperature (Tmin) and fine particulate matter (PM2.5).

METHOD: We use conditional logistic regression in a time-stratified case-crossover design to estimate associations on admission day and 6 lag days using 2005-2019 inpatient data from the NY Statewide Planning and Research Cooperative System (SPARCS) and daily fine-scale exposure estimates. RESULTS: Among children under 17, excluding newborns (N = 1.906.971), a 10 µg/m3 increase in PM2.5 conferred an increased risk of hospitalization year-round, [1.22% excess case-day risk (95% CI: 0.87, 1.57)] adjusted for case-day Tmin. Associations were stronger among younger children (0-4y), males, in urban areas, and in warmer months. Case-day PM2.5 was most strongly associated with risk of hospitalization for injury [3.53% (95% CI: 2.32, 4.75)], non-infectious respiratory disease [3.24% (95% CI: 2.18, 4.31)], and respiratory infections [2.21% (95% CI: 1.22, 3.20)]. A 10°F increase in case-day Tmin conferred an increased cool-season risk of hospitalization [2.46% (95% CI: 2.18, 2.73)] and decreased warm-season risk [-2.02% (95% CI: -2.45, -1.59)] adjusted for case-day PM2.5. Warm-season protective effects were strongest in urban areas. Associations were strongest (positive in the cool season, negative in the warm season) for respiratory and psychiatric outcomes. Injury and infections/parasitic diseases were positively associated with Tmin in both seasons with stronger warm-season associations [injury: 3.58% (95% CI: 2.12, 5.06), infections: 4.05% (95% CI; 2.00, 6.14)].

CONCLUSIONS: These results suggest that younger children and children in urban areas are particularly vulnerable to temperature and PM2.5. Future analyses will include ozone exposure, emergency department visit outcomes, and community-identified assets and stressors as potential effect modifiers.

Keywords: Air pollution, Particulate matter, Temperature, Climate, Environmental epidemiology

FP-201[Built environment » Green space]

The Association and Causal Effect of Park Visits on Social-Emotional Development in the ALSPAC cohort.

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BACKGROUND AND AIM:Literature has shown that greenspace is associated with child socialemotional development (SED). This study used repeat measures of maternal-reported park visits from the Avon Longitudinal Study of Parents and Children (ALSPAC), to assess the association between park visits and SED.

METHOD:Park visit variables were produced for 5 development periods from birth to 11 years old. Firstly, an analysis investigated the social patterning of park visits and covariates, by maternal educational attainment.

The association between parental-reported Strength and Difficulties total difficulties score (TDS) at 5 time points and park visits metrics (Less than Once a week vs Once a week or more) was assessed through a time-sequenced analysis (regressions with park visits preceding TDS), and a random-intercept model. Individual and area level covariates were identified through directed acyclic graph a priori.

RESULTS:Park visits were socially patterned over time. In early developmental periods, more educated families visited parks more frequently. In the latter three developmental periods families of lower educational attainment visited more frequently.

Time sequenced linear and random-intercept models produced consistent results. Adjusted models showed park visits, more than once a week, was consistently associated with reduced TDS. Adjusted coefficients were attenuated (while still providing evidence of an effect) in early development periods, in later developmental periods adjustment strengthened the associations.

CONCLUSIONS: The ALSPAC cohort was highly socially patterned. Lower maternal education linearly predicted increased adverse exposures, in all the studies covariates. Therefore, the inverted social patterning of park visits over time, coupled with the consistent associations between increased park visits and decreased TDS, means that it is implausible that the models were subject to conclusion-altering residual confounding. Sensitivity analyses assessed the impact of selection bias as being limited. Therefore, I posit that park visits more than once a week constitutes a causal effect on improved SED development.

Keywords: Greenspace, Self-report, Social-Emotional, Longitundal, Causal-Inference

Assessing the effects of fine particulate matter on cognitive function in healthy elderly women using amyloid positron emission tomography

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BACKGROUND AND AIM: Exposure to fine particulate matter (PM) has been linked to Alzheimer's disease (AD) in epidemiology studies. Amyloid positron emission tomography (amyloid-PET) using 18F-florbetaben, is used clinically to quantify brain β -amyloid deposition, a pathological hallmark of AD. The aim of the present study is to evaluate whether fine PM concentrations are associated with brain amyloid load in elderly women.

METHOD: Women aged \geq 70 years are randomly selected from a previous established healthy cohort in Northern Taiwan. Subjects with known neurological diseases, brain injury or cancer requiring therapy were excluded. Amyloid-PET images were analyzed using an automated quantification software. The PET parameter, standardized uptake value ratio (SUVR), was computed for six predefined cortical brain regions (anterior cingulate, frontal, occipital, parietal, posterior cingulate, and temporal cortices) by normalizing the regional count with cerebellar cortex (reference region). SUVRs were correlated with PM2.5, O3, and NO2 concentrations, Mini-Cog, and Apolipoprotein E4 (APOE4) genotype using Spearman's correlation.

RESULTS: Among 44 women (mean age, 74.3 \pm 2.8 years) included in the study, 20.5% (9/44) had only elementary school education. Twelve (27.3%) subjects scored <3 in Mini-Cog test, and 14 (31.8%) carried one APOE ϵ 4 allele. The median concentration (interquartile range) of PM2.5, O3, and NO2 from 2014 to 2018 were 23.5 (2.99), 23.0 (3.17), and 25.5 (2.25) µg/m3, respectively. Positive correlation, albeit mild, was noted between the degree of PM2.5 exposure and SUVR of anterior cingulate cortex (r=0.322, 95% CI=0.04 to 0.59; P=0.043), independently of age and APOE4 genotype. No association was found between other brain areas and pollutant concentrations or Mini-Cog score.

CONCLUSIONS: Chronic ambient PM2.5 exposure can lead to increased β-amyloid neuritic plaque

deposition in the anterior cingulate cortex of elderly women. The region is in close proximity to the olfactory bulb and plays a unique role in cognition and emotion.

Keywords: Neurodegenerative outcomes, Exposures

Phthalate exposure was associated with the risk of depressive symptoms in the US adult population

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BACKGROUND AND AIM: Our study aimed to examine the association between phthalate exposure and the risk of depressive symptoms in the US adult population.

METHOD: We used data from the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2018 to analyze the association between urinary phthalates and depressive symptoms. We included 11 urinary phthalate metabolites in our analysis and used the 9-item Patient Health Questionnaire (PHQ-9) to assess the presence of depression among study participants. Participants were divided into quartiles for each urinary phthalate metabolite, and we evaluated the association using a generalized linear mixed model with a logit link and binary distribution.

RESULTS:A total of 7340 participants were included in the final analysis. After controlling for potential confounders, we found a positive association between the molar sum of di(2-ethylhexyl) phthalate (DEHP) metabolites and depressive symptoms, with an odds ratio of 1.30 (95% CI = 1.02-1.66) for the highest compared to the lowest quartile. In addition, we found positive associations of mono(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP) and mono(2-ethyl-5-carboxypentyl) phthalate (MECPP) with depressive symptoms, with odds ratios of 1.43 (95% CI = 1.12-1.81, p for trend = 0.02) and 1.44 (95% CI = 1.13-1.84, p for trend = 0.02), respectively, for the highest compared to the lowest quartile.

CONCLUSIONS: In conclusion, this study is the first to identify a positive association between DEHP metabolites and the risk of depressive symptoms in the general adult population in the United States.

Keywords: Phthalates, Mental health outcomes, Environmental epidemiology
FP-204[Chemical exposures » Heavy metals]

Analysis of Urinary Metal Levels in Taiwan's 2019 Human Biomonitoring and Epidemiology Study

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BACKGROUND AND AIM: Human beings are often exposed to metals and metalloid elements in our daily life. Human biomonitoring can be used to determine internal aggregate exposures to chemicals from all different sources and through all exposure routes. The aim of this study was to establish the concentration distributions of heavy metals in urine among the general population in Taiwan. Compared with the National Health and Nutrition Examination Survey (NHANES), find out the heavy metals with higher concentration in Taiwan human biomonitoring.

METHOD: The research population was collected nationwide in 2019, recruiting a total of 1748 subjects aged 7 and over, collecting urine samples and conducting questionnaire interviews. The study design was a cross-sectional study with a stratified multistage cluster sampling design. The concentrations of 20 environmental heavy metals were analyzed by inductively coupled plasma mass spectrometry (ICP-MS).

RESULTS: The metal concentration distribution in urine presents the geometric mean concentration of 20 heavy metals and the 25%, 50%, 75% and 95% concentration value. It was found that the concentration of zinc was higher in men (358.3 μ g/g creatinine) than in women (357.0 μ g/g creatinine), and the concentrations of other heavy metals were higher in women. The concentration distribution of heavy metals in each age group (07-12 years old, 13-18 years old, 19-39 years old, 40-64 years old, and over 65 years old) showed a U-shaped trend, and the concentration of each age group was significantly different.

CONCLUSIONS: This study established the concentration distributions of heavy metals in urine among the general population in Taiwan. Seven heavy metals, including arsenic, barium, cadmium, chromium, manganese, nickel, and lead, were found to be present in the urine of the general population in Taiwan at higher concentrations than NHANES. The contribution and impact on heavy metal concentrations will be further discussed from environmental factors and main sources of dietary exposure.

Keywords: exposure assessment, environmental epidemiology

Reasons for wanting to be a dental surgeon as a career

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BACKGROUND AND AIM: In Bangladesh, more than 80% of the population has one or more oral and dental diseases.

METHOD: Its A descriptive type of cross-sectional survey and respondents were selected purposively. Semi-structured questionnaires were developed and delivered to the respondent. A total of 78 respondents were selected purposively from the old and new batches of 1st year BDS students. The survey was conducted on the period from 3rd February to 1st July 2022 at Marks Medical College Dental Unit, Mirpur-14, Dhaka with verbal consent from the principal of the institution. RESULTS: The respondents sex distribution, females were 80.77%. 51% of respondents were from Dhaka, Bangladesh and 27% came from the periphery. Fathers 25.6% and mothers 11.5% have postgraduation degrees. Graduation done by mother 24.4% and fathers 55.1% of the respondent's. 76.9% of respondents' fathers were service holders, 16.7% were businessmen and 15.4% mothers of the respondents had done a job, and 83.3% were homemakers. 75.6% did not get a chance at Gov. University and others got a chance at Government University among them, 36.8% did not get admission due to distance from Dhaka. 26.3% of replied subjects were not so good, and 31.6% mentioned, their family not supported them to study there. 18% of respondents responded that becoming a doctor was their aim in life, whether it may be MBBS or BDS. 53.8% of respondents have admitted to the BDS course to fulfill their parent's dream and 20.5% of participants reveled that BDS course is Less costly.

CONCLUSIONS: Every person has an aim in life. But sometimes they have been forced to do another thing that they are not want to be. So parents should understand their children's desires.

Keywords: Dental surgeon, career, choice.

Relationship of fungal spore richness, evenness, and abundance in school air with surrounding forest

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BACKGROUND AND AIM:Fungal spores are important aeroallergens linked to childhood asthma and other respiratory diseases. Next-generation sequencing-based methods have enabled the detailed study of airborne fungal spore diversity, including taxonomic richness (*i.e.*, the number of unique taxa present) and evenness (*i.e.*, the distribution of relative abundance among taxa). In a previous study, we found that the amount of forest cover surrounding schools influences fungal spore richness in classroom air in a season-dependent manner. This study aimed to examine the relationship of fungal spore richness, evenness, and abundance in school air with surrounding forest.

METHOD:Air was passively sampled for 24 h in up to 5 classrooms in 44 schools throughout Taiwan from December 2021 to April 2022, and DNA was promptly extracted in a sterile environment. A universal fungal DNA barcode (ITS2) was PCR-amplified from classroom DNA, and libraries were constructed with purified amplicons at equimolar amounts for each school and sequenced using Illumina MiSeq v3. Fungal spore equivalents were estimated using SYBR qPCR based on ITS2 copy number. Data were analyzed using R packages DADA2 (taxonomy assigned using UNITE), phyloseq, microbiome, and iNEXT.

RESULTS:School air had 4.4E+03 to 3.6E+05 mean fungal spore equivalents/m2/h. Camargo's evenness ranged from 0.04 to 0.28, and 93 to 280 genera were observed with sufficient sample coverage. Evenness and richness had a moderate positive association (Spearman's r = 0.5). The percentage of surrounding forest cover in a 10-km buffer was a significant positive predictor of both richness and evenness, although schools with high abundance had similarly low evenness regardless of the amount of surrounding forest.

CONCLUSIONS: Fungal spore richness and evenness are positively related in school air and similarly influenced by surrounding forest, but only evenness is influenced by abundance. Hence, evenness may be a useful indicator of airborne fungal spore exposure independent of richness.

Keywords: Microbes/Microbiome, Exposure assessment, Air pollution, Green space

FP-207[Outcomes » Childrens environmental health]

Prenatal Mitochondrial DNA Copy Number Predicts Childhood Verbal Memory

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BACKGROUND AND AIM: Mitochondrial dysfunction, indicated by reductions in mitochondria DNA copy number (mtDNAcn) has been linked to cognitive decline associated with neurodegenerative illness. However, few studies have examined the role of mtDNAcn in healthy cognitive development. We investigate associations between mtDNAcn measured in cord and child blood samples and children's memory and learning. We hypothesized that increased cord and childhood mtDNAcn would be associated with higher cognitive performance.

METHOD:Participants were drawn from a prospective longitudinal birth cohort following African American and Latinx children in New York City (N=342). Duplexed qRT-PCR quantified mtDNAcn relative to nuclear DNA collected at birth from umbilical cord blood and from children age 5-7. The Children's Memory Scale (CMS), administered to children ages of 9-14, measured immediate visual and verbal memory as well as attention/concentration. Multivariable linear regression models evaluated associations between mtDNAcn at birth or childhood and memory performance (Verbal Immediate Index; Visual Immediate Index; Attention/Concentration Index scores). We also examined associations between change in mtDNAcn (cord blood to childhood) with CMS Index scores. Models were adjusted for sex, ethnicity, maternal age, maternal BMI, education status, maternal hardship, and age at CMS assessment.

RESULTS: Analyses showed a significant positive association between cord blood mtDNAcn and Verbal Immediate Memory Index (β =10.77, 95% CI [2.31, 19.22], p=0.01) but not Visual or

Attention/Concentration Indexes. There were no significant associations between childhood mtDNAcn or mtDNAcn change and CMS Index scores. No effect modification by sex was observed and adjustment of models for cell type composition did not alter our findings.

CONCLUSIONS:Our results provided novel data suggesting that prenatal mtDNAcn may be a potential biomarker of children's verbal memory. Our findings also suggest that mtDNAcn may be a marker of healthy child development, in contrast to previously documented reductions in mtDNAcn as a marker of cognitive decline in the elderly.

Keywords: Molecular epidemiology, Neurodevelopmental outcomes

The Power of Metatranscriptomics: A New Frontier in TB Surveillance in Low and Middle Income countries

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BACKGROUND AND AIM:Tuberculosis (TB) is a significant public health issue globally, especially in low- and middle-income countries (LMICs), including Africa. Multidrug-resistant tuberculosis (MDR-TB) is a major concern, and accurate surveillance data on TB/MDR-TB is essential for tracking changes in resistance, setting national and global priorities, assessing the impacts of interventions, identifying new kinds of resistance, and investigating outbreaks of resistant pathogens. The aim of this study was to use a metatranscriptomic approach to profile the diversity of Mycobacterium tuberculosis complex (MTBC) species and related functional genes in domestic sewage samples from six African countries to determine the prevalence of MTBC species, antibiotic-resistant genes associated with TB drug resistance, and associated virulence genes, and to assess the feasibility of metatranscriptomics as an additional surveillance option for community TB/MDR-TB.

METHOD: We collected wastewater samples from Ghana, Nigeria, Kenya, Uganda, Cameroon and South Africa from untreated and treated wastewater (post-chlorination). Total RNA was extracted from wastewater samples and multiplexed paired-end libraries were prepared using the KAPA mRNA HyperPrep Kits (Roche) following the manufacturer's instructions and sequencing by the NovaSeq 6000 system (Illumina).

RESULTS: The study found that MTBC species were more abundant in untreated than treated samples, with Mycobacterium tuberculosis and related variants being the most common compared to other MTBC species. M. tuberculosis and related variants (BT2, PanR (0203,0704,0909,1007,1101), TRS29, Kurono, CCDC5180) were most abundant compared to other MTBC species (M. africanum, M. bovis [BCG Korea & Tokyo variant], M. caprae, M. microti found. Antibiotic-resistant genes associated with TB drug resistance and associated virulence genes were detected (alr, pncA, gyrA, InhA, rpoB genes). Functional annotation showed high gene expression associated with virulence in M. tuberculosis complex spp, particularly M. tuberculosis.

CONCLUSIONS: The findings suggest that metatranscriptomics applied to domestic sewage could be an affordable surveillance option for community TB/MDR-TB where early case detection will mitigate disease spread.

Keywords: Wastewater-based epidemiology, Tuberculosis surveillance, metatranscriptomics

FP-209[One health » Public health]

Comparison of Bactericidal Efficacy among Cleaning Agents for Residence

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BACKGROUND AND AIM: During COVID-19 situation. Room cleaning is necessary in order to control and prevent a hotbed of germs from this pandemic. The floor of the residence is the part that needs to be cleaned which must be cleaned regularly otherwise it will accumulate dust and germs. This study was to compare different cleaning products in terms of Bactericidal Efficiency for the Residence. METHOD: The experiment was set up to investigate the efficacy of cleaning agents. Five different cleaning products (laundry detergent liquid plus Sodium hypochlorite 6%, disinfectant products plus alkyl dimethyl benzoyl ammonium chloride 2.4%, disinfectant products plus Chloroxylenol 4.8%, Floor Cleaner product plus disinfectant Sodium laureth sulfate 0.7%, and distilled water have been used for Negative Control. Bactericidal activities were evaluated against seven bacteria species, Staphylococcus spp., Lactobacillus, P. Aeruginosa, B. Licheniformis, B. Cereus, B. fragilis and Bacillus spp., by Disc. Diffusion Method. The tests were conducted before and after the cleaning with tested agents in the morning and in the evening. All plates were collected by Microflow following NIOSH Method 0800. RESULTS: The results revealed that the efficacy of bactericidal properties was significantly different among each type of cleaning products both before and after cleaning. (p<0.05). When analyzing the average number of microorganisms, it was found that disinfectant products plus Chloroxylenol 4.8%, disinfectant products plus alkyl dimethyl benzoyl ammonium chloride 2.4%, laundry detergent liquid plus Sodium hypochlorite 6%, Floor Cleaner product plus disinfectant Sodium laureth sulfate 0.7%, and distilled water were the destruction of total bacteria., respectively.

CONCLUSIONS: The disinfectant products plus chloroxylenol 4.8% is the highly efficient bactericide for cleaning and safety for humans. It should be advised to use in the home.

Keywords: Microbes, Exposures

Association of cord blood levels of lead, arsenic, and intelligent quotient among 14 years old adolescents: Chitwan Birth Cohort Study

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BACKGROUND AND AIM: On a birth cohort living in Chitwan Valley, lowland Nepal, we have previously reported inverse associations between in utero levels of lead (Pb), arsenic (As) and neurodevelopment at birth measured by Brazelton Neonatal Behavioral Assessment Scale, third edition (NBAS III). Follow-up of the same cohort at 6, 24-and 36-month-old infants was conducted using the Bayley Scale of Infant Development, Second Edition (BSID II). Postnatal raising environment was evaluated using Home Observation for Measurement of Environment (HOME) scale. Unlike the NBAS conducted for newborns, none of BSID II cluster scores in 6, 24 and 36-months-old infants were associated with cord blood levels of Pb, As, and Zn. Only the total HOME score was positively associated with mental development scale (MDI) score and Psychomotor Development Index (PDI) evaluated using BSID II. METHOD: Now, same birth cohort (n=74) is followed after 14 years. The associations between in utero levels of Pb and As and intelligence quotient (IQ) evaluated by Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI II) was evaluated by multiple regression analysis. RESULTS: Association between in utero levels of Pb and As were consistently negatively associated with full-scale IQ (β = - -0.160 and -0.052), full-scale IQ-2 subtests (FSIQ-2) (β =-0.166 and -0.073), verbal comprehension index (VCI) (β =-0.114 and - 0.173), and perceptual reasoning index (PRI) (β =-0.165 and 0.090), respectively. Yet, none of the associations reach statistical significance. Association was strong and consistent between mothers' education and all four measures of WASI II (i.e., FSIQ, FSIQ-2, VCI and PRI). In addition to maternal education, annual income, reported/self rated growth environment, self rated health and body mass index (BMI) indicated consistent direction (positive) in association with WASI II measures and reported GPA by participants. CONCLUSIONS: These findings highlight the importance of in utero exposure and growth environment in developing countries like Nepal.

Keywords: Chitwan Birth Cohort Study of Nepal, In Utero Exposure of arsenic and lead, intelligence quotient (IQ), Wechsler Abbreviated Scale of Intelligence

Advancing Exposome Research for ADRD to Enable Precision Environmental Health Approaches to Treatment and Prevention

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BACKGROUND AND AIM: The complexity and heterogeneity of Alzheimer's Disease and Related Dementias (ADRD) are a consequence of a dynamic interaction between genes and the environment over the lifespan and a growing body of epidemiologic, genomic and mechanistic research pointing to a significant contribution of various environmental factors (i.e. the exposome) on ADRD risk and resilience.

METHOD: The National Institute on Aging (NIA) has embarked on a series of initiatives towards a Precision Environmental Health approach to ADRD risk reduction and disease prevention and to advance our understanding of ADRD etiology through the next-generation of Environmental Health research occurring at the intersection of G (epigenome/genome) perturbations x E (environmental exposures) x D (data-omics i.e. exposome, epigenome, genome, proteome, metabolome). Additionally, NIA supports the development of novel artificial intelligence / machine learning (AI/ML) approaches to identify patterns and relationships across large, complex, and disparate datasets to draw meaningful insights into the etiology of complex diseases such as ADRD.

RESULTS: This poster will highlight infrastructure enhancements for exposome research on ADRD including new research opportunities for understanding the mechanisms by which environmental toxicants influence the molecular trajectories of brain aging and ADRD and contribute to health disparities.

CONCLUSIONS:Opportunities for unique collaborations between the environmental and ADRD communities will be presented in addition to research perspectives between the communities and challenges in advancing exposome research to enable a precision environmental health approach to ADRD treatment and prevention. Studying populations in low and middle income countries (LMIC) will be prioritized.

Keywords: Exposome, ADRD, Precision environmental health, Infrastructure, LMIC

The association between alcohol intake and polymorphisms of alcohol metabolism genes and the risk of cognitive impairment

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BACKGROUND AND AIM:As of 2019 in Taiwan, 18.45% of people over 65 years old have cognitive impairment. The National Health Administration's National Health Interview Survey also pointed out that about 8.43 million people over 18 years old have the habit of drinking. Studies have suggested that cognitive impairment may be affected by alcohol and the genes involved in alcohol metabolism, but there is a lack of relevant research in Taiwan. We aimed to observe the association between alcohol intake and polymorphisms of alcohol metabolism genes and the risk of cognitive impairment. METHOD:We collected 22,779 short-term intelligent test (Mini-Mental State Examination, MMSE) data from the Taiwan Biobank for the elderly population aged 60 to 70. The total score of MMSE ranges from 0 to 30, and the cognitive impairment is determined to be less than 24. The personal drinking habit was obtained from the health behavior questionnaire, and the genetic polymorphisms of *ALDH2* rs671, *ADH1B* rs1229984, and *ADH1C* rs1693482 were also obtained from the database. The logistic regression models were used to estimate the association between genotype and drinking and the risk of cognitive impairment, and all the statistics analysis were performed using SAS version 9.4 software.

RESULTS:Although no significant association between alcohol consumption and *ADH1B* rs1229984 and *ADH1C* rs1693482 genotypes and cognitive impairment risk, *ALDH2* rs671 genotype was significantly associated with cognitive impairment risk (P=0.0063). After covariates adjustment, both the dominant model (OR=1.164, 95% CI=1.052-1.288) and recessive model (OR=1.204, 95% CI=1.009-1.436) of *ALDH2* rs671 polymorphism were significantly associated with cognitive impairment risk. However, alcohol consumption did not significantly interact with the three polymorphisms of alcohol metabolism genes to affect cognitive impairment risk.

CONCLUSIONS:Our results suggest that alcohol consumption is not a risk factor of cognitive impairment, and *ALDH2* rs671 polymorphism may serve as a biomarker for risk prediction of cognitive impairment.

Keywords: Neurodegenerative outcomes, Molecular epidemiology, Food and nutrition, Public health

The Impact of Sleep Duration on Health-Related Quality of Life in Korean Workers: Explainable AI (XAI) Investigation

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BACKGROUND AND AIM: Health-related Quality of Life (HRQoL) is a measure of the physical, emotional, and social aspects of an individual's life directly influenced by their health condition. While various instruments have been developed to measure HRQoL, HINT-8 (Health-related Quality of Life Instrument with 8 Items) was recently developed as a more suitable instrument for Korean characteristics. This study employed machine learning techniques to identify key features that affect HINT-8 scores among Korean workers and to explore the association between sleep duration and HINT-8 scores. So we aimed to findout the factors that influence HRQoL in this population. METHOD:Data was obtained from the eighth Korea National Health and Nutrition Examination Survey, conducted by the Korea Ministry of Health and Welfare and the Korea Centers for Disease Control and Prevention, with 2489 Korean workers. Permutation feature and accuracy was calculated by using Cat Boost model. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) of were calculated after adjusting for socioeconomic status, by using logistic regression model.

RESULTS:Using permutation feature with Cat Boost model, our study identified education (0.034 ± 0.013), shiftwork (0.012 ± 0.008), sleep duration (0.010 ± 0.013), and occupation (0.006 ± 0.015) as the key features with high weights. We found that short sleep duration (aOR 1.27, 95% CI 1.05 - 1.54) was significantly associated with lower HRQoL, when compared to a reference sleep duration of 7-8 hours. The accuracy of the train set was 0.831, and the accuracy of the test set was 0.749 among the study population.

CONCLUSIONS:Our study contributes to the body of knowledge on HRQoL among Korean workers, highlighting the crucial role of sleep duration, education, shiftwork, and occupation in determining HRQoL. The findings may inform the development of targeted interventions to improve HRQoL among this population and promote overall well-being.

Keywords: Health related quality of life (HRQoL), Sleep duration, Occupatinal health, Explainable artificial intelligence

Temperature effects on cerebrovascular disease: a nationwide study using ambulance call data in Japan

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BACKGROUND AND AIM: Cerebrovascular diseases are the leading cause of morbidity and mortality. Meteorological factors have been shown to be a key aspect in causing this deadly disease. However, it is not clear whether the impacts of those factors are different in background meteoritical conditions. This study aims to evaluate the temperature effects on cerebrovascular disease in Japan and show the regional characteristics of those associations.

METHOD: Ambulance call data of cerebrovascular disease (ICD:10: I60-I69) between 2015 and 2019 in Japan except for Tokyo was obtained from Fire and Disaster Management Agency. We used a time-stratified case-crossover design and calculate the prefecture-specific Odds ratios (ORs) by using conditional logistic models. We then calculated pooled ORs in each geographical region and the entire Japan.

RESULTS:Decreasing the temperature (1°C) was significantly associated with an elevated risk of cerebrovascular disease. This association was observed shortly after decreasing the temperature (pooled adjusted OR of Japan in Lag0: 1.018 (95% CI: 1.017⁻¹.019)). Similar trends were observed for three days. In the regional-based pooled analysis, slightly higher impacts were observed in the South-West area [e.g. 1.021 (1.018⁻¹.025) in the Chugoku region) than North-East area [e.g. 1.016 (1.014⁻¹.019). These associations were also observed in the summer season. Meanwhile, during extremely hot days (above 90% tile), with increased temperature (1°C) was also associated win an elevated risk of cerebrovascular disease. These associations were observed 5-6 days after the event [1.014 (1.002⁻¹.027) lag5]. These associations were particularly observed in the Kanto area, but geographical differences were still not clear.

CONCLUSIONS: Increasing risks of cerebrovascular disease were observed shortly after the temperature decrease and 5 might be different in background meteorological conditions. This study is supported by Pfizer health research foundation 2019 and JSPS KAKENHI Grant Number JP21K10496.

Keywords: Environmental epidemiology, Big data, Cerebrovascular diseases

Strengthening regulation of PFAS in Food Packaging: Perspectives from the Philippines

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BACKGROUND AND AIM: We sought to determine the presence and extent of the regulations in place for per- and polyfluoroalkyl substances (PFAS) in food packaging standards, trade on food packaging, waste management, locally and internationally, and provide recommendations to strengthen and bridge the gaps within the local policy landscape.

METHOD: We conducted a scoping review of Republic Acts and policy documents from relevant Philippine government agencies, including the Food and Drug Administration (FDA) and Department of Environment and Natural Resources (DENR). We reviewed international guidelines and international best practices on PFAS regulation from news articles and original research articles from PubMed, the Cochrane Library, and Scopus.

RESULTS: Existing standards and regulations for PFAS are limited both in the local and international context. Food packaging is primarily regulated by the FDA, and specific policy issuances that tackle food manufacturing and packaging safety requirements do not explicitly mention PFAS. There is also an absence of regulation and supporting guidelines on the monitoring and surveillance of PFAS in waste management chains and the environment at large. In the international scene, best practices and guidelines are publicly available. While there has been a call to action, these remain especially weak among Asian countries despite being a major source of food packaging manufacturing products. CONCLUSIONS:Including PFAS as an issue of concern in national agendas for health and research can help develop and strengthen policies and guidelines for its usage, monitoring, and disposal. Support for local research projects and initiatives focused on PFAS monitoring, measurement, and investigating impacts to health and environment would help find alternatives and ways to mitigate existing or potential effects. Through time, the Philippines can also transition from using alternative products to a complete ban of PFAS substances altogether, to avoid further harm to health and the environment.

Keywords: Food/nutrition, Public health, Policy research

Associations between phthalate metabolites and phenol concentrations measured in urine with food consumption among Swedish adolescents

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BACKGROUND AND AIM: Many studies use single spot samples of urine when investigating relations between phthalate and phenolic substance exposure and health outcomes. To identify possible confounding factors in such studies, we analysed associations between substance concentrations in urine and demographic/lifestyle determinants, and the food consumption of the Swedish adolescents during the entire day prior to urine sampling.

METHOD:The study population came from the Riksmaten Adolescent 2016-17 national dietary survey, ages 11-21 (N=983). Up to 29 substances, including phthalate metabolites, DiNCH-metabolites, phosphorus flame retardants (PFRs), bisphenols, metabolites of polycyclic aromatic hydrocarbons (PAH), two insecticide metabolites, triclosan, the preservative 3-tert-Butyl-4-hydroxyanisole (BHA) and benzophenone-3 were analysed in spot urine samples using LC-MS/MS. Two sets of log-linear regression models were used to identify associations of density-adjusted concentrations with base determinants and food consumption.

RESULTS:Age, gender, adolescent/maternal birth country and rural/urban living were the most predominant significant determinants. Consumption of milk/sour milk/yoghurt, processed meat, cheese, fish and vegetables during the day prior to sampling were predominantly associated negatively with many of the analysed urine substances. One food covariate, ice-cream consumption, was positively associated with concentrations of the metabolites of different phthalates particularly, diethyl phthalate (DEP), dibutyl phthalate (DBP), di-2-propylheptyl phthalate (DPHP), di-2-ethylhexyl phthalate (DEHP), the PFR tri-2-butoxyethyl phosphate (TBEP), and the preservative BHA. Sampling month was significantly associated with metabolites of several phthalates, PAHs and TBEP, with increased adjusted mean concentrations in most cases for November and December. The weekday of sampling was significantly associated with 18 of the measured substances with varying trends. CONCLUSIONS:We identified several demographic/lifestyle factors and food consumption variables that may be confounding factors in studies of relations between rapidly excreted toxic substances in urine and health effects when only using a spot urine sample in exposure assessment.

Keywords: phenol, phthalates, adolescents, sampling-time, food-consumption

Effect modification by gestational weight gain in the association between maternal exposure to heavy metals and birthweight

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BACKGROUND AND AIM: The association between blood level of heavy metals in pregnant women and fetal growth can be mediated by gestational weight gain (GWG). We assessed serially mediation by GWG and blood heavy metal in late pregnancy in the path linking early blood heavy metal levels and fetal growth using a prospective cohort of pregnant mothers.

METHOD: We analyzed 4,712 term singleton live births from the participants of the Korean CHildren's ENvironmental health Study (Ko-CHENS), a prospective cohort study conducted in 12 regional centers of South Korea from 2015 to 2018. Maternal blood lead (Pb), mercury (Hg), and cadmium (Cd) levels were measured in early and late pregnancy and neonatal birthweight and height were recorded. We fitted a path analysis model that includes the direct effect of early metal level on neonatal anthropometric measures and the indirect effect of early metal level on neonatal anthropometric measures involving GWG and late metal level.

RESULTS:In single exposure models, late lead (adjusted coefficient = -15.470, P = 0.036) and late cadmium (-24.150, P = 0.004) were associated with lower birthweight. Serial mediation model showed different mediation features across metals and anthropometric measures. For early lead and birthweight z-score, the total negative effect of early lead (-14.787, P = 0.036) was mediated by the late lead level (-7.417, P = 0.049). For the model of early mercury level and birthweight, the indirect effect involving GWG was positive while the direction of total effect was toward negative (-8.519, P = 0.301).

CONCLUSIONS: This study provides an insight in understanding the causal pathway from intrauterine exposure to heavy metals to fetal growth mediated by GWG and blood metal levels in the late pregnancy.

Keywords: metal, pregnancy, birthweight

Retention of medical doctors in rural area in Bangladesh: challenges and way out

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BACKGROUND AND AIM: Bangladesh faces significant challenges in providing adequate healthcare services to rural communities due to physician shortages, unequal workforce distribution, and high attrition rates. Despite government recruitment efforts, poor retention of medical doctors in rural areas remains a major obstacle to efficient healthcare delivery. This study intends to find and investigate challenges and barriers to rural physician retention in Bangladesh. METHOD: A concurrent mixed-method approach will be employed in randomly selected Medical College Hospitals, District Hospitals, Upazila Health Complexes, and Union Health Sub-Centers, from all eight administrative divisions of Bangladesh. Quantitative data will be collected from the medical doctors working in rural and urban government health facilities, whereas qualitative data will be from physicians, government officials, professional and local leaders, and journalists. A document review will be done to understand the physician retention rate and factors influencing the retention. In the quantitative part, a self-administered questionnaire includes the well-being index, job satisfaction scale, and work environment scale to measure the doctor's mental well-being, job satisfaction, and working environment, respectively. Qualitative data will be collected through in-depth (20 physicians) and key informant interviews (30 other professionals). The Institutional Review Board, Bangabandhu Sheikh Mujib Medical University, Dhaka, approved the protocol.

RESULTS: Multiple logistic regression and structural equation modeling will be used to identify predictors and understand their interrelationships. We will do manifest content analysis to identify codes, categories, and themes to capture medical doctors' challenges in rural areas. We will utilize triangulation to ensure the validity of findings obtained from various data sources.

CONCLUSIONS: The study will help policymakers develop and implement targeted healthcare service policies to improve healthcare quality and access nationwide.

Keywords: Physician retention, Healthcare workers, Health care delivery, Rural area, Bangladesh

Association between PM2.5, PM10, SO2, and O3 Exposure and Prehypertension: A Systematic Review and Meta-Analysis

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BACKGROUND AND AIM:Prehypertension is a medical condition characterized by elevated blood pressure levels, which may lead to hypertension and an increased risk of cardiovascular disease. Despite numerous studies exploring the connection between air pollution and hypertension, there was a lack of studies to comprehensively investigate the association between air pollution and prehypertension. Therefore, we conducted a meta-analysis to assess the relationship between air pollution and prehypertension in the general public.

METHOD: We searched PubMed and Embase for relevant studies published until March 26, 2023. A total of 4 studies reporting OR with 95% CI for the association between air pollution and the risk of prehypertension were included, with a total of 44660 individuals involved. Meta-analysis was performed using STATA.

RESULTS:The analysis revealed significant positive correlations between prehypertension and exposure to O_3 and SO_2 , with the odds ratios of 1.17 (95% CI: 1.07-1.27, p = 0.50) and 1.15 (95% CI: 1.03-1.29, p = 0.26), respectively, per IQR of exposure. As to particulate matter pollutants, it showed that the risk of prehypertension was not statistically associated with the PM10 and PM2.5 exposure, with the odds ratios of 1.10 (95% CI: 0.94-1.29, p = 0.11) and 1.01 (95% CI: 0.95-1.08, p = 0.30), respectively, per IQR of exposure.

CONCLUSIONS: We conducted this pilot study to find the association between exposure to O_3 and SO_2 pollutants and the risk of prehypertension. Further course of prehypertension to hypertension by air pollution should be concerned. In addition, more evidence was needed to clarify the association between particulate matter exposure and prehypertension.

Keywords: Air pollution, Particulate matter, Ozone, Cardiovascular diseases

Realities of living and perceptions on water quality of an urban slum at Yamuna bank in Delhi: An exploratory study

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BACKGROUND AND AIM: Urban slums at the bank of Yamuna River in Delhi possess more exposure to waterborne disease along with the issues like safe drinking water, sanitation facilities, and healthcare services due to a surge in its population.

The aim of the study was to explore the realities about accessibility and usage patterns of available water sources with concomitant water testing for various contaminants.

METHOD:An exploratory qualitative study was conducted to explore sources of water supply, perceptions about the water quality and related health issues among 17 participants living in the vicinity of Yamuna River along with the chemical and microbial analysis of water samples collected from river and hand pumps to understand their contamination profile. Convenience sampling was done to select the participants who were above the age of 18 years living in study area for more than 6 months. River water samples were collected from the centre of river stream and ground water was collected from the hand pumps from different location of the slum to cover the whole area. An interviewer-administered topic guide was used. For water testing of ammonia and E.coli Jal –Tara kit was used. Pesticides contamination was tested in laboratory.

RESULTS:Thematic analysis was done and data was categorized into themes and subthemes. Participants had different perceptions on the quality of available water sources based on odor, taste and transparency of water which determined their usage pattern. Participants also reported various dermatological and gastro-intestinal symptoms. Chemical and microbial testing showed that water sample collected from hand pump located in nearest proximity of river was the most polluted. CONCLUSIONS:Due to the lack of availability and accessibility to clean water people were unable to adhere to hygienic habits. Waterborne symptoms including diarrhea, vomiting, etc. are mostly prevalent among the population living in the proximity of polluted water sources.

Keywords: Water quality, Pesticides, Public Health, Infectious Disease

The Correlation Between School Neighborhood Environment And PM2.5 In Taichung City

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BACKGROUND AND AIM:Air pollution is one of the biggest health and environmental issues worldwide, and children are more vulnerable to its impacts than adults. Particulate matter (PM) is a common indicator of air pollution, and many studies have found that exposure to PM may have negative effects on children's health. However, previous research has focused mainly on assessing PM2.5 concentrations through aerodynamic sampling or satellite remote sensing to discuss health-related issues, with less attention given to the impact of environmental factors on PM2.5. Therefore, this study aims to use unsupervised machine learning to cluster the school environments in Taichung City and analyze their correlation with PM2.5.

METHOD:PM2.5 concentration data for Taichung City schools were obtained from the EDIMAX AIRBOX open data provided by the Networked Research Laboratory and were organized into annual average concentrations. The normalized Difference Vegetation Index (NDVI) was used to estimate green spaces on school campuses. Other environmental data (such as the number of factories and bus stops) were obtained from the government's open data platform and standardized. The K-means algorithm was used to cluster 231 elementary schools in Taichung City, and 10-fold cross-validation was applied. Descriptive analysis was performed on the different clusters, and generalized linear models were used to compare the relationships between different environmental factors and PM2.5. RESULTS:The optimal number of clusters is expected to be determined using the Elbow Method. The study found that different school environment characteristics (such as the number of factories, bus stops, etc.) are correlated with PM2.5.

CONCLUSIONS: Different clusters reflect different environmental characteristics of schools, and understanding these characteristics can help improve PM2.5 concentrations and create a better learning environment for students.

Keywords: Particulate matter, Environmental epidemiology, Children's environmental health

FP-222[Air pollution » General]

The impact on air pollution by epidemic prevention policy of COVID-19 in Taipei of Taiwan

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BACKGROUND AND AIM: This study aims to investigate the changes in concentrations of NO2, PM2.5 and PM10 as well as possible influencing factors during the level 3 alert period and outbreak period of the COVID-19 pandemic in Taipei and New Taipei city.

METHOD: Using the monthly average of hourly data from 18 central air quality monitoring stations of the Environmental Protection Administration from 2015 to 2019 for Theil-Sen trend estimation. The data from the same period in 2019 was applied to estimate the predicted concentrations of pollutants during level 3 alert period (May 19,2021 - July 25,2021) and outbreak period (May 19,2022 - July 25,2022). The predicted concentrations of pollutants were further compared with the actual concentrations to calculate the percentage difference. In addition, Google Mobility Trends was used to estimate the changes in the stream of people during study period.

RESULTS:NO2 decreased significantly during the level 3 alert, especially at traffic stations. NO2 significantly decreased 27.3% (95%CI -25.3%, -29.9%). There were no significant changes of NO2 during the outbreak. The concentration changes of PM2.5 was not statistically significant during the level 3 alert. During the outbreak, PM2.5 increased 11.9% (95%CI -0.4%, 23.4%). PM10 significantly decreased 8.4% (95%CI -1.5%, -14.3%) during the level 3 alert, while there was no statistically significant change during the outbreak. Google Mobility Trends indicated that the stream of people only increased in residential area.

CONCLUSIONS: During the level 3 alert, the concentrations of NO2 and PM10 significantly decreased. The impact of changes in stream of human may related to the changes of air pollution during pandemic. In the future, it could clarify the patterns of traffic and stream of people changes during COVID-19 pandemic period to further adjust relevant traffic policies to effectively improve air pollution in the post-epidemic era.

Keywords: COVID-19, Particulate matter, Oxides of nitrogen

Biomass Smoke Exposure and Anthropometric Growth among Children in Rural Guatemala Participating in the RESPIRE and CRECER Prospective Cohort Studies

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BACKGROUND AND AIM: Cooking-related biomass smoke is a major source of household air pollution and an important health hazard in rural regions of low-income countries. Prior studies have associated early-life air pollution exposure with childhood stunting, but less is known for other growth indicators such as underweight and wasting.

METHOD:557 households in rural Guatemala were assigned to three groups that received chimney stoves at different ages (< 3, ~18, and ~57 months) of the study children. Multiple personal CO exposure measurements were combined to estimate children's cumulative CO exposures as a proxy for biomass smoke exposure. Children's height and weight were measured around 5 years old. Height-for-age z-score (HAZ), weight-for-age z-score (WAZ), and weight-for-height z-score (WHZ) were calculated based on the World Health Organization's child growth standards. Two or three standard deviations below a median international reference population were classified as moderate or severe for stunting, underweight and wasting, respectively.

RESULTS:541 children had valid anthropometric measurements, among whom 488 (90.2%) were stunted, 192 (35.5%) were underweight, and none were wasted. No significant difference was found across study groups. A 1 ppm-year higher cumulative CO exposure was associated with 0.02 lower HAZ (95% CI: -0.004, 0.04), 0.005 lower WAZ (95% CI: -0.01, 0.02), moderate stunting (OR = 1.01, 95% CI: 0.92 - 1.13), severe stunting (OR = 1.003, 95% CI: 0.95 - 1.06), moderate underweight (OR = 1.03, 95% CI: 0.98, 1.09) and severe underweight (OR = 1.05, 95% CI: 0.92, 1.16). CONCLUSIONS:Although not statistically significant, we found suggestive evidence that early-life exposure to biomass smoke might be associated with higher risks of underweight among children in rural Guatemala. Biomass chimney stoves might not be effective enough to reduce HAP exposures to levels that benefit childhood body growth. Larger, future studies with clean fuel stoves should be considered.

Keywords: Air pollution, Environmental epidemiology, Children's environmental health, Long-term exposure

Challenges and a Way Forward in Constructing Geospatial Data Pipeline to Assess Health Effects of Environmental-Risk Factors in South Korea

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BACKGROUND AND AIM: There have been dramatic increase of data availability and incredible technological advance for data storage and processing to enhance public health research. These improvements led to emerging interests in data pipeline that comprises the series of steps including transferring raw data from disparate sources, modifying data, storing to a unified database, and constructing analytical platforms. As constructing data pipelines of accumulating genomic data allows understanding genetic risk factors and biological mechanisms, the pipelines of geospatial data can improve our understanding of environmental risk factors and mechanisms in human health. This research intends to investigate challenges to construct the geospatial data pipeline for epidemiological research as a case study in South Korea.

METHOD: This research examined challenges in constructing the pipeline of South Korean geospatial data including various sociodemographic features and physical/built environments. Our investigation specifically focused on 1) data quality and accuracy, 2) processing and management, and 3) privacy and security.

RESULTS: For quality and accuracy, there are spatial data errors resulting from sampling, digitizing and projection, data inconsistency such as different spatio-temporal scales across multiple data sources, and data deficiency derived by technical limitations. In processing and management, we find different types of data including geographic information system files, satellite images, and nongeocoded tables and continuous updates with changes in formats and contents, that makes it difficult to create a unified database. Lastly, publicly-available geospatial data are often available as aggregated data with a coarse spatial scale to avoid privacy concerns which result in the limitations in identifying environmental risk factors.

CONCLUSIONS:Our investigation suggests that we should prioritize not only standardized procedures of data acquisition and processing but also application of efficient workflows in order to construct a geospatial data pipeline.

Keywords: data pipeline, geospatial, heath effects, environmental-risk factors, big data

Exploring the relationship between low carbon behavior drives, behavior intention and actual carbon emissions, from a game design thinking perspective

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BACKGROUND AND AIM: The ecosystem of university campuses, as one of the most important green space in the city, is strongly influenced by the behaviors of the students live there. Theoretically, Understanding students' carbon emissions and promoting low-carbon behavior is an available way to achieve a sustainable campus ecosystem. However, the relationship between low-carbon behavior intention and actual carbon emissions has not been verified. Therefore this study aims to assess users' carbon footprint and collect their low-carbon behavior intention, then discuss the feasibility of reducing actual carbon emission by increasing low-carbon behavior intention. Meanwhile, the study also explores the relationship between users' behavioral motivations and their low-carbon behavioral intentions from the perspective of game design thinking, hoping to build sustainable campuses from the perspective of enhancing students' low-carbon behavior motivations.

METHOD: This study is divided into two parts. The first part collects the daily carbon emission behaviors and low-carbon behavior intention of university students by online questionnaire, and obtains their carbon footprint data through conversion. In the second part, based on low carbon behavior theories, an Octalysis Framework is established to collect students' agreement on the eight core drives of low-carbon behaviors and their low-carbon behavior intention through online questionnaire.

RESULTS:Preliminary findings show that users' actual carbon emission have a significant negative correlation with low-carbon behavior intention, while the stepwise linear regression result (R-squared=0.672) shows that meaning, accomplishment and scarcity have a significant positive impact on users' low carbon behavior intention.

CONCLUSIONS: This work contributes to confirming the correlation between low-carbon behavior intention and actual carbon emissions, and proposes an effective model to predict low-carbon behavior intention through behavior motivation. This study is also an effective attempt of game design thinking in understanding pro-environment behavior motivations and provides new ideas for achieving a sustainable campus ecosystem.

Keywords: Ecosystem health

FP-226[Air pollution » Other (to be specified with keywords in the keywords section)]

Anemia Prevalence and Ambient Air Lead Levels in Taiwan: A Before and After Comparison of the Leaded Gasoline Ban

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BACKGROUND AND AIM:Lead exposure can adversely affect many physiologic functions of human, and it was associated with anemia risk. Due to the adverse health effects of lead exposure, the governments worldwide put forward the regulation to decrease lead emissions. Therefore, the leaded gasoline was banned in Taiwan in 2000. The introduction of lead-free gasoline resulted in a decrease in air lead levels and a decrease in average blood lead levels consequently. My study aimed to investigate the differences of prevalence of anemia and ambient air lead level before and after the ban of leaded gasoline in Taiwan.

METHOD: The study population would be adults aged from 19 to 64. Data of hematological indicators, such as hemoglobin level, was obtained from Nutrition and Health Survey in Taiwan during 1993-1996 and 2004-2008. Anemia was defined using a strict cut-off of <13.0 g/dl in men and <12.0 g/dl in women. And the ambient air lead levels of years were extracted from Environmental Protection Administration in Taiwan.

RESULTS: The ambient air lead levels in Taiwan have been decreasing from 1998 to 2021. Furthermore, among adults aged from 19 to 64 that included in this study, prevalence of anemia (12.4%) in 2005-2008 was lower than the prevalence (13.5%) in 1993-1996.

CONCLUSIONS: The prevalence of anemia was decreased among adults aged from 19 to 64 included in this study after the ban of leaded gasoline. The potential confounding variables are considered and the further analysis will be conducted. The results of this study can provide evidence of the improvement of anemia risk after the ban of leaded gasoline and help the authorities to evaluate the impact of the environmental regulations.

Keywords: Air pollution, Heavy metals, Policy and practice

FP-227[Chemical exposures » Endocrine disrupting chemicals]

Using Silicone Wristband to Estimate the Concentrations of UV Filters in Indoor Environment

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BACKGROUND AND AIM:Nowadays, UV filters are widely used in the world. They are added to personal care products, sunscreens, cosmetics, and so on to protect human skin. Therefore, most people worldwide are exposed to UV filters via dust, air, and water, including males, females, babies, and all ages. As we know, UV filters exposures have many adverse effects, such as skin irritation, endocrine disruptors, phototoxicity, and decreased vitamin D synthesis. The exposure routes of UV filters include inhalation, skin absorption, and ingestion. Hence, a tool that can obtain the concentrations of UV filters in multi-environmental media will greatly benefit exposure assessment. Recently, using silicone wristbands has been an excellent way to sample because there are lots of advantages like cheap, non-invasive sampling, long-term exposure assessment, ease to wear, and present personal exposure. Thus, the aim of this study aim is to use the silicone wristband to take air samples and convert them into gas-phase concentrations, followed by establishing the correlations between air and dust concentrations of UV filters indoors.

METHOD: After sampling, the silicone wristband was divided into pieces, followed by solvent desorption and analysis with Gas Chromatography-Tandem Mass Spectrometry (GC-MS/MS).

RESULTS: The findings showed that various UV filters, including benzophenone-3 (BP-3),

benzophenone-8 (BP-8), homosalate (HMS), octyl methoxycinnamate (OMC) and butyl

methoxydibenzoylmethane (BMDM), were determined at different indoor environments. The estimated gas-phase concentration from the silicone wristband was used to find the relationship between air and dust samples. Temperature, wind speed, and photodegradation might affect the correlations between air and dust concentrations.

CONCLUSIONS: The relationship between the concentrations of UV filters in the air and dust was established. Chances are that by using only the silicone wristbands to take air samples, the exposures of UV filters in the indoor air and indoor dust can be assessed simultaneously in the future.

Keywords: Chemical exposures, Endocrine disrupting chemicals, Exposure assessment

Effect of residential environment on children's allergic diseases in the Greater Taipei area

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BACKGROUND AND AIM: In recent years, the prevalence of allergic diseases in children has been increasing, affecting their quality of life. To prevent the development and exacerbation of allergic diseases in children, this study aims to evaluate the household environmental characteristics and allergen levels and their impacts on allergic diseases in children in the Greater Taipei area. METHOD: The participants were recruited from an ongoing birth cohort study, Longitudinal Examination Across Prenatal and Postpartum Health in Taiwan. Structured questionnaires were used to collect information on the participants' demographic factors, health conditions, and household environmental status. Environmental sampling was performed to assess indoor allergens and important pollutants at participants' homes. Multiple regressions were used to examine the correlation between allergic diseases and household environmental factors.

RESULTS:A total of 108 households were recruited in this study. The mean concentrations of air pollutants were below Taiwan's Indoor Air Quality Standards. The levels of total volatile organic compounds, formaldehyde, ozone, and carbon dioxide in some households exceeded the standards due to recent renovation, the presence of pollutant sources, and insufficient ventilation. The prevalent fungal spores in the air and children's bed dust were ascospores, Aspergillus/Penicillium,

Cladosporium, and basidiospores. Aspergillus/Penicillium had the highest concentration in the living room and children's bed dust. According to the regression analysis, fungal spores and dust mite allergen (Der p 1) in children's beds, airborne fungal spores, and PM10 adversely impacted children's allergic diseases.

CONCLUSIONS: The results of this study indicate that household pollutants can affect children's health. Regular cleaning and proper ventilation may reduce pollutant exposure and the health risk of children.

Keywords: Built environment, Children's environmental health, Environmental epidemiology, Exposure assessment, Microbes

Efficacy of Portable Air Purification on Public Buses: A Pilot Study

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BACKGROUND AND AIM: High concentrations of fine particulate matters (PM2.5) has been frequently reported in public transit systems and can cause adverse health effect. Portable air purifier is an inexpensive solution and has the potential to clean in-cabin PM2.5.

METHOD: This study aims to find the PM2.5 removal efficacy of portable air purifiers in a public transit bus. In various scenarios, after artificially preloading in-cabin PM2.5 concentration to 400 μ g/m3, the PM2.5 concentration was measured every 10 seconds with and without the intervention of air purifiers, respectively.

RESULTS: The results showed that in a test bus with a volume of approximately 65 m3, after an artificial preload of high concentration PM2.5, three portable air purifiers reduced the average concentration of PM2.5 by 42-74% to levels below 15 μ g/m3, the acceptable short-term exposure concentration recommended by WHO. When high concentration PM2.5 came into the bus from outdoors, purifiers maintained a relatively low level of in-cabin PM2.5. Therefore, air purifiers were significantly more effective in reducing in-cabin PM2.5 than traditional air filtration and ventilation methods (air conditioning system filtration and door opening) in public transit buses.

CONCLUSIONS: The deployed air purifiers reduced the concentration of particulate matter inside the bus, which may reduce the health risk of PM2.5 exposure and the spreading of airborne infections in public transit; thus, implying the potential to enhance passengers' and drivers' health.

Keywords: Particulate matter, Exposure assessment

Aristolochic Acid and the Risk of Liver cirrhosis in Patients with Hepatitis B Virus Infection

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BACKGROUND AND AIM:BACKGROUND: Some studies indicated that aristolochic acid (AA) can causes liver injury, playing an important role in liver cirrhosis. However, epidemiology research regarding whether AA increases the risk of cirrhosis are limited. The purpose of this study was to investigate whether the exposure of AA was associated with increased risk of cirrhosis among Hepatitis B virus (HBV)-infected patients.

METHOD: This population-based cohort study identified a total of 800,701 HBV infected patients using the National Health Insurance Research Database in Taiwan. Landmark analysis design was conducted in this study. The use of Chinese herbal products containing AA, including Guan Mu Tong, Guang Fangchi (Aristolochia fangchi), Ma Dou Ling (Fructus Aristolochiae), Qing Mu Xiang (Radix Aristolochiae), Tian Xian Teng (Caulis Aristolochiae), and Xi Xin (Asarum heterotropoides), was identified during the exposure window between1997 and 1999. The Cox proportional hazards regression was used to calculate the hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between the use of Chinese herbal products containing AA and the occurrence of cirrhosis. RESULTS:There were 51,304 cirrhosis in the HBV-infected cohorts during the follow-up period; and there were higher risks of cirrhosis in patients with HBV infection who took Chinese herbal products containing AA (adjusted HR, 1.09; 95% CI, 1.07 to 1.12). Consistent result was found in two additional landmark analyses with 5-year and 7-year exposure window, which showed AA exposure might increase cirrhosis risk.

CONCLUSIONS:Our study found the exposure of AA associated with increase cirrhosis risk in patients with HBV infection.

Keywords: Aristolochic acids, hepatitis B virus, liver cirrhosis, National Health Insurance Research Database, NHIRD

Disability Prediction in Ageing Population Based on Disease Status: Machine Learning Approaches

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BACKGROUND AND AIM: Elderly disability represents an inescapable public health challenge for all aging nations, and the profound burden it imposes on healthcare resources is a critical concern. To efficiently allocate long-term care resources and prevent disability, it is crucial to employ accurate disability prediction models to evaluate the elderly population's disability status. Previous research had demonstrated a strong association between chronic diseases and disability. Accordingly, this study utilizes healthcare claims data to identify diseases associated with disability and construct a disease-based disability prediction model. The model provides information on high-risk disability groups and diseases with significant impacts on disability, facilitating the formulation of resource allocation and prevention strategies.

METHOD: This study adopts the Long-Term Care Database to define the elderly disability population and utilizes the National Health Insurance Research Database to construct disability-related disease variables. Five explainable machine learning models are employed to build the disability prediction model. The disability model assesses the probability of disability for each elderly person through disease status and identifies the disabled population in the elderly population. Additionally, we employ the Shapley Additive Explanation method to analyze the extent to which diseases impact disability and identify illnesses that significantly influence disability.

RESULTS: The study revealed that among all the algorithms tested, the XGBoost algorithm exhibited the strongest predictive power. Its AUC was 0.867 and balance accuracy was 0.795. Based on the feature importance ranking generated by the predictive model, it was found that chronic conditions, including renal failure, dementia, cerebral vascular obstruction and stenosis, and hypertension, were significantly associated with disability.

CONCLUSIONS:Our disease-based disability prediction model offers a real-time digital prediction mechanism to identify high-risk groups of disability among the elderly, serving as a valuable decision-making tool for disability prevention and allocation of medical care resources.

Keywords: Big data, Risk assessment, Policy and practice

FP-232[Respiratory and allergic outcomes » Asthma]

Inter-alpha-trypsin inhibitor heavy chain 4 mitigated allergic response in OVA-induced asthma mouse

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BACKGROUND AND AIM:Asthma is a chronic inflammatory disease of the airway. Approximately 5-10% of asthma patients remain uncontrolled with current treatments. Previous research has shown elevated blood levels of Inter-Alpha-Trypsin Inhibitor Heavy Chain 4 (ITIH4) during acute inflammation, but its significance in respiratory diseases remains unknown.The aim of this study is to investigate the therapeutical potential of ITIH4 in the physiological and pathological changes of the lungs in asthma.

METHOD:An asthma animal model was established by intraperitoneally administering 50µg/kg OVA to six-week-old Balb/C mice once a week for 4 weeks. The control group received the same volume of phosphate-buffered saline (PBS) under the same conditions as the OVA group. After 4 weeks, the OVA group was intranasally administered 0 (PBS), 1.25, or 2.5 µg/mL of recommended ITIH4 protein for 7 days. Subsequently, the mice were challenged with intranasal administration of 100µg/kg OVA for 3 days. We collected bronchoalveolar lavage fluid and lung samples to analyze airway inflammation and thickness. Additionally, we measured body weight, exercise oxygenation, lung function, white blood cell, and serum IgE levels.

RESULTS: In the OVA-induced asthma mouse model, ITIH4 treatment significantly reduced body weight loss and airway resistance. ITIH4 administration led to a significant decrease in serum IgE levels, indicating a reduction in the allergic response. The analysis of white blood cells showed a decrease in eosinophils, lymphocytes, and monocytes, further supporting the anti-inflammatory properties of ITIH4. Additionally, H&E staining indicated that ITIH4 effectively suppressed OVA-induced allergic airway inflammation and thickness, leading to a mitigation of asthma-related pathological changes.

CONCLUSIONS:ITIH4 mitigated body weight loss, exercise oxygen desaturation, central airway resistance, white blood cell count, and serum IgE levels. ITIH4 played an anti-inflammatory role in the OVA-induced asthma mouse model, indicating its potential as a drug for the treatment of asthma.

Keywords: inter-alpha-trypsin inhibitor heavy chain 4, airway inflammation

FP-233[Exposures » Other (to be specified with keywords in the keywords section)]

Investigation of the toxic effects of the nanomaterial Titanium dioxide on Cryptobacterium elegans

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BACKGROUND AND AIM:This study investigated the toxicity of Titanium dioxide using Caenorhabditis elegans as the model organism. The lethality, lifespan, growth, reproduction, locomotion, and oxidative stress induced by varying concentration of TiO2 on C. elegans were investigated. In this study, commercially available (Degussa P25) and synthetically prepared TiO2 solutions were prepared. METHOD:The nematodes were acutely exposed (from L3 to young adult stage) to 4 concentration levels of each TiO2 solutions (10 mg/L, 1 mg/L, 0.1 mg/L, and 0.01 mg/L). RESULTS:The results showed that there is no significant effect to the survival rate, growth, and life span of the nematodes for all concentrations of both solutions compared to the control group. However, there is an observed decrease in the brood size of the nematodes, where the head thrashing and body bending decreased as the concentration increased. Oxidative stress expression of sod-1, sod-3, ctl-1, ctl-2, cyp35A2, mlt-1, and mlt-2 was also observed. For commercially available TiO2, there is an overexpression of all genes at 1 mg/L exposure and for synthetic TiO2, there is a significant overexpression of all genes at 10 mg/L exposure.

CONCLUSIONS: In conclusion, acute exposure of C. elegans to high concentrations of TiO2 reduced the brood size produced and have affected the locomotion of the nematodes.

Keywords: Titanium dioxide, Caenorhabditis elegans, Reproductive toxicity, Neurobehavioral toxicity

FP-234[Air pollution » Short-term exposure]

The association of hourly exposure to PM2.5 and O3 with emergency department visits of asthma

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BACKGROUND AND AIM: The short-term exposure to air pollutants, such as particles with an aerodynamic diameter $\leq 2.5 \ \mu m$ (PM2.5) and ozone (O3), has been linked to an increased risk of asthma exacerbations. Although most studies have explored the relationship between 24-hour air pollution exposure and the daily risk of asthma exacerbations, there is limited evidence regarding the association between hourly exposure and health risk.

METHOD: This study collected hourly data of PM2.5 and O3 as well as meteorological information from the air quality monitoring station of Nantou, central Taiwan, between 2011 and 2021. The study included data on emergency department visits (EDVs) related to asthma (ICD-9-CM: 493 and ICD-10-CM: J45) for all age groups during the same period from Nantou Hospital of the Ministry of Health and Welfare.

The excess risks (ERs) of asthma EDVs were estimated using multivariable quasi-Poisson generalized additive models (GAMs), with adjustments made for days of the week, season, and smoothing splines such as the year, temperature, and relative humidity at the same hours.

RESULTS: The study revealed that positive associations exist between the hourly concentration of PM2.5 and O3 pollutants and asthma EDVs, even with only one-hour exposure. The highest risks were observed with a 10-ug/m3 increase in 6-hour exposure to PM2.5 at lag 21 and a 10 ppb increase in 1-hour exposure to O3 at lag 8, associated with an increase in hourly asthma EDVs by 5.41% (95% CI: 2.53-8.29) and 2.91% (95% CI: 2.36-3.46), respectively.

CONCLUSIONS: The findings indicate that hourly exposure to PM2.5 and O3 is significantly associated with an increased risk of asthma EDVs. The study highlights the need for setting hourly air quality standards and interventions for PM2.5 and O3 to mitigate the negative health impact of air pollution.

Keywords: fine particle, ozone, asthma, hourly exposure and outcome, emergency department visits

The Effect of Concurrent Exposure to PM2.5 and High Glucose on the Toxicity Induced in A549 Lung Cancer Cells

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BACKGROUND AND AIM: Fine particulate matter (diameter $<2.5\mu$ m) or PM2.5 can adsorb a variety of toxic and harmful substances which can be deposited in the lower respiratory tract and alveoli through the respiratory system to enter into the whole body through blood circulation. Previous study indicated that PM2.5 exposure increased the incidence of diabetes. This study aimed to investigate the health risk of PM2.5, with/without high glucose exposure on lung cancer cells A549.

METHOD:In this experiment, PM2.5 and high glucose were first exposed to A549 cells, and then coexposed to selected toxic concentrations to measure cell growth, cell apoptosis and wound healing in A549 cells. The study involved exposing A549 lung cancer cells to varying concentrations of PM2.5 (control, 10, 20, 50, 100 μ g/mL) and glucose (control, 20, 40, 80, 120 mM). After analyzing the results, a concentration of 80 mM glucose and 50 μ g/mL PM2.5 were selected for co-exposure to assess whether the combined exposure to PM2.5 and high glucose levels would result in higher toxicity.

RESULTS: The results showed that 10-100 μ g/mL PM2.5, or 20-120 mM glucose exposure significant decreased A549 cell lines growth and wound healing, but increased mortality compared with the control group. According to the findings, both PM2.5 and glucose exposure caused a significant reduction in the growth of A549 cell lines and increased mortality when compared to the control group. Additionally, the combined exposure of PM2.5 and glucose intensified the negative effects on A549 cells.

CONCLUSIONS: This highlights the importance of considering the impact of high glucose levels in combination with PM2.5 exposure. This study may provide a potential therapeutic or preventive approach for people with diabetes or residents located in areas with high PM2.5, exposure.

Keywords: PM2.5, High glucose, A549 cells

Identifying Critical Windows of Air Pollution Exposure during Preconception and Gestational Period on Birthweight

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BACKGROUND AND AIM: Few studies have assessed air pollution exposure association with birthweight during both preconception and gestational periods. In this study, we aim to identify critical periods of air pollution exposure during preconception and gestational period on birthweight outcomes. METHOD: Leveraging a preconception cohort consisting of 14,220 pregnant women and newborns in Shanghai, China during 2016 – 2018, we assessed effects of NO₂ and PM_{2.5} exposure, derived from high-resolution spatial-temporal models, during preconception and gestational periods on outcomes including term birthweight, birthweight Z-score, small-for-gestational age (SGA) and large-forgestational age (LGA). Linear and logistic regression approaches were used to estimate 3-month preconception and trimester-averaged air pollution exposure associations; and distributed lag models (DLM) were used to identify critical exposure time windows at the weekly period from preconception to delivery. Two-pollutant models and effect modifications of children's sex were explored. RESULTS: One standard deviation (SD) (11.5 μ g/m³, equivalent to 6.1 ppb) increase in NO₂ exposures during the second and third trimesters were associated with 13% (95% confidence interval: 2 % -26%) and 14% (95% CI: 1% – 29%) increase in SGA, respectively; and one SD (9.6 μg/m3) increase in PM2.5 exposure during the third trimester was associated with 15% (95% CI: 1% - 31%) increase in SGA. DLM found that gestational weeks 22 - 32 a critical exposure time window, when NO2 exposure had strongest associations with SGA. The effects of air pollution exposure tended to be stronger in female newborns than in male newborns (p-value < 0.05). CONCLUSIONS: We found that air pollution exposure during mid-to-late pregnancy was associated with adverse birthweight outcomes.

Keywords: Air Pollutant; Birth outcomes; Environmental epidemiology; Multi-pollutant; Pregnancy outcomes

FP-237[Air pollution » Long-term exposure]

Saving collection efforts of mobile monitoring campaigns by transfer learning methods

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BACKGROUND AND AIM:Generating hyperlocal air pollution maps for the whole Europe requires efficiently conducting numerous mobile monitoring campaigns in different cities. Previous mobile studies have shown that stepwise linear regression (SLR) can achieve stable and satisfactory accuracy in mapping long-term concentrations with only a few collection days. This work investigates whether transfer-learning based land-use regression (LUR) models can further reduce collection durations without compromising accuracy.

METHOD:Our Amsterdam Google AirView campaign collected mobile measurements for 10 months (165 individual collection days, weekdays only). SLR and two transfer learning methods - CPH2AMS and Global2Local were developed using the Amsterdam mobile measurements and validated by independent long-term routine monitors (Palmes, n=82). Transfer-learning LUR models adapt external knowledge from another similar task in order to save the demanded amount of training data. CPH2AMS does this by transferring mobile measurements from another city (e.g., Copenhagen), while Global2Local leverages long-term measurements from a larger geographic region (e.g., Airbase measurements from several neighboring countries – Netherlands, Belgium, Luxemburg and Germany). We plotted the performance (R2 and MAE) of all three methods trained with the Amsterdam mobile measurements sliced into sequentially increasing continuous collection days (from 1 to 160) and resampled 20 times (randomly selecting a starting date and averaging the mobile measurements of the following days).

RESULTS: The performance curve of CPH2AMS increased faster than SLR when sequentially adding collection days. In case of a small number of collection days (e.g., 1 to 20), the MAE of CPH2AMS was on average only 62% of SLR'MAE (5.04 ug/m lower). With only 10 collection days, CPH2AMS already achieved 70% accuracy of the SLR fitted with mobile data collected for 160 days.

CONCLUSIONS:Transferring mobile knowledge from another mobile-monitored city or long-term knowledge from larger geographic regions can shorten collection durations, which stimulates the progress of conducting mobile campaigns covering the entire Europe.

Keywords: Exposure assessment-air pollution, Oxides of nitrogen, Long-term exposure

Association of Metal Exposure and Mortality in American Indian Populations: A Prospective Cohort Study

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BACKGROUND AND AIM:Metal exposure has been associated with premature mortality in the U.S. population; however, little is known among American Indian (AI) communities. This analysis assessed the association between exposure to five elements (four toxic metals and one essential element) and three mortality outcomes in the Strong Heart Study (SHS) cohort.

METHOD: The study population comprised 2,004 participants from 12 AI communities in four U.S. states. Archived blood samples collected during 1988-1989 (SHS Phase-3) were analyzed for lead, manganese, mercury, cadmium, and selenium. Mortality surveillance on these participants was collected during subsequent Phases 4-6 (2001-2021). The target outcomes for this analysis were all-cause, cardiovascular disease (CVD)-related, and cancer-related mortality. For each blood metal and mortality outcome, a set of six progressive Cox proportional hazard regression models were developed by adding covariate classes to the model sequentially. Covariates were identified based on results from univariate and exploratory multivariable regression analyses, including participant demographics, characteristics, comorbidities, tobacco smoking, other metal exposure, and state.

RESULTS:Blood cadmium, lead and manganese were positively associated with all-cause mortality in all models. Hazard ratios (HR) and 95% confidence intervals in the final adjusted models were 1.10 (0.98-1.23), 1.17 (1.11-1.23), and 1.14 (1.06-1.23), respectively, for an interquartile change in blood metal concentration. Blood selenium (0.88 [0.82-0.94]) and mercury (0.88 [0.76-1.00]) were inversely associated with all-cause mortality. For cause-specific mortalities, blood cadmium (1.33 [1.06-1.66]) and lead (1.18 [1.09-1.29]) were associated with cancer-related mortality, and lead was associated with CVD-related mortality (1.18 [1.06-1.31]).

CONCLUSIONS:Toxic metal exposures were positively associated with all-cause mortality in AI communities. Lead also increased the risks of cancer- and CVD-related mortalities. Selenium, a micronutrient, was negatively associated with all-cause mortality, suggesting a protective effect. These findings highlight the harmful effects of toxic metal exposures and low micronutrient level on mortality.
Keywords: Exposure, Heavy metals, Mortality, Environmental justice

Neuropsychiatric disorders in Farmers associated with pesticide exposure – Results from the study in Kelantan State, Malaysia

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BACKGROUND AND AIM: Chronic exposure to pesticides have been linked to various symptoms of neuropsychiatric disorders. However, little information available on this issue in Malaysia. Hence, this study sough to investigate the associations between neuropsychiatric disorders and pesticide exposure among farmers in Kelantan State, Malaysia.

METHOD:A cross-sectional study was carried out in the areas around Kelantan, between September 2018 and February 2019. A questionnaire was used to collect information neuropsychiatric disorders and pesticide exposure. Multiple logistic regression was performed to analyse the predictors for neuropsychiatric disorders.

RESULTS:150 farmers growing either rice (n=83) or vegetables/fruits (n=67) participated in this study. One screen positive case of dementia was identified. However, no screen-positive cases of Parkinsonism/neurology and depression were identified. 18.0%, 16% and 9.3% of farmers reported being bothered at all by any of the Parkinsonism/neurology, dementia and depression symptoms, respectively. The farmers who had incident while using pesticide had 4-folds increase (OR=4.48; 95%CI:1.46, 10.94) of having bothered at all of Parkinsonism/neurology symptoms. There was a trend towards significance for having an incident while using pesticide with an OR of 3.06 (95%CI: 0.92, 10.18) and dementia symptoms. There was no significant association between depression symptoms and pesticide exposure.

CONCLUSIONS: This study found that the farmers who reported being bothered at all for Parkinsonism/neurology and depression but not dementia symptoms were more likely to have had an incident while handling pesticides. Given the potential effect resulting from pesticide exposure, further toxicologic and epidemiologic research is required to confirm these findings and assess the impact on public health.

Keywords: Pesticide, exposure assessment, neuropsychiatric disorder, chronic exposure

FP-241[Air pollution » Particulate matter]

Emission characteristics of condensable and filtration PM2.5 from coal-power and steel plants

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BACKGROUND AND AIM:Receptor models are often used to investigate the source of outdoor PM2.5 according to chemical profiles from emission sources for reducing PM2.5 exposure. Stationary sources are important contributors to PM2.5, most studies analyzed chemical profiles in filterable particulate matter (FPM) samples to assess sources of PM2.5. However, an increasing number of studies found that condensable particulate matter (CPM) concentrations from stationary sources are much higher than that of FPM. A few studies analyzed chemical profiles in CPM for source identification. METHOD:In this study, we used Taiwan's reference methods to collect FPM and CPM samples from stacks of two major emission sources (coal-power and steel plants) in Taiwan, for chemical profile analyses and comparison.

RESULTS:Our data showed that CPM concentrations were much higher than that of FPM in coal-power plant and steel plant by 42 and 12 times, respectively. There were higher ion concentrations in CPM in these two sources, which accounted for 92-96%, the predominant ions were sulfate and ammonia. The results reflected that secondary aerosol formation is not the only the source of PM2.5. The metal concentrations in FPM and CPM, which accounted for 33-37% and 1-4%, respectively. The major metals were Al, Fe, Mg, and Ca in FPM from coal-power plant, Al, Fe, Na, K, Ca, and Zn in CPM. The corresponding results for steel plant were Fe, Na, Mg, K, Ca, and Pb in FPM, Al, Na, Ca, and Zn in CPM. The organic acids, phthalates, and polycyclic aromatic hydrocarbons (PAHs)) concentrations were significantly higher in CPM, the major species were oxalic acid, phthalic acid, Di(2-ethylhexyl)phthalate, fluoranthene, and pyrene, which means that we only analyze chemical profiles in

ethylhexyl)phthalate, fluoranthene, and pyrene, which means that we only analyze chemical profiles in FPM will influence the accuracy of source identification.

CONCLUSIONS: In summary, this study suggests that chemical profile analyses in CPM is necessary to improve the identification accuracy.

Keywords: PM2.5, source identification, FPM, CPM

Surveillance of zoonotic infectious diseases in wildlife, the advance of Taiwanese rabies surveillance based on WOAH twinning project for rabies

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BACKGROUND AND AIM: In order to upgrade Taiwanese rabies management with all-round improvements, with the special focus on zoonotic infectious diseases in wildlife, the WOAH twinning project for rabies between Anses-Nancy (Nancy WOAH/WHO/EU Laboratory for Rabies and Wildlife, France) and AHRI (Animal Health Research Institute, Taiwan) was signed in 2018. The implementation of this project fully demonstrated both the One Health and solidarity of Taiwan veterinary service system.

METHOD: This project was designed to reach ultimate goals of improving laboratory quality system for rabies diagnosis at AHRI, enhancing the Taiwanese rabies veterinary service system through education activities, and providing proficiency testing service for rabies diagnosis in Asian region.

RESULTS: After the implementation of this project, the diversity of wildlife specimens for input to Taiwanese rabies surveillance system was increased, and in addition, rabies in yellow-throated marten and new bat lyssaviruses were discovered as well. Moreover, to provide the sound rabies laboratory diagnosis as the staunch backing of Taiwan rabies surveillance system, AHRI established the quality management for rabies laboratory work based on ISO 17025, and successfully launched proficiency testing activity for rabies diagnosis in Asia with a total of 11 participating laboratories from 7 countries.

CONCLUSIONS: Through the implementation of this project, AHRI deeply experienced expertise construction, unity of Taiwan, the cooperation of regional network, and the improvement of Taiwan rabies surveillance system.

Keywords: Surveillance of zoonotic infectious diseases, wildlife diseases, rabies, WOAH twinning project

Association between environmental factors and dengue incidence in the Lao People's Democratic Republic: a nationwide time-series study

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BACKGROUND AND AIM:Dengue fever is a global public health concern. Previous studies have shown that meteorological factors influence dengue transmission; however, evidence for weather-dengue linkages is lacking in the Lao People's Democratic Republic (Lao PDR). We aimed to assess the association between meteorological factors (i.e., temperature and rainfall) and dengue incidence and examine whether this association differed by altitude in Lao PDR.

METHOD: We used weekly dengue incidence and meteorological data across 18 subnational jurisdictions (17 provinces and the capital city of Vientiane) in Lao PDR from 2015 to 2019. A two-stage distributed lag nonlinear model with a quasi-Poisson distribution was used to account for nonlinear and delayed associations between dengue incidence and meteorological variables, adjusting for long-term time trends and autocorrelation. Moreover, we conducted a meta-regression analysis by incorporating the area of low and high altitudes for health care facilities.

RESULTS:There were 55,561 dengue cases reported in the Lao PDR from 2015 to 2019. In general, the risk of dengue increased with increasing weekly mean temperature. The cumulative relative risk (RR) for the 90th percentile of temperature over 22 weeks was estimated at 4.21 (95% CI = 2.00-8.84), relative to the 25th percentile. We observed a bell shape relationship between rainfall and dengue risk. The cumulative RR for the weekly total rainfall over 12 weeks peaked at 82 mm (RR = 1.76, 95% CI = 0.91-3.40) relative to no rain. We observed a protective effect of heavy rain exceeding 200 mm. We found no effect modification of altitude on the associations. CONCLUSIONS:We found a lagged nonlinear relationship between meteorological factors and dengue here the between the relative between there the relative between the relative between the

incidence in Lao PDR. The association found in this study may help to develop climate-informed early warning systems and provide insights into improving vector control in the country.

Keywords: climate, temperature, risk assessment, infectious diseases

Prenatal exposure to per- and polyfluoroalkyl substances and adverse pregnancy outcomes

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) are a group of ubiquitous synthetic chemicals widely used in consumer and industrial products. Some studies have linked prenatal PFAS exposures to adverse pregnancy-related outcomes (APROs) such as preterm birth (PTB) and low birthweight (LBW), but the evidence remains limited and inconsistent. This study aimed to examine associations between PFAS and APROs: overall PTB, placental PTB (pPTB), spontaneous PTB (sPTB), BW Z-score (BWZ), small for gestational age (SGA), and large for gestational age (LGA). METHOD: Concentrations of eight PFAS congeners were measured in early pregnancy plasma samples (median GA = 9.9 week) collected from 478 pregnant women (122 PTB cases; 356 controls) enrolled in the LIFECODES study, a longitudinal birth cohort based in Brigham and Women's Hospital in Boston, MA. Logistic regression was used to assess individual PFAS-outcome associations, while Bayesian Kernel Machine Regression (BKMR) was used to evaluate the joint effects of all PFAS congeners. RESULTS: In adjusted models, an interguartile range (IQR) increase in concentrations of perfluorononanoic acid (PFNA) (OR = 1.63, 95% CI: 1.07-2.5) and perfluorodecanoic acid (PFDA) (OR = 1.6, 95% CI: 1.01-2.55) were associated with increased odds of pPTB, with stronger associations observed in males. Associations between PFAS and overall PTB, sPTB, BW, and SGA were mostly null. However, positive associations were observed between some PFAS (PFDA and perfluorooctanoic acid) and LGA in females only; and Perfluoroundecanoic acid and LGA in males only. The BKMR analysis confirmed the findings from the logistic regression models and selected PFNA as the most important PFAS congener responsible for observed associations with pPTB.

CONCLUSIONS: Prenatal exposure to PFAS was associated with higher odds of some APROs, with fetal sex modifying the associations. Future studies should strongly consider examining PTB subtypes and sex-specific effects of PFAS in relation to pregnancy outcomes.

Keywords: perfluoroalkyl substances, placental, preterm birth, birthweight

Association among endocrine-disrupting chemicals, metabolic syndrome, and nonalcoholic fatty liver disease in adolescents and adults

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BACKGROUND AND AIM: Metabolic syndrome (MetS) and Non-Alcoholic Fatty liver Disease (NAFLD) are common and increasing in prevalence worldwide. MetS is more common in patients with NAFLD than in those without, and NAFLD has shown to be a risk factors for cardiovascular disease and MetS. This study explored the association and mediation effects among endocrine-disrupting chemicals (EDC) mixtures, NAFLD, and MetS in both adolescents and adults.

METHOD:A total of 2,942 adults and 803 adolescents participated in the Korean National Environmental Health Survey 2018 to 2020 were included in this study. Urinary concentrations of eight phthalate metabolites, three phenols, one antibacterial, four parabens, four polycyclic aromatic hydrocarbons, and one pyrethroid pesticides metabolite and blood concentrations of five perfluorinated compounds were quantified. We used hepatic steatosis index (HSI) to define NAFLD and those with HSI>36 were thought to have NAFLD. Continuous metabolic syndrome score (cMetS) was calculated to evaluate MetS in adolescents. We assessed the mixed effects of EDCs on the risk of MetS or NAFLD using weighted quantile sum (WQS) regression. In addition, we conducted causal mediation analysis (CMA) to explore the mediation effects of NAFLD to the association between EDC mixture and the risk of MetS. All estimates were adjusted for age, sex, education level, physical activity, drinking, smoking, and involuntary smoking.

RESULTS:High WQS scores had increased risk of NAFLD and MetS in both adolescents (OR=1.37 (1.01-1.85), β =0.51 (0.05-0.97)) and adults (OR=1.30 (1.11-1.52), OR=1.28 (1.09-1.51)). NAFLD significantly mediated 40% (p=0.003) and 32% (p< 0.001) association between WQS score and MetS in adolescents and adults respectively.

CONCLUSIONS: The findings of this study suggest that exposure to EDC mixtures is associated with the existence of MetS and NAFLD in both adolescents and adults. In addition, EDC mixtures may increase the risk of MetS through NAFLD.

Keywords: endocrine-disrupting chemicals, Non-Alcoholic Fatty liver Disease, metabolic syndrome, weighted quantile sum regression, causal mediation analysis

FP-246[Climate » Temperature]

Intersectional inequalities in temperaturerelated mortality risk in South Korea

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BACKGROUND AND AIM: Previous studies have found spatial heterogeneity in temperature-related mortality across regions. However, despite the intersectional experience of multiple disadvantages at regional-level, most studies have focused on a single factor contributing to spatial variations in mortality risks. This study explored spatial variations in heat- and cold-related mortality in South Korea and examined interactions among multiple regional-level susceptibility characteristics based on the intersectionality framework.

METHOD:We used daily meteorological and non-accidental mortality data at the district level in seven metropolitan cities in South Korea, 2011-2020. In the first stage, we used a quasi-Poisson regression model with a distributed lag non-linear model for each district over 21 days of lag. We then fitted a multivariate meta-regression model and calculated the number of deaths attributable to heat and cold from the best linear unbiased prediction of the temperature-mortality association for each district. In the second stage, using district-specific deaths attributable to heat and cold per 10,000 population as outcomes, we used a multilevel model that nested 74 districts within 8 intersectional strata combining categories of the level of socioeconomic deprivation, the proportion of persons with disabilities (PwD), and the prevalence of obesity to explore interactions of three dimensions of susceptibility. RESULTS:The deaths attributable to cold per 10,000 population ranged from 14.0 for districts with low deprivation, low proportion of PwD, and low prevalence of obesity to 28.8 for districts with high deprivation, high proportion of PwD, and high prevalence of obesity. We found evidence for elevated health burdens associated with heat and cold in multiply disadvantaged districts. Although most of the between-strata variation was explained by additive main effects, results showed meaningful interaction effects for the intersectional strata (adjusted VPC=4.5%).

CONCLUSIONS: The intersectionality framework can provide a detailed mapping of regional-level inequalities in temperature-related health burdens and more accurately guide public health policies.

Keywords: Health inequalities, environmental epidemiology

Performance of a low-cost sensor (LCS) network for long-term indoor and outdoor PM2.5 measurements at rural communities in Beijing, China

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BACKGROUND AND AIM:Low-cost sensors have been widely developed and applied globally to measure high temporal and spatial resolution air pollution data for exposure, epidemiology, and environmental justice studies. However, obtaining accurate and precise measures from low-cost sensors is a challenge, especially in developing countries and low-income areas, where high-caliber environmental stations are not available to provide reference data for sensor calibration. METHOD:We set up a low-cost sensor network to measure indoor and outdoor PM2.5 for four consecutive winters in 50 villages in rural Beijing, China. In each village, two sensors were deployed in different locations to measure outdoor PM2.5, and six were randomly deployed in six homes for indoor measurements. Before and after each field campaign, all low-cost sensors were co-located with Federal Equivalent Method (FEM) instruments for 7-10 days to evaluate the performance of sensors. We co-located filter-based PM2.5 samplers with both indoor and outdoor sensors in the field for later calibration.

RESULTS:Sensor performance was consistently good over the four years of deployment. The Intraclass Correlation Coefficients (ICCs) of our low-cost sensors relative to FEM PM2.5 were larger than 0.75 with tight confidence, indicating our low-cost sensors performed well in catching hourly variation in ambient PM2.5. Including meteorological information in the linear regression between filter-based PM2.5 and time-weighted average sensor-based PM2.5 concentration did not improve the explanation of data. Calibration factors for indoor and outdoor PM2.5 were different, and varied from 1.11 to 1.14, and from 0.98 to 0.94, respectively, due to the different meteorology and emission sources of indoor and outdoor environments.

CONCLUSIONS: It is essential to conduct careful calibration in the field, and our low-cost sensors performed well over multiple years. Due to the different meteorology and emission sources of indoor and outdoor environments, indoor and outdoor sensors should be calibrated separately.

Keywords: Low-cost sensor, indoor PM2.5, calibration, rural community, long-term

Long-term effects of indirect and direct exposure to oil spills on post-traumatic stress disorder: the Hebei Spirit Oil Spill Cohort

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BACKGROUND AND AIM: Environmental disasters such as oil spills have been shown to increase the prevalence of post-traumatic stress disorder (PTSD) more in exposed communities than the natural disasters. These effects may not immediately manifest and could take months or even years to appear. Additionally, subsequent negative experiences may continue to increase long-term mental health risks. However, most of the previous studies were conducted only in the acute phase and used a single indirect exposure indicator. This study aimed to evaluate the long-term effects of PTSD, considering both indirect and direct exposure to oil spill accidents.

METHOD:Using the 2009–2016 Hebei Spirit Oil Spill Cohort survey data for adults, we confirmed the effect on PTSD by dividing the oil spill accident into indirect (n=7,771) and direct (n=660) exposure indicators. Hazard ratio (HR) and a 95% confidence interval (CI) were estimated using the Cox proportional hazards regression model, adjusted for gender, age, marital status, income level, drinking, smoking, physical activity, BMI, education level, and comorbidities.

RESULTS:As the distance from the accident site increased, the adjusted HR (95% CI) for PTSD was 0.975 (0.96, 0.991), and as the clean-up work duration increased, the adjusted HR (95% CI) was 1.005 (1.003, 1.007). In addition, as the urinary level of 1-hydroxypyrene, a direct exposure indicator, increased, the adjusted HR (95% CI) was 1.585 (1.051, 2.389).

CONCLUSIONS: In conclusion, exposure to oil spills increases the risk of PTSD in the long term. Although the exact mechanisms of these effects have yet to be precisely elucidated, we suggest that long-term effects on oil spills may be attributable to direct oil spill exposure. A comprehensive understanding of the long-term effects of exposure to future environmental disasters on mental health is needed, and disaster response and management strategies should be designed to support community mental health.

Keywords: Environmental disasters, Mental health, Oil spill exposure, Post-traumatic stress disorder.

The effectiveness of infection control strategies in a workplace during COVID-19 pandemic

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BACKGROUND AND AIM: This study investigated the effectiveness of screening tests performed in a workplace infection control intervention. By evaluating whether frequent screening tests can be a successful occupational hygiene measure that maintains maximum productivity and infection control for occupational settings during the COVID-19 pandemic.

METHOD: This study has used data obtained from a factory in Vietnam from October 25 to December 22, 2021. Vaccination records, diagnosis and recovered data of workers has been used into extended Susceptible-Infected-Quarantined-Recovered (SIQR) models. By concerning different prevalence, R0 value and different screening frequency were simulated. The cost-effective analysis conducted to evaluate the costs and effectiveness of screening test strategies in the factory by Average Cost-Effectiveness Ratio (ACER) and Incremental Cost-Effectiveness Ratio (ICER).

RESULTS: The transmission rates were calculated in different screening frequencies and simulated by SIQR model. The results of the screening frequencies of five and seven times a week would not cause any infection in the factory. The frequency of every three days resulted in 0.1% of workers being infected, and the frequency of once-a-week results in 1% of the workers being infected. When compared to higher prevalence rate, the lower prevalence rate with high screening frequency could have more effective infection control in this factory. ACER results showed that the lowest cost is once-a-week screening test. ICER results showed the frequency of five times a week maintained the 100% production capacity and was less expensive when compared to the seven times a week screening test. CONCLUSIONS:To implement a high-frequency screening test strategy in a factory with low COVID-19 prevalence initially could effectively control COVID-19 infections, and it might maintain the production capacity with cost saving.

Keywords: COVID-19,occupational hygiene,screening test,compartmental models,agent-based models.

FP-250[Air pollution » Short-term exposure]

A study on the association between heat waves and acute kidney injury (AKI) due to climate change

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BACKGROUND AND AIM:Although a link has been reported between heatwaves caused by climate change and kidney health, researches on heat waves and kidney disease are scarce. Thus, we aim to investigate the association between heat wave and hospital visits for acute kidney injury (AKI). METHOD:Daily time-series data on 17,730 outpatients who visited hospitals with AKI were obtained from the data of the Korea National Health Insurance Corporation during 2002–2019. Heatwave was defined as the occurrence of daily mean temperature above the 75th (moderate heatwave) and 99th (extreme heatwave) percentile of the temperature distribution for two or more consecutive days. We estimated the heatwave-related risks of hospital visits for AKI using a time-series regression with a distributed lag linear model. The association was also examined by age, sex, path to hospital visit (via emergency room or not), and disease history.

RESULTS: Extreme heatwave was associated with increased risk of hospital visits for AKI with RR of 1.87 (95% CI: 1.68, 2.08) and the risk was more prominent in male than female. Moreover, the association between hospital visits for AKI and heatwave was more evident in the case of hospital visits through emergency room than them not through emergency room (Wald p-value < 0.05). CONCLUSIONS: Among kidney diseases, AKI disease requires attention because the risk may increase depending on high temperature, temperature exposure duration.

Keywords: Heat, Heatwave, Acute kidney injury (AKI)

Evaluation of confounding for occupational radiation exposure and cancer incidence among radiologic technologists

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BACKGROUND AND AIM: Confounding is essential in observational epidemiology, particularly in lowdose radiation studies. We examined the impact of potential confounders on cancer risk from occupational radiation exposure and the magnitude and direction of these potential confounding estimates among radiologic technologists.

METHOD: The study included 4,308 radiologic technologists who participated in the questionnaire survey study that investigated non-radiation factors and 19,408 radiation technologists from the registration-based cohort study enrolled in the National Dose Registry that obtained non-radiation factors by multiple imputations. We quantified the confounding effects of cancer risks on radiation exposure based on a linear dose-response model. To determine whether a given risk factor caused confounding on the estimate of the baseline model, we compared the estimated measure of the association before and after adjusting for non-radiation factors.

RESULTS:In the questionnaire survey-based cohort, the ERR per 100 mSv of the baseline model for the association between radiation dose and cancer risk was 0.58 (95% CI: -0.91, 2.07, 10-years lagged) after adjusting for sex, attained age, birth year, and years of employment duration. Directly adjusted for confounding by smoking (ERR/100mSv=0.58), alcohol intake (0.57), BMI (0.64), exercise (0.55), sleep (0.62), shift work (0.53), personal medical examination (0.52), and past medical history (0.70). In the registration-based cohort, the baseline ERR per 100mSv estimate was 0.12 (95% CI: -0.34, 0.57). After indirectly adjusting for the imputed non-radiation factors by smoking (ERR/100mSv=0.13), alcohol intake (0.12), BMI (0.11), exercise (0.12), sleep (0.13), and shift work (0.13), there was no significant difference compared to the estimation of the baseline model. CONCLUSIONS:We found little evidence of factors with statistically significant confounding effects on prior was described and and and and and and an advantage of acceptent between directly adjusted to the advantage of acceptent between directly adjusted to the advantage of acceptent between directly adjusting and shift work and indirectly adjusting and shift and advantage of acceptent between directly adjusted to the advantage of acceptent between directly adjusted to advantage of acceptent between directly adjusted to advantage of acceptent between directly adjusted to acceptent between directly adjusted to acceptent between directly adjusted and advantage of acceptent between directly adjusted and advantage of acceptent between directly adjusted acceptent acceptent between directly adjusted acceptent between dindirectly acceptent between directly adjusted acceptent be

risk per unit dose of cancer between directly and indirectly confounder-adjusted effects. However, cautious interpretation is needed due to the possibility that unmeasured confounders or insufficiently measured confounding factors cannot be excluded.

Keywords: ionizing radiation, causation, occupation, cohort

Assessing the Impact of Household Energy Transition on Winter Indoor Air Quality in Rural Beijing, China: Field Evidence and Implications

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BACKGROUND AND AIM: Air pollution has been identified as one of the major threats to environmental safety and human health. To alleviate the contributions of residential coal combustion to ambient air pollution, China has pursued household energy transitions to replace coal stoves with clean energy for space heating. Studies that assess the impacts of household energy transition programs are scarce, especially those that are based on large-scale field measurements.

METHOD: We recruited 50 villages from four districts in Beijing, and randomly selected 6 households in each village to monitor indoor PM2.5 in winter, using both sensor-based measurements (over several months) and filter-based measurements (24-h). Community-level outdoor PM2.5 was measured concurrently. In the first year (Year-1), 10 of 50 villages were involved in the energy transition program and, therefore, did not use coal. Ten more were involved in the second year (Year-2). We used a two-way fixed effects difference-in-difference (DID) analysis to assess the impact of the energy program on indoor air quality.

RESULTS:Geometric mean [95% Confidence Interval] indoor PM2.5 levels in the recruited homes decreased in Year-2 (to 47 [42, 53] μ g/m3) compared to Year-1 (73 [66, 80] μ g/m3). We observed the largest reduction in indoor PM2.5 [mean (SD): 55 (48) μ g/m3] in the ten villages which were treated in Year-2. By our analysis, the energy transition program contributed 37.5 (SD: 13.0) μ g/m3 to the reduction of indoor PM2.5 in homes in treated villages.

CONCLUSIONS: The household energy transition program in Beijing, China contributed partially to the reduction in indoor PM2.5 levels. One of the key goals for the future is to promote learning and ongoing progress in such projects, in order to extend their benefits to other regions in China, and even globally, to achieve further improvements in air pollution.

Keywords: Indoor air quality, household energy transition, coal stove, clean energy, Difference-indifference (DID)

Air pollution and cognitive impairment among the Chinese elderly population: A Nationwide cohort study

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BACKGROUND AND AIM:Cognitive decline and dementia have long been recognized as growing public health threats, especially in an aging society. Studies have found that air pollution is a potential risk factor for dementia, but the association between air pollution and cognitive impairment has not been fully understood. This study aimed to evaluate the association between three major air pollutants (i.e., PM2.5, O3, and NO2) and cognitive impairment among the Chinese elderly population.

METHOD:Study participants were selected from the Chinese Longitudinal Health Longevity Survey (CLHLS) after 2005. We define cognitive impairment as a Chinese Mini-Mental-State Exam (CMMSE) score lower than 24. Yearly mean exposure to PM2.5, NO2, and warm-season (April-September) average MDA8 O3 were evaluated by assigning three high-performance satellite remote sensing models to the participants' residential addresses. The association between air pollution and cognitive impairment was evaluated with a logistic regression model adjusted for time since enrollment, sociodemographic characteristics as well as chronic conditions like high blood pressure, heart disease, and diabetes.

RESULTS:A total of 3,887 participants were enrolled in this study, and 931 (24%) developed cognitive impairment during follow-up visits. In single-pollutant models, we found that per IQR increase in warm-season O3 (OR per 20.98 μ g/m3 = 1.011 [1.000, 1.022], p = 0.033), yearly average PM2.5 (OR per 18.34 μ g/m3 = 1.009 [1.001,1.016], p = 0.034), and NO2 (OR per 18.20 μ g/m3 = 1.019 [1.007, 1.031], p = 0.001) were positively associated with cognitive impairment. Only NO2 remained positively associated with cognitive impairment (OR per 10 μ g/m3 = 1.018 [1.002, 1.033], p = 0.033) in a multi-pollutant model with PM2.5 and O3.

CONCLUSIONS:Our results suggested that cognitive impairment could be positively linked to PM2.5, O3, and NO2. O3 is possibly more hazardous in the warm season (April-September).

Keywords: Air pollution, cognitive impairment, CLHLS, concentration-response relationship

Source and infiltration of carcinogenic metals in indoor air in an urban area

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BACKGROUND AND AIM: Arsenic (As) and cadmium (Cd) are classified as carcinogenic compounds to human. People spend over 80% of their time indoors. However, a few studies investigated the sources of As and Cd in indoor PM2.5. The objective of this study was to investigate the source of As and Cd in indoor PM2.5 in households through lead (Pb) isotope ratios, and to calculate the infiltration factors (Finf).

METHOD:Indoor and outdoor PM2.5 simultaneously were collected for As, Cd, and Pb isotope ratios analyses from residential buildings in 2021 to 2022 in an urban area. Pb isotope ratios were used to assess the possible source of As and Cd based on the ratios from pollution sources. This study also calculated the Finf values of As and Cd and further estimated the contribution of indoor- and outdoor-generated As and Cd to indoor air.

RESULTS:The average concentrations of As and Cd in indoor air were 0.87 ± 0.69 ng/m3 and 0.19 ± 0.15 ng/m3, respectively; the corresponding values for outdoor air were 1.44 ± 0.80 ng/m3 and 0.33 ± 0.19 ng/m3, respectively. The 208Pb/207Pb ratio indicated that traffic-related emission was an important source of indoor and outdoor As and Cd. However, significant correlations between indoor 208Pb/207Pb values and As and Cd concentrations in indoor air were found only in households with ventilation rate >1.5 h-1. The Finf values of As and Cd were 0.60 ± 0.37 and 0.58 ± 0.39 , respectively. The contribution of outdoor-generated As and Cd to indoor air pollution was approximately 85%.

CONCLUSIONS: These findings suggest that 208Pb/207Pb is a useful indicator for the identification of the source of indoor and outdoor As and Cd; however, ventilation conditions influence the applicability of this approach on source identification in indoor air. The traffic-related emission outdoors was identified as a major source of As and Cd.

Keywords: indoor air, PM2.5, metal, isotope, infiltration factor

Assessment of DNA Adducts Related to Oxidative Stress in Residents of Heavy Metal-Contaminated Areas

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BACKGROUND AND AIM: Heavy metals are known to cause oxidative stress in the body, leading to the formation of DNA adducts. This study aimed to develop an analysis method for DNA adducts related to oxidative stress and assess the level of DNA adducts in residents of heavy metal-contaminated areas. METHOD: Quantification of eight DNA adducts related to oxidative stress was performed using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) in Multiple Reaction Monitoring mode. The analytical method was verified for linearity, precision, recovery rate, and matrix effect using a synthetic urine standard calibration curve. Ten non-smoker residents of heavy metal-contaminated areas who had lived there for more than 30 years were included here. Urine was collected from the subjects for DNA adducts analysis.

RESULTS:The study demonstrated excellent linearity (R² >0.99), precision (RSD <5%), and recoveries (94.6 – 125.9%) for the eight oxidative stress-related DNA adducts, with the matrix effect being less than 15%. 7-Methyl-guanine and 8-Hydroxy-2-deoxyguanosine were detected in 100% of the urine samples collected from residents of heavy metal-contaminated areas. The average values for these markers were 0.33 μ g/mL and 2.01 ng/mL, respectively. The detection rate for the remaining six DNA adducts was less than 50%.

CONCLUSIONS: This study established an LC-MS/MS method for the quantification of eight DNA adducts related to oxidative stress in urine. The detection of 7-Methyl-guanine and 8-Hydroxy-2-deoxyguanosine in all samples suggests that heavy metal exposure can cause oxidative stress and DNA damage. This preliminary study underscores the potential use of DNA adducts as biomarkers in future environmental epidemiological studies.

Keywords: DNA adducts, heavy metal, oxidative stress, biomarker

Exposure to residential greenness and allergic rhinitis in children

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BACKGROUND AND AIM:Allergic rhinitis (AR) is a disease that frequently occurs in childhood, such as atopy and asthma, and the prevalence rate is increasing worldwide. Various studies are being conducted to find the cause, and explanations of air pollution, climate change, and environmental pollution are dominant. Young children have relatively many outdoor activities and are inevitably exposed to green areas, so further research on this seems necessary. Currently, research on the relationship between green space and AR are not inconsistent. This study attempts to examine the relationship by adding air pollution as a mediating factor.

METHOD: We used a data that the Environment and Development of Children (EDC) cohort study in 525 children at age 8. AR data was collected using the ISSAC questionnaire, and 243 respondents who answered "YES" were classified as case group, and 283 respondents who answered "NO" were classified as control group. The satellite-derived land cover map from Environmental Geographic Information Service in South Korea was used to estimate the residential exposure to greenness. We controlled the covariates and used a logistic regression model to estimate the association between green exposure and AR. Mediation analysis was conducted by SPSS PROCESS macro.

RESULTS: We found that exposure to built greenness in 50m buffer was associated with AR in a crude model [OR (95% CI) = 1.014(1.00-1.03)]. In fully adjusted models, exposure to total greenness in 50m buffer [OR (95% CI) = 1.015(1.00-1.03)] and built greenness in 50m buffer [OR (95% CI) = 1.020(1.00-1.04)] was also associated with AR.

CONCLUSIONS: The results of the study showed that higher exposure to green area had an adverse effect on AR. Although health benefits of greenness were shown in many studies, we also need to consider an harmful effect on AR, possibly through the influence of weed and tree pollen.

Keywords: Residential greenness, Allergic rhinitis, Children, Air pollution

MODERATED POSTERS

Development of spatiotemporal high-resolution temperature data for São Paulo, Brazil; a valuable resource for epidemiologists

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BACKGROUND AND AIM: Most studies investigating temperature-related health effects in cities rely on temperature recordings from few meteorological stations or models at coarse spatial resolution. Overlooking the spatial variability of temperature in cities may lead to biased epidemiological findings. Here, we propose a machine learning algorithm to predict daily mean temperature at 500m-squared in São Paulo between 2015 and 2019, and we compare it to traditional multilinear regression approaches.

METHOD: We built a random forest (RF) model combining daily mean temperature from 44 stations with satellite data and satellite-based products. A gap-filling approach was performed to recover the missing values from satellite products before including them into the RF model. The most relevant features were identified through a forward feature selection and the hyper-parameters were tuned using a grid search technique. The model was validated using a 10-fold spatial cross-validation (CV) and an external hold-out dataset with 5 stations. Finally, we compared our RF algorithm against a linear model using the same features. The root mean squared error (RMSE) and R-squared were used to compare their performance capability.

RESULTS:Based on feature selection, the final model included: land surface temperature, solar zenith angle, black sky albedo, normalized difference vegetation index, day length, wind, and skin surface temperature. Of all features, land surface temperature was the best predictor. The RF, with an R-squared and RMSE of 0.88 and 1.26°C, respectively, outperformed the linear model (R-squared: 0.78 and RMSE: 1.72°C). Validation of the RF results with the hold-out dataset showed a performance of 0.75 and 1.22°C for R-squared and RMSE, respectively. Overall, the RF model outperformed linear model, probably as it better captures microclimates and complex associations.

CONCLUSIONS: Our model provides epidemiologists with data of high spatiotemporal resolution to

investigate patterns in daily mean temperature exposure and associated health outcomes in São Paulo at an unmatched resolution.

Keywords: Modeling, exposure assessment, temperature variability, spatial statistics, big data

Determination of Bisphenols and Phthalate Metabolites in Human Urine with Ultraperformance Liquid Chromatography/Tandem Mass Spectrometry

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BACKGROUND AND AIM: Bisphenols and phthalates can leach from products; humans can get exposed to them directly or indirectly, which may result in reproductive and developmental adverse health effects. This study evaluated human exposure by measuring bisphenols and phthalate metabolites in urine.

METHOD:150 urine samples were obtained from the 2019 National Nutrition and Health Survey in Taiwan, aged 14 to 91. Six bisphenols and twelve phthalate metabolites were measured. Urine samples were mixed with β -glucuronidase/arylsulfatase enzymes for 40-min hydrolysis at 37°C; after adding acetonitrile, the samples were filtered through a Sirocco 96-well plate, and 20 μ L of dimethyl sulfoxide was added. The samples were concentrated to about 20 μ L and were reconstituted with methanol for the analysis with ultra-performance liquid chromatography coupled with tandem mass spectrometry with isotope-dilution techniques. Analytes were separated on an Atlantis Premier BEH C18 AX (50 × 2.1 mm, 1.7 μ m) column with 10-min gradient elution.

RESULTS: The linear range of the calibration curves were between 0.5-500 ng/mL with a coefficient of determination greater than 0.99. The matrix effect factors ranged from 42% to 94%, and the extraction efficiency ranged from 80% to 129%. The intra-day and inter-day quantitative biases and relative standard deviations were mainly less than 20%. The positive rates of bisphenol A, bisphenol S, and the metabolites of DEHP, DnBP, DiBP, DPHP, and DEHTP were higher than 90%. Levels in elderly people (> 65 years old) were significantly higher than those in adults below 65 years old. CONCLUSIONS: The analytical method possesses good quantitative precision and accuracy in determining six bisphenols and 12 phthalate metabolites in urine, facilitating future biomonitoring for human exposure assessment.

Keywords: Endocrine disrupting chemicals, Phthalates, Phenols, Exposure assessment-biomarkers of exposure, Environmental epidemiology

Exposure measurement error correction in air pollution epidemiology: Scale matters

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BACKGROUND AND AIM: In air pollution epidemiology it is common to use modelled or measured ambient concentrations as a surrogate for people's "true" exposure, either total personal or personal from outdoor sources. A problem in this approach is that even though these are measured in the same units, personal exposures tend to be much lower because individuals spend most of their time indoors. These discrepancies inflate the resulting measurement error bias in epidemiological analyses. We used simulations to quantify these biases using two correction methods and a range of plausible scenarios. METHOD: We simulated true and surrogate long-term ambient NO₂ concentrations for 10,000 subjects using the latent variable mixed error model and assuming varying correlations and variance ratios between the exposures. To introduce the different scales of measurements, true personal exposures to NO₂ from outdoor sources were calculated as 50% of the corresponding true ambient concentrations and an all-cause mortality outcome was generated. Cox proportional hazards models produced naïve estimates for surrogate exposures without scaling and corrected ones scaled by the mean ratio of true personal versus ambient concentrations or reported per interquartile range (IQR) increase in the corresponding exposures.

RESULTS: Mean percent bias in the unscaled health effect estimates was large and negative, ranging from -48.8% to -93.6%. When no measurement error was assumed in the surrogate exposure, both correction methods reduced mean percent bias from 50% to less than 3%. For scenarios with measurement error, bias was consistently smaller in magnitude when using IQR correction for different scales rather than mean ratio correction.

CONCLUSIONS: Investigators should be aware of the additional bias in health effect estimates resulting from using a surrogate exposure which is measured at a different scale compared to the true exposure (but with the same units) and apply a method to correct for this.

Keywords: Environmental epidemiology, long-term exposure, exposure measurement error, measurement error correction, simulations

MP-004[Methods » Big data]

Construction of a geospatial data pipeline for epidemiology: a case study of land use and road network in South Korea

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BACKGROUND AND AIM: Given the extended data availability of geospatial data along with improved computational capability, the application to epidemiological research has gained considerable attention. However, researchers may encounter challenges when handling geospatial data. Efforts to overcome these challenges require significant investments of time and resources as geospatial data are continuously updated and need repetitive processing. The construction of a data pipeline that automates data acquisition, processing, and calculation can minimize such efforts. Given our ultimate goal of constructing a geospatial data pipeline including sociodemographic, physical, and built environment characteristics for assessing the associations with mortality and morbidity in South Korea, this study aimed to illustrate key issues of geospatial data processing.

METHOD: We investigated spatial-temporal consistency and coordinate systems of nationwide land use and road network data in South Korea. We obtained land use data from the Ministry of Environment for 2000-2019 including different types of land use such as residential and commercial areas. Road networks for 2005-2020 available through the Korea Transport Database consist of eight types of roads from national highways to local roads.

RESULTS: The land use map over South Korea consists of about 750 sections each of which includes 7, 22, and 41 types of land use categories at the low, middle, and high levels, respectively. We found different parts of the sections were updated in different years, and some sections have never obtained high-level categories. The coordinate system of land use data also varies over time: 'Korean 1985/Modified Central Belt' or 'Korea 2000/Central Belt'. Likewise, road network data had different coordinate systems depending on the year.

CONCLUSIONS:Our findings suggest geospatial data processing should achieve data consistency over time and space as well as coordinate systems to construct a geospatial data pipeline and our practical guidance will help assess the association of environmental risk factors with human health research.

Keywords: Geospatial data pipeline, Geospatial data processing, Modeling

Attitudes and perceptions of public health postgraduate students towards the use of artificial intelligence in public health

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BACKGROUND AND AIM:Artificial Intelligence (AI) subfields such as machine learning, deep learning, robotics and virtual agents (chatbots) are increasingly applied in medicine and public health. AI education for students in these field is therefore essential, as addressed in the National Digital Health Strategy for South Africa (2019-2024). This study aimed to assess the perceptions and attitudes regarding AI among Postgraduate Diploma in Public Health students at the School of Health Systems and Public Health, University of Pretoria, South Africa.

METHOD:Students were enrolled in a 7-week Introduction to Research Methodology course during 2 May to 17 June 2022. The online questionnaire was administered anonymously in English using Qualtrics. Ethics approval was obtained for the study (Ref 171/2022). The data from Qualtrics was exported to a Microsoft Excel spreadsheet before being imported to STATA 15 for statistical analysis. RESULTS:618 students (507 females, 108 males, 5 chose not to indicate their gender) completed the questionnaire (81.5% response rate). Generally, students thought AI would be capable of performing various tasks that did not provide direct care to individuals. Most (69%) agreed that introduction of AI could reduce job availability in public health fields. Students agreed that AI in public health could raise ethical (84%), social (77%) and health equity (77%) challenges. Relatively few students (52%) thought they were being adequately trained to work alongside AI tools and the majority (76%) felt training of AI competencies should begin at an undergraduate level.

CONCLUSIONS: The results highlight diverse perceptions and attitudes regarding AI among the students. This study is a baseline for more extensive in-depth studies to be done within an African context. Follow-up studies could better inform the inclusion of AI into medical and public health tertiary education. The subject of AI is still quite a novel concept that needs to be explored.

Keywords: Attitudes, perceptions, postgraduate students, artificial intelligence, South Africa

Burden of disease from short-term exposure to fine particulate matter in South Korea

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BACKGROUND AND AIM:Previous studies have estimated excess mortality from long-term exposure to fine particulate matter (PM2.5), but studies on short-term exposures are still scarce. Moreover, most studies have estimated the burden of disease based on the linear relationship between air pollutant and mortality. Therefore, we aimed to investigate the cause-specific mortality burden due to short-term PM2.5 exposure by considering potential non-linear relationship in South Korea.

METHOD: We obtained daily cause-specific mortality data in 2010-2019 from the Korea National Statistical Office and ambient PM2.5 concentration levels from modeling and monitoring stations covering 17 provinces of South Korea. We used a generalized additive mixed model to estimate the relative risk of mortality for 1 μ g/m3 increase in PM2.5 exposure. Assuming a non-linear relationship, we estimated the number of deaths attributable to short-term exposure to ambient PM2.5. To estimate the health impact of PM2.5, we calculated excess mortality due to short-term exposure to ambient PM2.5 compared to two counterfactual PM2.5 levels: WHO air quality guideline level (15 μ g/m3) and minimum concentration (2 μ g/m3).

RESULTS:Of 2,749,704 deaths, 2,453,686 (89.2%), 591,267 (21.5%), and 141,066 (5.1%) were nonaccidental, cardiovascular, and respiratory deaths, respectively. Daily mean PM2.5 levels ranged between 14.7 μ g/m3 (Jeju) and 28.4 μ g/m3 (Chungbuk). A supralinear relationship between exposure to PM2.5 at lag 0 and all-cause mortality was observed. A total of 9,591, 7,593, 1,642, and 1,412 allcause, non-accidental, cardiovascular, and respiratory deaths were attributable to short-term exposure to PM2.5 above the WHO guideline. The doubled burden of deaths was estimated when the population was exposed to daily PM2.5 levels above 2 μ g/m3.

CONCLUSIONS: The study suggests a supralinear relationship between short-term exposure to PM2.5 and mortality in South Korea. These results indicate the need for immediate action plans to prevent the population's health from daily exposure to PM2.5.

Keywords: Burden of disease, Fine particulate matter, Health impact assessment, Premature mortality, Short-term exposure

MP-007[Birth and pregnancy outcomes » Other (to be specified with keywords in the keywords section)]

Advancing chemical risk assessment through prioritization and systematic mapping of high throughput mechanistic in vitro data

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BACKGROUND AND AIM:Synthetic chemical use has outgrown our ability to regulate. Our project's object was to develop a prioritization framework to identify environmental chemicals of greatest concern for human reproductive and developmental effects, and utilize systematic approaches to identify current high throughput in vitro data and identify data gaps and evaluate its predictivity of human health outcomes.

METHOD: We established a protocol outlining a process to prioritize environmental chemicals of concern for reproductive or developmental health outcomes. The considerations included identifying environmental chemicals: 1) measured at detectable levels in pregnant women; 2) produced at high production volumes; 3) targeted for assessment by environmental regulatory agencies; and 4) that can be assessed using high-throughput screening approaches. A subset of chemicals identified through the prioritization process was then evaluated using systematic evidence mapping and predictive models to validate high throughput in vitro data with in vivo toxic potencies using a semi-automated benchmark concentration modeling approach.

RESULTS:Our prioritization framework yielded a list of 40 environmental chemicals of concern. Five chemicals were selected for further evaluation (two PBC congeners, BPA, and two PBDE congeners). Systematic evidence maps for each chemical illustrated study design characteristics and results from high throughput in vitro studies. Validation of data with the U.S. Environmental Protection Agency's ToxRef database (supplemented with published scientific studies) of mammalian in vivo endpoints found that the in vitro studies predicted rodent toxicity with balanced accuracy nearing 70%. The assay was most predictive of rodent ovarian defects and overall reproductive performance with a relative risk value close to 10.

CONCLUSIONS: Leveraging scientific findings in a comprehensive and systematic manner is critical to develop public policies. This study proposes a prioritization process to identify environmental chemicals of greatest concern, and illustrates that high throughput in vitro screening data may be an effective approach to support rapid development of health-protective policies.

Keywords: Chemical exposures, Children's environmental health, Risk assessment

MP-008[Methods » Causal inference]

Estimating Heterogeneous Causal Effects under Bipartite Network Interference: An Application to Air Pollution Regulatory Policy

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BACKGROUND AND AIM: Given the disproportionately high air pollution exposures experienced by marginalized population groups, robust evaluations of the heterogeneous health impacts of air quality regulations are key to justifying and designing maximally protective future interventions. Such evaluations are complicated by two key issues: 1) much of air pollution regulatory policy is aimed at intervening on large emissions generators while resulting health impacts are measured in the populations exposed to emissions from these sources; 2) due to air pollution transport, interventions on one emissions generator can impact geographically distant communities. In causal inference, such a scenario has been described as that of *bipartite network interference* (BNI). In this work, we develop novel methodology to estimate heterogeneous causal effects under BNI and apply these methods to study the impacts of power plant emissions interventions on ischemic heart disease (IHD) hospitalizations, particularly for vulnerable subpopulations.

METHOD: Within the BNI context, we propose and implement causal estimators for subgroup-specific direct and spillover treatment effects via G-computation and augmented inverse propensity weighting methods. Using the proposed methods, we estimate the causal impact of power plant scrubber installations on IHD hospitalizations in 2005 among Medicare fee-for-service beneficiaries in 29,034 U.S. ZIP codes.

RESULTS: In the overall study sample, we found that scrubber installation at the power plant that most influences a ZIP code is associated with a decrease in the ZIP code's IHD hospitalization rates, though these decreases were not statistically significant at the a=0.05 level. However, for high-poverty and largely non-white ZIP codes, treating their most influential power plants when less-influential plants were untreated was found to result in statistically significant decreases in hospitalization rates. CONCLUSIONS: We present the first study of heterogeneous treatment effects within the BNI setting, which provides evidence that marginalized populations may benefit most from power plant emissions reduction interventions.

Keywords: air pollution, cardiovascular diseases, environmental disparities, environmental justice, policy

MP-009[Air pollution » Particulate matter]

Spatial distribution of PM_{2.5} in Bangkok and its vicinity during 2011 – 2020

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BACKGROUND AND AIM: Bangkok is the capital city of Thailand and is seriously affected by PM_{2.5} which contributes from various sources spatially. High concentration exposure results in various adverse health outcomes of the residents. This study aims to reveal the spatial distribution of PM_{2.5} in Bangkok and its vicinity from the first monitoring in 2011 – 2020.

METHOD:The monitoring station data for Bangkok metropolis and vicinity provinces during the period of 2011 – 2020 were obtained from the Pollution Control Department. The land utilization information was obtained from the Land Development Department. The concentration of PM_{2.5} was reported as μ g/m³, Geographic information system was used to illustrate the spatial distribution of PM_{2.5}. RESULTS:Currently, there are 23 stations covered in the study areas. PM_{2.5} in Bangkok and vicinity areas show a seasonal trend and are strongly influenced by land utilization. The concentration of PM_{2.5} peaked in the winter season (Nov - Feb). Although the average annual concentration was lower than Thailand standard (50 µg/m³), the maximum concentration of PM_{2.5} was reached to 173 µg/m³ which was considered as the health hazard. Spatial distribution map indicated that the high concentration during winter originated from the northwestern area of Bangkok, which is the sugar cane planting area. The harvesting by open field burning can cause high pollutant levels. The southern and eastern parts of Bangkok show much lower concentrations. These areas are the rice paddies, residential, and industrial areas that are close to the coastal area. The rice harvesting method causes a lower concentration of PM_{2.5} in the area.

CONCLUSIONS: Proper land utilization management would help to reduce the concentration of PM2.5, which consequently benefits the resident's health and well-being.

Keywords: Air pollution, Particulate matter, Exposure assessment

Comparison of the use of a chemistry transport model with a recurrent neural network method for modeling ambient ozone concentrations

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BACKGROUND AND AIM: Air pollution has become a major priority and a global issue at a worldwide scale. Ozone is considered as one of the most toxic and dangerous air pollutants with widely known harmful effects on the environment and the human health. Predicting ozone concentrations has a lot of benefits, and one of them is to provide legislators an idea about the near future situation to take the necessary measures.

METHOD:In this work, we acquired meteorological and air pollution data from February to March 2021 from the Moroccan General Directorate of Meteorology. Then, we compared the performance and the capacity of two different models in term of modeling and predicting ambient ozone concentrations over the city of Casablanca. The first model is a special case of recurrent neural networks, called Nonlinear Autoregressive Network with eXogenous inputs (NARX). The second model is CHIMERE: it is a chemistry-transport model that allows analysis of pollution episodes as well as forecasts of ozone, aerosols, and other pollutants.

RESULTS: The results show that the NARX models are more suitable for short term prediction of ozone concentrations, while the CHIMERE transport model can perfectly predict the long-term trend of these concentrations.

CONCLUSIONS: We highlight the potentiel and the deficiencies of each technique for air quality forecasting. A combination between both techniques could has a potentiel application in this domain.

Keywords: Machine learning, Chemistry transport model, CHIMERE, NARX, Ozone forecasting

A hybrid spatiotemporal model for estimating daily NO₂ concentrations across Israel

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BACKGROUND AND AIM:Nitrogen dioxide (NO₂) is an important traffic-related pollutant associated with both short- and long-term health effects. Exposure to NO₂ has been associated with numerous health outcomes, including asthma, decreased lung function, lung cancer, and premature mortality. There has been growing interest and efforts in recent years to construct fine-scale air pollution prediction models, including for NO₂, but such efforts have been mainly focused in the United States and Europe.

METHOD: We modeled average daily ground-level NO₂ concentrations in Israel using a multistage framework from 2004 to 2022. Spatial and temporal predictor variables included data from the Ozone Monitoring Instrument (OMI), Copernicus Atmosphere Monitoring Service (CAMS), land use data, and meteorological variables. We employed linear mixed effects (LMM) and random forest (RF) models to downscale satellite measurements and incorporate local sources, then utilized a generalized additive model (GAM) to geographically weight predictions from the two base learners (LMM and RF). Performance from all models were evaluated based on 10-fold cross-validation.

RESULTS:On average, the LMM, RF, and GAM models explained 68, 74, and 84% of variations in measured NO₂ concentrations. We observed higher levels of NO₂ in urban centers (including Tel Aviv, Jerusalem, and Haifa), heavy traffic corridors, and along valleys in mountainous areas. Lower levels of NO₂ were observed in more rural areas, with levels dropping to nearly zero in areas of high altitude. CONCLUSIONS:This is one of the first studies, to the best of our knowledge, which show the potential of using earth observation data to develop robust models with fine-scale spatial (1-km²) and temporal (daily) variation of NO₂ across Israel from 2004 to 2022. The predicted NO₂ concentrations will be made available to facilitate health research in Israel.

Keywords: air pollution, nitrogen dioxide, ensemble modeling, Israel

Environmental Disparities in Outdoor PM 2.5 Across Different Residential Densities in Ibadan, Nigeria

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BACKGROUND AND AIM:Globally, air pollution constitutes a major risk to human health. Research has focused on the impact of PM_{2.5} pollution on health in cities, with scant attention to its variations across different residential densities in cities. Socioeconomic, demographic, and cooking behaviour often vary across different residential densities in cities. We analysed variations in outdoor PM_{2.5} concentrations across different residential densities and its association with household cooking fuel and power generator usage.

METHOD:Previous studies guided identification of High Density Residential Areas (HDRA), Medium Density Residential Areas (MDRA), and Low Density Residential Areas (LDRA) in Ibadan, Nigeria. Fifteen households were selected in each residential density. An air quality monitoring device was placed outside eacoh household, far from known polluting sources. Air quality data was continuously sampled for 24-hours and averaged for each household. Socioeconomic, cooking fuel, and power generator usage information were obtained through a questionnaire. Variations in outdoor PM_{2.5} was analyzed using Chi-Square and Analysis of Variance at P<0.05.

RESULTS: Households varied significantly in outdoor PM_{2.5} concentrations (x^2 =14.329, df=4, ρ <0.006), with ratings from fair (22%) to poor (76%) to very poor (2%). Concentrations varied significantly by residential density (F(2,42) =6.585, ρ <.005). The average outdoor PM_{2.5} concentrations in HDRA, MDRA, and LDRA were 38.67±15.83µg/m³ 30.78±4.54µg/m³, and 25.53±5.26µg/m³ respectively. There was no significant difference in the type of cooking fuel used across HDRA, MDRA and LDRA (x^2 =8.780, df=6, ρ =0.186), but mean outdoor PM_{2.5} concentrations differed significantly across households using different fuels (F(³ 41)=5.325, ρ <.005). Number of households that used power generators differed significantly by residential density (x^2 =22.878, df=2, ρ <0.005), with owning a generator showing higher mean PM_{2.5} concentrations (F(¹ 4³)=8.271, ρ =0.006).

CONCLUSIONS:Outdoor PM2.5 concentrations in Ibadan, overall, is poor, with the most elevated PM2.5 in HDRA. Household's choice of cooking fuel has an impact on outdoor PM2.5 concentrations, as does use of power generators.

Keywords: Particulate Matter, Environmental Disparities, Respiratory Outcomes, Policy, Exposure Assessment- Air Pollution

MP-013[Exposure assessment methods » Spatial statistics]

The combination effects of feature selection and machine learning on SO2 spatiotemporal estimation: a case study in Kaohsiung, Taiwan

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BACKGROUND AND AIM: Feature selection is noted as an efficient approach in data preprocessing, especially for high-dimensional data. Machine learning models are widely used to predict the spatiotemporal variation of air pollution concentration. This study aimed to assess whether the combination of statistical and machine learning based feature selection methods with machine learning models can maximize the efficiency in air pollution modelling. Feature selection methods (including SelectKBest, stepwise feature selection, elastic net, and random forest) and XGBoost machine learning model were applied to test the combinations in estimating SO2 concentration variations. METHOD: Daily SO2 of period 1994 to 2018 in Kaohsiung was collected from Taiwan Environmental Protection Agency. Variable such as land-use/land cover information, roads, landmarks, meteorological factors, socioeconomic indicators, and satellite images were collected as potential predictors. Important variables were identified by SelectKBest, stepwise feature selection, elastic net, and random forest feature selection methods, respectively. The four groups of identified features were then fitted in XGBoost model to create different combinations to estimate SO2 variation. RESULTS: The combination of features selected from random forest with XGBoost performed best with R2 of 0.83, followed by the combination of stepwise feature selection (R2=0.81), SelectKBest (R2=0.80), and elastic net (R2=0.77) with XGBoost. The results from external data validation showed a similar model prediction accuracy with training model, which indicated no overfitting issue and good extrapolation ability. Features with temporal variation including Kriged SO2, NO2, PM2.5, PM10, and wind speed were identified by random forest. In addition, local and major roads, distance to thermal power plant and density of industrial reflected SO2 spatial variation.

CONCLUSIONS: The combination of random forest with XGBoost model outperformed the other combination using statistical based feature selection methods. The applied feature selection and modelling procedure in this study could help estimate spatiotemporal variation of SO2 concentration.
MP-014[Air pollution » Particulate matter]

A new single particle mass spectrometer detects health-relevant Polycyclic Aromatic Hydrocarbons, soot and metals from individual aerosol particles

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BACKGROUND AND AIM: The chemical composition of aerosol particles is highly relevant for the PMtoxicity. In particular, the content of toxic compounds/fractions such as soot, polycyclic aromatic hydrocarbons (PAH) or redox-active metals (e.g., Fe, Cu) is of concern. An analysis of filter samples gives only integral values for pollutant concentrations but no information on the toxicant-mixing state (i.e., the distribution of toxicants in the particle ensemble). The mixing state, however, is a crucial parameter to assess health effects: the toxicants could be highly concentrated within a specific, small sub-population (externally mixed) and the few particles with very high toxicant-concentration induce stronger cellular and systemic effects (e.g., by DA MP-signaling). Consequently, on-line analysis techniques enabling the mixing-state-analysis of health-relevant PM-chemicals are required for innovative health-related aerosol studies.

METHOD:An on-line Single Particle Mass Spectrometry (SPMS) with a novel laser ionization process is presented. The aerosol particles are directly on-line sampled from air and size-characterized by laser velocimetry. The organic coating of particles is desorbed by IR-laser pulses and subsequently the relevant toxicants are ionized particle-by-particle, using a novel UV-laser ionization-scheme. The ions are detected by MS (Schade et al. Anal. Chem. 2019). The novel SPMS particle characterization system offers the characterization of the most relevant aerosol particle-borne toxicants (soot, metals, PAH) on a sized-resolved, single particle basis.

RESULTS:Thus, in addition to classifying sources and quantifying main aerosol compound the systems gives insight into the mixing state of the revenant air toxicants (PAH/metals/soot) and other compounds (nitrate, sulfate etc.). First results for PAH, e.g., show that, depending on the conditions, PAH may either concentrate on a very small fraction of the particles (Passig et al. ACP 2022) or be rather uniformly distributed over all dust particles.

CONCLUSIONS: The system enables a new approach in source apportionment and toxicant internal/external mixture

analysis and suggest new epidemiological and health studies.

Keywords: Air pollution, Heavy metals, Particle components, Risk assessment, Chemical exposures

Machine Learning-Based Analysis on Factors influencing Blood Heavy Metal Concentration in Korean Children Health and Environmental Study (Ko-CHENS)

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BACKGROUND AND AIM: Heavy metal concentration in pregnant women affects neurocognitive and behavioral development of their infants and children. The majority of existing research focusing on pregnant women's heavy metal concentration has considered individual environmental factor. Therefore, in this study, we aim to comprehensively consider lifestyle, food, and environmental factors to determine the most influential factor affecting heavy metal concentration in pregnant women. METHOD: The Ko-CHENS(Korean Children Health and ENvironmental Study) is a nationwide prospective birth cohort study in South Korea enrolling pregnant women from 2015 to 2020. A total of 5,458 eligible pregnant women were included in this study, and 897 variables were included in questionnaire comprising: maternal general information, indoor and living environment, dietary habits, health behavior, exposure to chemicals. Lead, cadmium and mercury concentration on blood were measured in early, late pregnancy and in cord blood at birth. The randomforest model was used for predicting and extracting important factors affecting concentration of heavy metals in pregnant women.

RESULTS:We finally used 447 variables for 4,033 pregnant women in the model. The Mean Squared Errors (MSE) of models for lead were 0.27, 0.25, and 0.35 in early and late pregnancy, and cord blood, respectively. The most important variable influencing lead concentration was BMI. The MSEs of models for mercury were 0.18, 0.18, and 0.19. The most important variable influencing mercury concentration was the frequency of eating raw fish. The MSEs of models for cadmium were 0.13, 0.08, and 0.07. The most important variable influencing cadmium concentration was age for early and late pregnancy, while it was the frequency of dried laver intake for cord blood.

CONCLUSIONS:Our study showed that pregnant women could reduce their exposure to heavy metals by eliminating and modifying specific factors in their environment and thereby decrease their negative effects on the children's development.

Keywords: Children's environmental health, Environmental epidemiology, Heavy metals

Sufficient conditions for causal reasoning in mixtures epidemiology

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BACKGROUND AND AIM: Investigations of the health effects of mixtures have surged in the last decade with the increased availability of biomarkers for multiple exposures and the development of new statistical methods. We have previously identified a number of situations where such methods yield biased, non-causal inferences. Here we identify some conditions where the results can be interpreted causally.

METHOD: We previously used directed acyclic graphs (DAGs) to identify several problematic situations. Suppose for simplicity that there are two exposures of interest that are correlated because of some unmeasured common cause, e.g., a common source. Coexposure amplification bias occurs when one of the two exposures is subject to uncontrolled confounding. Table 2 errors—improperly interpreting beta coefficients as total causal effects—are other problems that can occur when one exposure can affect another, e.g., by modifying pharmacokinetics. Biomarkers of exposure are more prone to these issues. We derive other directed acyclic graphs where these problems do not occur.

RESULTS:Use of external measures of exposure (rather than biomarkers) avoid Table 2 errors due to modification of pharmacokinetics of one biomarker by another. As correlations between large numbers of exposure biomarkers typically show a block diagonal structure, backdoor paths between such groups will be weaker if they occur, reducing co-exposure amplification bias (care is still needed within groups). For exposure biomarkers that are correlated because of a common source, it may often be easier to identify and control backdoor pathways between the source and the outcome; if there are no other confounding pathways and the biomarkers do not affect each other, then many recent statistical methods for mixtures may be adequate.

CONCLUSIONS: Despite pitfalls there are situations where mixtures epidemiology can yield unbiased causal estimates.

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Keywords: causal inference, mixtures, chemical exposures

Identifying Novel Alzheimer's disease Biomarkers Using Hair Metabolomics and Machine Learning

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BACKGROUND AND AIM: The prevalence of Alzheimer's disease (AD) among elderly individuals is increasing globally, posing a significant threat to public health. Detecting and preventing AD at an early stage is crucial for improving patient outcomes. However, current diagnostic methods are invasive, expensive, and often unreliable, highlighting the need for reliable and non-invasive biomarkers for early detection and disease progression prediction. Machine learning has emerged as a powerful tool for identifying AD biomarkers from hair metabolomics.

METHOD: To investigate the predictive and novel metabolomics features associated with AD in elderly patients, we conducted a case-control study that included 48 age and sex-matched individuals from tertiary medical centers in Tainan city. We analyzed the data using both epidemiological and machine learning approaches, and applied random forest and deep learning models to identify essential features for differentiating between AD and control groups.

RESULTS:Based on our criteria, we selected 772 meaningful features from 12,358 positive ions, which were then filtered and subjected to machine learning-based AD biomarker investigation procedures. We trained the Random Forest classification model and selected 271-294 peak features in each model with an importance score greater than 0%. Our final model, which used 12 selective features from hair metabolomics, achieved 100% accuracy in training and testing for predicting AD. Additionally, the cross-validation of the model was 0.833, indicating good generalizability beyond the specific training dataset. The accuracy between training (1.0) and validation (0.8) from the deep learning model was also considered reliable. Although our study was conducted using a small sample size, we were able to identify significant and novel biomarkers for AD classification from the hair metabolomics dataset. CONCLUSIONS:However, these findings need further validation using larger sample sizes and different populations. Overall, our results highlight the potential of machine learning and metabolomics to develop non-invasive diagnostic tools for AD detection and treatment.

Keywords: Alzheimer's disease (AD), metabolomics, machine learning

MP-018[Air pollution » Traffic-related]

Integrating traffic pollution dispersion into spatiotemporal high-resolution NO2 prediction

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BACKGROUND AND AIM:Accurately predicting ambient NO2 concentrations has great public health importance, as traffic-related air pollution is of major concern in urban areas. Previous studies showed that line-source dispersion models such as Research LINE source (RLINE) added predictive power to land-use regression for NO2. In this study, we formulated a framework in which point-based traffic data are linked with RLINE and further incorporated into an advanced spatiotemporal smoothing model for NO2.

METHOD: Our experiment was conducted in the greater Los Angeles area (4,555 km2) over a five-year period, with regulatory, low-cost, and road-side gradient snapshot observations for NO2 (N of monitors = 283). We implemented spatial regression models with nearest-neighbor Gaussian processes (spNNGP) to obtain road-type specific annual average daily traffic (AADT) prediction on road segments; the model is trained based on over 1 million observations nationwide. Along with meteorological data from AERMET, the AADT estimates on all A1 roads served as the input for the RLINE model. We proposed two strategies to integrate RLINE estimates into our NO2 model: incorporating RLINE estimates as a space-only covariate and as a spatiotemporal covariate. RESULTS: The results showed that integrating the RLINE estimates as a space-only covariate contributed to an increased in overall cross-validation R2 from 0.83 to 0.84, and a decreased root mean squared error (RMSE) from 3.58 to 3.48 ppb. The improvement was more profound in snapshot sites close to highways, with R2 increased from 0.56 to 0.66 and RMSE decreased from 3.52 to 3.11. CONCLUSIONS: This improvement indicates that the RLINE estimates added strong predictive value even after considering a comprehensive list of geographic covariates and the improvement is highly related to distance to roads. Our data and methodology are available nationwide in the U.S.; our modeling framework can be easily generalized to predicting traffic-related NO2 in other urban areas.

Keywords: Long-term exposure, Oxides of nitrogen, Spatial statistics, Modeling

Diagnosis Of WasteWater Contamination By Metal Trace Elements In The Areas Of Yopougon (Abidjan South) And Marcory, Koumassi (Abidjan North)

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BACKGROUND AND AIM: The contamination of the aquatic environment by trace metals (TMEs) is one of the major problems facing society today. In Côte d'Ivoire, certain communes in the city of Abidjan, which are made up of residential and industrial areas, discharge wastewater of a worrying nature into rainwater channels, which end up directly in the Ebrié lagoon. In fact, these wastewater discharges linked to human activities have a strong colouration and foul odours that make the daily life of the residents of certain communes in the city of Abidjan unpleasant. To highlight the origin of the chemical pollution carried by these waters, we evaluated the TMEs of the wastewater samples taken upstream and downstream of the canals.

METHOD: A multiparameter was used to measure pH, temperature and ICP-OES was used for the analyses and PCA and Excel were used for data processing.

RESULTS:The waters are neutral at the Abidjan North sites with an average pH of 7.28 and saline waters with an average pH of 8.95 at the Abidjan South sites. The average temperature of the water is 23.7°C and 22.31°C respectively. From Abidjan North to Abidjan South, the lowest values were observed at the sites north of Abidjan. The metal concentrations exceeded the standard recommended by the USA standard except for Cd. The typological structure shows 85.74% of the total information for TMEs. The F1 design represents 63.90% of the variance and describes the overloading of water by copper (0.95), zinc (0.90), iron (0.84) and aluminium (0.84). Design F2 accounts for 21.84% and describes the enrichment of water with lead (0.84).

CONCLUSIONS: It is therefore more than necessary to raise the awareness of industries on the treatment of their waste and to set up treatment systems for this wastewater before its natural outlet, including the water bodies of the city of Abidjan.

Keywords: TME, wastewater, contamination, typology, channels

Perceptions and governance of One Health in African countries: A workshop report

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BACKGROUND AND AIM: There is strong evidence connecting epidemics with the disruption of the human-animal-environment interaction. Despite the fact that several cases of emerging and endemic zoonotic diseases in different parts of Africa have been documented, there is limited evidence regarding which specific interventions are effective in preventing and managing the associated risks using a One Health approach. The aim of the African One Health Initiative study is to better understand perceptions and ongoing research related to interventions in Africa through the implementation of suitable projects and policies.

METHOD:A bibliometric review of the scientific literature on one health studies with a focus on African countries was conducted, followed by a qualitative survey among stakeholders involved in fields related to One Health research or management in the Africa, including veterinary experts, public health professionals, environmentalists and policy makers, to learn about determinants of their perceptions, as well as barriers to and promoters of successful interventions and governance. The project was concluded with an international workshop in March 2023, where a broad range of topics relevant to One Health were discussed.

RESULTS:94% of the respondents were aware of the importance of the One Health approach and strongly endorse it within their respective countries. The top reported barriers to One Health development in Africa included paucity of data, weak linkages and institutional communication between the different departments and the lack of funding. Key areas of improvement identified were the impact evaluation of current initiatives, awareness raising compaigns among citizens targeted at behavioral changes, capacity building of relevant professionals and stakeholders, as well as the implementation of adequate policies with an intersectoral approach and enforcement of national and continental regulations, allowing for better coordination on the African level.

CONCLUSIONS: All One Health sectors in Africa require strong governance and leadership, as well as interministerial, intersectoral, and interdisciplinary cooperation.

Keywords: One health, governance, Africa

ASSOCIATIONS OF HISTORICAL REDLINING AND FLOOD RISK PROPERTIES IN PHILADELPHIA, PA, and EFFECT MODIFICATION BY NEIGHBORHOOD GENTRIFICATION

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BACKGROUND AND AIM:Upstream drivers, such as the historical deprivation of funding for built water infrastructure in certain neighborhoods, may place context for current spatial inequities in flood vulnerability. Historical redlining, introduced by the Homeowners Loan Corporation (HOLC) in 1938, graded neighborhoods from A-"best" to D-"hazardous" which indicated the risk for mortgage approval based on the neighborhood's racial composition. Previous research indicates that historically "hazardous" neighborhoods may be associated with increased climate vulnerability indicators such as land surface temperatures and lower tree canopy cover yet few studies have explored associations with flood risk or how the extent to which these relationships vary across categories of neighborhood gentrification.

METHOD:To calculate census tract level percentages of properties at risk for flood, we utilized 2022 First Street's risk assessment data which ranked the number of properties within each census tract that were flood prone from 0-10. We used 1938 HOLC grade maps and areal weighting to identify historically redlined neighborhoods. We identified census tracts that were ineligible to gentrify, were eligible but did not gentrify, and did gentrify between years 1990-2000, by calculating changes in neighborhood sociodemographics using decennial Census data. We calculated associations between categorical redlining grades and the continuous measure of tract-level flood risk percentages, overall and stratified by gentrification categories.

RESULTS:Across all 384 residential Philadelphia census tracts, the mean risk score percentage was 15.2 ± 18.5 . Census tracts subjected to historical redlining had higher mean percentages of flood risk (HOLC Dhazardous= 18.1 ± 21.5 versus HOLC A+Bbest/ still desirable = 11.3 ± 8.6). Lastly, HOLC Dhazardous census tracts that underwent gentrification were less likely to have properties that were flood risk (mean= 12.9 ± 14.5) compared to those that did not (mean= 15.9 ± 18.8). CONCLUSIONS:Our preliminary results suggest that flood risk is related to a past indicator of structural racism (redlining) and that these relationships may be attenuated by contemporary gentrification processes.

Keywords: climate, built environment, public health

MP-022[Climate » Natural disasters]

Social disparities in flood exposure and associations with the built environment in 47,187 urban neighborhoods in eight Latin American countries

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BACKGROUND AND AIM:Climate change is expected to greatly increase population exposure to flooding and related health impacts, particularly in urban areas of the Global South. We aimed to examine within-city social disparities in exposure to flooding within 326 Latin American cities and associated features of the neighborhood environment.

METHOD: We used a high spatial resolution dataset of historical flood events from 2000-2018 to describe flood exposure at the neighborhood level for all cities with 100,000+ residents in eight Latin American countries (Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Mexico, and Panama). We estimated the percent of the population living in neighborhoods with one or more observed floods, comparing across neighborhood educational attainment quintiles. We also contrasted within-city disparities across study cities (i.e. Slope Index of Inequality). We modeled univariable city- and neighborhood-level factors of the urban environment associated with flood exposure. RESULTS: We examined 47,187 neighborhoods in 326 cities from eight countries with a total of 236 million residents, and over 150 distinct flood events from 2000-2018. Over 22% of residents in neighborhoods in the lowest education guintile lived in neighborhoods with flooding, while only 4.3%

of residents in the highest neighborhood education quintile lived in flooded neighborhoods. Neighborhood flooding was associated with lower neighborhood-level educational attainment and with neighborhoods that were less dense (population or intersection), further from the city center, greener, and had steeper slopes (all p-values < 0.05). There was no association between city-level educational attainment and flood risk.

CONCLUSIONS: There are large social disparities in neighborhood flooding within Latin American cities. Residents of areas with lower education attainment face substantially higher risks of flooding. Neighborhoods that were less dense, more peripheral, greener, and had steeper slopes had higher odds of flooding. Policymakers must prioritize flood adaptation and recovery efforts in neighborhoods with lower socioeconomic position.

Keywords: built environment, environmental disparities, environmental justice, socio-economic factors

Prospective study on health status of patients with idiopathic environmental intolerance attributed to electromagnetic fields after a provocation test

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BACKGROUND AND AIM: The self-reported symptoms of patients with idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) are generally non-specific. Previous short-term follow-up studies showed that IEI-EMF sufferers still had IEI-EMF after a provocation test, but the severity of symptoms substantially decreased. Around 30% of them were willing to consider the possibility that their symptoms might have been caused by something else. However, there are few, if any, long-term follow-up of IEI-EMF sufferers. We conducted a study aiming to investigate long-term changes in symptoms and concerns about IEI-EMF after a provocation test and to assess the reversibility of IEI-EMF.

METHOD: We conducted a prospective follow-up of the participants in the previous provocation tests from 2010 to 2015 in 2019 in Taiwan. The same questionnaire was applied to interview the participants by phone, and the results were compared.

RESULTS:Of the 147 participants of the provocation tests, 48 changes their contact phone number, and 29 did not answer the phone after five trials. All the remaining 70 completed the telephone interview, and 35 of them had IEI-EMF, of whom 62.9% reported they had recovered. Of the recovered sufferers, 86.4% described idiopathic recovery. Of the participants with IEI-EMF, 60.0% were willing to consider the possibility that their symptoms might have been caused by something other than electromagnetic fields (EMFs). In comparison with the condition while participating in the provocation test, the self-reported symptoms generally decreased, but the levels of the disturbance and worry related to EMFs were similar.

CONCLUSIONS: In the long-term follow-up of four years or more, 62.9% of the IEI-EMF sufferers had recovered after the provocation test, and 60.0% were willing to consider the possibility that their symptoms might have been caused by something other than EMFs; both were higher than those reported by previous short-term studies.

Keywords: Epidemiology, Long-term exposure

Urban Public Space Initiatives and Health in Africa: A Mixed-Methods Systematic Review

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BACKGROUND AND AIM:Africa has one of the fastest rates of urban growth in the world. With unplanned urbanisation, African cities run the risk of getting locked in cycles of informality and poverty where residents face high socio-economic inequalities, lack sufficient resources, and struggle to access basic services. As resources to address health and social impacts of unplanned and inequitable urbanisation are limited, it is crucial to examine and deploy high-impact, city-scale interventions that can rapidly produce health and wellbeing gains.

METHOD: We synthesized evidence on public space initiatives to prevent non-communicable disease (NCD) in African cities. Between May and June 2020, we searched PubMed, Scopus, Web of Science and Global Health for studies published between 1990 and 2020. We used predetermined medical subject headings (MeSH) terms and consulted grey literature. We followed PRISMA guidelines, complied with the PRISMA checklist and registered with PROSPERO.

RESULTS:We analyzed 48 studies, 15 of which were mixed methods, 23 qualitative and 10 quantitative. Sports accounted for 50% of initiatives. 30 of the 48 papers originated from South Africa. Communities viewed initiatives' wellbeing impacts through social, economic, and ecological lenses, with health being but one dimension. The sustainability of initiatives was often limited by funding, historical marginalization, and competing land uses.

CONCLUSIONS: Given ongoing urban infrastructure expansion on the continent, public space initiatives are a high-impact avenue to equitably improve the health of the public. Existing evidence on such interventions shows that use of public spaces for sporting activities and gardening are dominant, and that public space initiatives are valued for their social, economic, ecological and health benefits. There is a need for more comprehensive documentation and implementation of interventions that address public health through initiatives in public spaces across the continent.

Keywords: Africa, public spaces, public health, cities, non-communicable diseases

MP-025[Methods » Environmental justice]

Electrification equity planning: a framework

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BACKGROUND AND AIM:Transitioning away from fossil fuel use towards electricity from renewable energy (electrification) is important to achieve California's goal to be carbon free by 2045. In response, many cities and implementers across the state have established aggressive goals to transition gas appliances to electric alternatives, increase solar installation, and electricity storage, with an eye towards equitable transitions.

The framework developed includes analytical tools and programming guidelines for policy development, analysis, and advocacy that will enable implementers to screen proposed communities for electrification potential, enhance outreach into disadvantaged communities, and develop initial estimates of required economic incentives and potential impacts (e.g. health co-benefits and GHG emission reduction).

METHOD:The framework combined existing datasets to enable multiple criteria to be considered when screening potential project sites, including rooftop solar resource potential (Google EIE), air quality data (Google EIE, Purple Air sensor network), demographic and health data (e.g. CalEnviroScreen, census data, EPA EJScreen); and relevant energy, building, appliance efficiency, and infrastructure data available from partner cities and/or publicly available sources. Additionally, cost-savings calculations, GHG emissions reduction calculations, and assumed health benefits were identified RESULTS:Spatial analyses identified neighborhoods in California that would benefit most from electrification. Wealthy neighborhoods versus low income neighborhoods were 5x more likely to take advantage of the current incentive structures for electrification. Though, disadvantaged neighborhoods show greater cost-saving and assumed health co-benefits if targeted more for electrification. CONCLUSIONS:Those who contribute the least to climate change, in terms of GHG emissions, continue to suffer the most from environmental pollution and climate impacts. Structuring adaptive measures, like electrification, to target environmental justice communities (low income, hazard prone, racial/ethnic diverse) with incentives and programs to build resilience and sustainable infrastructure can greatly improve social, health and economic wellbeing of these communities.

Keywords: Environmental Justice, Climate, Public Health, Policy Research

Short-term associations of diarrhoeal diseases with temperature and precipitation: a multicountry study in Asia and Africa

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BACKGROUND AND AIM:Diarrheal diseases continue to be a major disease burden in developing countries. Although studies described the seasonality of diarrheal diseases, the association of weather variables with diarrheal diseases has not been well characterized in resource-limited settings where the burden remains high. This study examines the short-term associations between weather and hospital visits due to diarrhoea in children in seven low-income and middle-income countries. METHOD:The primary health outcome was hospital visits due to diarrhoea among children under five years of age. The data were collected from seven sites in each country via the Global Enteric Multicenter Study project from December 2007 to March 2011. Daily weather data in the same period were downloaded from the ERA5-Land. For each of the seven sites, we fitted a time series regression model to examine the relationship of daily diarrhoeal cases with daily ambient temperature and precipitation for the last 21 days using a generalized linear model with distributed lag nonlinear functions.

RESULTS: The analysis included 66,056 cases of diarrhoea. Daily mean temperatures ranged from 15.2 °C in Bangladesh to 37.4 °C in The Gambia over the study period. Sites had a highly skewed distribution of precipitations. The associations of diarrhoeal hospital visits with temperature and precipitation varied by country. The relative risk (RR) of diarrhoeal visits for temperature exposure (95th percentile vs. 1st percentile) ranged from 0.19 to 8.80, with Mozambique, Kenya, and Bangladesh showing positive associations, while Mali and Pakistan having negative associations. The

RR for precipitation (95th percentile vs. 1st percentile) ranged from 0.82 to 1.66, with Mali and India showing positive associations, while the only negative association was observed in Pakistan. CONCLUSIONS:Our findings suggest the essential roles of ambient temperatures and precipitations, especially high temperatures and high precipitation, in increasing diarrhoeal infection both in south Asia and sub-Saharan African countries.

Keywords: temperature, infectious diseases, children's environmental health.

Prenatal residential greenness exposure on behavior and cognitive development in children

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BACKGROUND AND AIM: We investigated the association between residential greenness exposure during pregnancy and children's intelligence and behavior, while accounting for the potential confounding and mediating effects of air pollutants.

METHOD: We analyzed a birth cohort study on 231 mother-child pairs enrolled in central Taiwan between 2000 and 2001, and with the maximum of six-times followed up until 2019. Greenness was estimated based on the normalized difference vegetation index (NDVI), and air pollutant was estimated using hybrid kriging-land use regression based marching learning model. Children's intelligence was assessed with the Wechsler Intelligence Scale for Children (WISC), and behavior was determined based on the Achenbach Child Behavior Checklist (CBCL). For analysis, multiple linear regressions were used to investigate the association of greenness with children's IQ and CBCL scores at each follow-up. We also account for repeated measurements using mixed model. Lastly, we estimated the mediating effects of air pollutants through causal mediation analyses. RESULTS: Greenness exposure was associated with a higher IO score at 2-3 years of age (Estimate =3.65, p-value = 0.02). When we further adjusted for PM2.5 and NO2 air pollutants, the association became stronger (Estimate = 5.96, p-value = 0.001) and, interestingly, the greenness-IQ association was only seen in boys. Greenness was associated with a lower CBCL score at 14-15 years of age (Estimate = -1.68, p-value = 0.09), especially for withdraw, anxiety, and internalizing problems, and these associations were only seen in girls. Mixed model revealed that greenness was associated with a higher overall IQ score in boys, and a lower overall CBCL score in children whose mother did not have a college degree. We do not find evidence to show that the associations were mediated by air pollutants.

CONCLUSIONS: Maternal exposure to greenness has beneficial long-term effects on children's intelligence and behavior.

Keywords: Green space, Children's environmental health, Mental health outcomes, Multi-pollutant, Air pollution

Trace metal concentrations, geoaccumulation index and risk assessment from soil of electronic waste (e-waste) exposed and nonexposed area, Bangladesh

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BACKGROUND AND AIM: Electronic waste (e-waste) recycling is primarily carried out in the informal sector, where it releases significant quantities of hazardous pollutants into the environment. We evaluated distribution, contamination, and human health risks of trace metals in soil from e-waste exposed and non-exposed sites in Bangladesh.

METHOD:20 exposed and 11 non-exposed soil samples were collected and analysed for lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chromium (Cr), copper (Cu), manganese (Mn), nickel (Ni), zinc (Zn), beryllium (Be), cobalt (Co), selenium (Se), and vanadium (V) using ICP-MS. RESULTS:Pb, Cd, Hg, Cu and Zn were the most abundant elements in exposed soil (587, 25.57, 2912, 894 ppm) and were present in significantly greater concentrations than in non-exposed control sites (15.94, 0.07, 23.71, 121; all p: ≤ 0.001). The mean concentrations of Pb, Cd, Hg, Cu and Zn were higher than their corresponding values of the WHO, USEPA limits, Dutch soil guidelines. The mean geoaccumulation index values of Cd, Hg, Cu indicated "extremely contaminated" and "heavily to extremely contaminated" for Pb. E-waste combustion sites were associated with substantially higher levels of soil contamination than dismantling, storage, or disposal sites. Non-carcinogenic risks from ingestion were significant with children being more susceptible than adults. Noncarcinogenic risks from dermal and inhalation exposure were negligible. Median Pb, maximum Hg and Cu showed hazard index >1, implying a greater than acceptable risk in children. In contrast, no contributor was found to the cancer risk; these values are less than the permissible limit (1*10⁻⁴).

CONCLUSIONS: This study suggests significant accumulation of trace metals in e-waste exposed sites and exposure via soil poses environmental and human health risks, especially for children. Therefore, there is an urgent need for decision-makers to initiate control measures and deploy cost-effective techniques to limit the trace metal pollution of the environment.

Keywords: E-waste, trace metals, soil, geo-accumulation index, health risk assessment

The urban burden of disease estimation for policy-making: a project for European cities

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BACKGROUND AND AIM: In Europe, over 70% of the population lives in urban areas. Cities promote innovation and wealth creation; however, they are also a main source of pollution, disease and mortality, to some extent linked with suboptimal urban and transport planning practices. The aim of the project is to improve the estimation of health impacts and socioeconomic costs of environmental stressors related to urban and transport planning, advance modelling approaches and strengthen evidence-based policy-making.

METHOD: We will (1) develop an overall urban burden of disease impact assessment framework; (2) identify health and wellbeing indicators; (3) obtain exposure-response relationships for environmental stressors and health outcomes of interest; (4) develop tools and guidelines for cost-benefit analyses; (5) obtain health and environmental stressors data for cities for 2015, 2018, 2021 and 2024 and (6) calculate health and socioeconomic impacts and monitor trends. The analyses will focus on air pollution, noise, temperature/heat and lack of green spaces for nearly 1000 European cities. Specific urban and transport planning scenarios will be developed for selected cities and include additional aspects such as mobility, physical activity and inequities. To achieve greater science-policy impacts, we will conduct consultation with and provide knowledge translation to cities and stakeholders. RESULTS:The project started in January 2023 with initial workshop planning. Objective 1 will be addressed at the kick-off meeting (May 2023) and at the first stakeholder workshop (summer 2023), while objectives 2 and 3 will be addressed at the second stakeholder workshop (autumn 2023). Data collection on health and environmental stressors for the 1000 cities has started and will continue throughout 2023. Additionally, development of case studies has started for Utrecht, the Netherlands, and Sofia, Bulgaria.

CONCLUSIONS: By improving health impact and socioeconomic costs estimations and engaging with stakeholders we expect to generate impact and promote healthier urban and transport planning practices in European cities.

Keywords: Health impact assessment, air pollution, noise, green spaces, European cities

MP-030[Chemical exposures » Heavy metals]

A Field Application of an Innovative Digital Sensor for Arsenic without Reagents and Calibration

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BACKGROUND AND AIM: This research proposes a digital microfluidic sensor similar to blood glucose meter, adopting anodic stripping voltammetry(ASV) to rapid test arsenic(III) in water in 180 sec. without reagent and calibration. Inorganic arsenic is listed as Group 1: "Carcinogenic to humans" by IARC. In countries such as Taiwan, Bangladesh, India, China, etc. whose groundwater taken as irrigation or drinking may contains high concentrations of arsenic due to geological conditions, which put local residents in serious risks of various types of cancer. It is crucial to detect arsenic with a timely, convenient and reliable method.

METHOD:86 groundwater well samples were collected in this study from 4 counties along the southwest Taiwan. All 86 samples were tested for arsenic(III) right in field by digital microfluidic sensor and 45 of them were selected to lab for total arsenic analysis by ICP-OES. The arsenic microfluidic sensor used in this study has a detection range of 0.03-0.50 mg/L, which is pre-coated with reagents and also been calibrated in factory. Users can easily operate it like blood glucose strip in field without adding reagents and calibration. The field data from microfluidic sensor and the lab. data from ICP-OES of the same 45 samples will be compared by simple linear regression to evaluate the applicability of this microfluidic sensor.

RESULTS:The comparison result shows the correlation coefficient r reaches 0.978 and R2=0.9572, which indicates [As3+] and [total As] has a strongly linear positive relationship and also represents the data from microfluidic sensor in field is able to predict the concentration of total As. CONCLUSIONS:As an innovative rapid digital testing method for arsenic, an user-friendly design of reagents-free and calibration-free with non-toxic substances contained, this technology can provide rapid and reliable data for local governments whose water source threaten by arsenic to make a water supply policy.

Keywords: Heavy metals, Water quality, Epidemiology, Waterborne diseases

Implementation of Flipped Education to Improve Home Prevention Chemical Hazard Literacy for the Elderly within the Community

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BACKGROUND AND AIM:Cleaning and disinfection are one of the most important steps in the prevention of the coronavirus virus. The elderly are a vulnerable population during the Covid-19 pandemic. Therefore, it is vital to help the community elders in learning of the usage and storage of any chemical disinfectants to prevent chemical hazards within the home setting.

METHOD: This study used purposive sampling, a quasi-experimental research design within randomized allocation and intervention methods. There were 118 participants who were 65 years or older individuals involved from Luzhou, District, New Taipei City. The experimental group (n=59) received the modified flipped education program as the intervention method, and the control group (n=59) maintained a non-experimental regular lifestyle. Both groups filled out the pre-test and 4-week post-test questionnaires. The assessments included: Basic Demographic Data, Health Literacy Questionnaires (HLQ), Chemical Hazard Literacy Scale (CHLS), and Covid-19 Prevention Knowledge Scale (CPKS).

RESULTS:The modified flipped education results revealed that there was improvements which were found in the elderly's knowledge of CPKS (p=0.05) and CHLS (p=0.07) in the intervention group. The average score of HLQ in the experimental group was 38.12 ± 3.94 which was higher than the control group (36.85 ± 5.67). The elderly had better knowledge of CPKS, which had relatively improved the CHLS scores ($\beta = 0.19$, p = 0.04). Thus, the dilution of home-based concentrated disinfectant products increased a higher learning challenge for the elderly within the community.

CONCLUSIONS: A modified flipped education intervention effectively improved the community elder's knowledge of health literacy, chemical hazard literacy, and Covid-19 prevention. It is essential to continue to provide systematic learning activities with the use of interesting but interactive technology using webpage models or internet applications.

Keywords: Chemical Exposures, COVID-19, Solvents

Occurrence and accumulation of microplastics contamination in freshwater fishes from natural and farmed sources in Taiwan

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BACKGROUND AND AIM: The presence of microplastics (MPs) in the marine environment with a diameter less than 5 mm has sparked widespread public concern. Although rivers are potentially the major transport pathway of MPs pollution to the ocean, accumulation of MPs in freshwater and farmed fishes is comparatively understudied. This study was carried out to investigate MPs bioaccumulation in freshwater in 30 major Taiwan's

rivers and farmed fishes in Southern Taiwan.

METHOD:90 freshwater fishes and 9 farmed fishes of the main species Oreochromis mossambicus were collected in 30 principal rivers and 4 fish farms. The fish sample's intestine, gills, head, and muscle were digested by KOH before MPs were isolated using a 5 mm stainless steel sieve. Image J was used to measure the diameters of the MPs and Raman spectroscopy was used to analyze the MPs' types. Mann–Whitney U test was used to compare the differences in the amount of MPs between the freshwater and farmed fishes as well as the different areas in Taiwan. The correlations between the amounts of MPs and the fish characteristics were examined.

RESULTS: The average MPs concentration in 99 fishes was less than 0.01 MPs/g, and the intestine had the highest MPs level of the four tissues. The most identified polymer of MPs was polyethylene (PE), and followed by polyethylene terephthalate (PET), polystyrene (PS), and polypropylene (PP). The amount of MPs was positively correlated with the weight of the intestines in the farm fish. There was no significant

difference in MP amounts between freshwater and farmed fish.

CONCLUSIONS: The freshwater and farmed fishes were highly contaminated with PE plastic. Further studies are needed to assess the dietary risk of MPs through ingesting these fishes for the Taiwanese populations.

Keywords: Microplastics, Exposures

MP-033[Built environment » Green space]

Association between Residential Greenness and Children's Behavioral Development

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BACKGROUND AND AIM: With the rapid development of modern society, greenness on earth has largely decreased. People in urban area are hard to access greenness in their daily lives. However, many studies show a positive association between greenness and health. Among the population, children are the most sensitive to the environment and the main subjects to protect in sustainable development. Therefore, we aimed to compare prenatal exposure and postnatal exposure to residential greenness and children's behavioral development.

METHOD:Participants were from Taiwan Birth Panel Study (TBPS I). A total of 172 infants born in 2004~2005 and their parents were recruited in this study. They were asked to do Children Behavior Checklist (CBCL) at the age of 2 and 5. Greenness levels were gathered from the image of Landsat 5 within a 250, 500, and 1000 meters radius, counted as Normalized Difference Vegetation Index (NDVI). Multiple linear regression was used to investigate the association.

RESULTS: The participants showed a low level of exposure to greenness because most lived in Northern Taiwan urban areas. Our study showed a slight negative association between prenatal exposure and initializing problems, emotionally reactive, somatic complaints, and sleeping problems. This could only be observed within 250 and 500 meters radius.

CONCLUSIONS: We found a slight negative association might exist between prenatal residential greenness exposure and the early development of children's behavioral or emotional problems. Further research could be conducted to demonstrate the impact and promote a green environment for children in urban cities.

Keywords: Residential greenness, Children health, Behavioral development, Neurodevelopment, Prenatal exposure

MP-034[One health » Public health]

Study of Home Visiting for Elderly Live Alone Clients and their Specific Health and Safety Requirements

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BACKGROUND AND AIM: According to a study by the Ministry of Health and Welfare in Taiwan, onethird of the elderly over 65 years old and one-half of the elderly over 80 years old and in a home living situation have experienced a fall within the previous year. After the fall, they may have suffered some physical disablement and poorer quality of life.

METHOD:Using the community-engaged research and nurse visit to investigate the elderly's fall risk assessment, medication literacy abilities, physiological and mental health outcomes, interaction needs and environmental health and safety situations within their home. There were 30 elderly people living alone at home from New Taipei City who were involved in this study.

RESULTS: The results of the study showed that in addition to the problems of aging and normal physiological deterioration and inappropriate medication usage, other external factors included wearing unsuitable shoes and clothing, dim lighting, no anti-slip mats, wet and slippery floors, unassisted bathrooms, floor placement, too much debris, and a generally unsafe home environment. Elderly people living alone need external support to improve their living needs, but most elderly do not use relevant long-term care services because they do not understand social welfare resources, resulting in more serious daily life problems and practices. Most elderly people living alone suffer from chronic diseases, they often cannot receive timely care when sickness and accidents occur, which makes it difficult to recover from their health status, and even worsens.

CONCLUSIONS: We recommend the promotion and the installation of the government initiated "Home Emergency Rescue System" in the homes of the elderly who live alone. Health professionals will make regular visits and daily follow-up, and can intervene in a timely manner to provide relevant assistance, so as to reduce the occurrence of accidents and promote a safer home environment for the elderly living alone.

Keywords: Community-engaged Research, Mental Health Outcomes

Influence of the green view index and evergreen trees on ambient fine particulate matter in Tainan City

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BACKGROUND AND AIM:Introducing greenery into urban areas can mitigate air pollution, but conventional green indices, such as the normalized difference vegetation index (NDVI), fail to include the contributions of green plants and roadside trees at the community level due to insufficient spatial resolution. To bridge this gap, this study elucidated the difference between the greening index at the bird's eye view and the pedestrian perspective in terms of air pollution by comparing NDVI from satellites and green view index (GVI) from street view, and evaluated their impacts on PM2.5. METHOD:We sampled observation points at 30-m intervals following the road network in the Tainan metropolitan area. NDVI was calculated using satellite data from Landsat 8 with a geographic resolution of 30 m and MODIS with a spatial resolution of 250 m. We computed GVI by analyzing 760,080 Google Street View images using a deep learning algorithm to extract greenness at horizontal and vertical angles, spanning a panorama at 0-degree and 45-degree elevation angles. We applied a multiple linear regression model to assess the relationship between the green index and PM2.5 concentrations from 320 airboxes, and adjusted for 15 land-use related variables with varying buffer sizes.

RESULTS: In our multiple regression model, GVI and PM2.5 displayed a significant negative association (β = -0.063, p=0.029). No significant association was observed between PM2.5 and NDVI at different buffer sizes. Among different types of trees, evergreen trees were found to exert a stronger dust-capturing effect on PM2.5 than deciduous trees (β = -2.83, p=0.002).

CONCLUSIONS: The association between increases in GVI and reductions in PM2.5 is significant and superior to NDVI. Planting evergreen trees will reduce PM2.5 to a greater extent than planting deciduous trees. These findings can provide a reference for future urban planning and air quality improvement.

Keywords: Built environment, Green space, Particulate matter, Big data

Developing Study Protocol to Determine the Association Between Built Environment Factors and Physical Activity

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BACKGROUND AND AIM:Physical activity (PA) can prevent and manage NCDs such as heart disease, stroke, diabetes, and some cancers, but over a quarter of the world's adults are insufficiently active. Previous studies have found that higher built environment (BE) scores were linked to higher PA levels in residents of various countries. This cross-sectional study will use objective measures of BE and PA in Putrajaya. This study aims to examine the relationship between the BE and PA in Putrajaya, the administrative capital of Malaysia with high prevalence of noncommunicable diseases (NCDs). METHOD:This protocol follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist to ensure all recommended elements are addressed. This cross-sectional study will investigate how personal and built environment (BE) factors affect physical activity (PA) among adults in Putrajaya. A questionnaire with personal factors and the long-version International Physical Activity Questionnaire (IPAQ-LF) will measure PA levels. The ArcGIS software will map respondent distribution based on their house coordinates (longitude and latitude) and the BE factors of residency and intersection density, land use mix and park access. IBM SPSS software will analyse the data to predict the factors associated with PA in Putrajaya. Ethical approval from University Putra Malaysia Ethics Committee will be obtained.

RESULTS: A comprehensive protocol with introduction, methods and analysis and discussion was developed based on the STROBE checklist. This study expects to find that residents in areas with high residential and intersection density, high land use mix and closer park access will have higher physical activity levels.

CONCLUSIONS: These findings will inform targeted interventions for the community and future town planning.

Keywords: Built environment, Physical activity, Methodological study design, Epidemiology

Negative Associations of Cord Blood Mitochondrial DNA Copy Number with Childhood Adiposity Trajectories in Children

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BACKGROUND AND AIM: Mitochondrial DNA copy number (mtDNAcn) is a biomarker representing the average number of mitochondrial genomes in a cell. Significant changes in mtDNAcn may indicate mitochondrial dysfunction and can be used as a measure for mitochondrial toxicity or cellular stress. While alterations in mtDNAcn have been implicated in dysregulated pathways associated with diabetes and obesity, research has mainly focused on adults and not on children.

METHOD:The study sample included a cohort of Dominican and African American children from Northern Manhattan and South Bronx, NY recruited from 1998 to 2006. mtDNAcn was measured in cord blood and split into low (<33rd percentile), middle (33rd-67th percentile), or high (>67th percentile) categories. Children were followed up with measurements for height, weight, and bioimpedance at ages 5, 7, 9, and 11 years. Mixed-effects models with random intercepts for participants were used to assess associations between mtDNAcn in cord blood and child BMI and BMI-z scores. Interactions between mtDNAcn categories and child age or child age squared were used to assess associations between age, ethnicity, BMI, completion of high school, previous birth, environmental tobacco smoke exposure, receipt of public assistance, sex, age, age squared, and DNA input concentration), BMI was on average 1.2 kg/m2 higher ($\beta = 1.2, 95\%$ CI: 0.24, 2.15) and BMIz was on average 0.34 standard deviations higher ($\beta = 0.34, 95\%$ CI: 0.07, 0.62) in individuals with low mtDNAcn compared to individuals in the middle mtDNAcn group. BMI trajectories also differed by mtDNAcn level – children beginning life with lower cord blood mtDNAcn tended to follow a trajectory of higher BMI and BMI z-score.

CONCLUSIONS: Results suggest that lower cord blood mtDNAcn is associated with higher childhood adiposity in this cohort of Dominican and African American children.

Keywords: mtDNAcn, Childhood Adiposity, biomarker, trajectory

Associations of home and school-level ambient air pollution exposures with blood pressure in schoolchildren in Accra, Ghana

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BACKGROUND AND AIM: Air pollution exposure has been linked to elevated blood pressure (BP) in adults, but research is limited among children, particularly in sub-Saharan Africa (SSA). We investigated the effect of long-term exposure to ambient fine particulate matter (PM2.5) and black carbon (BC) on BP in schoolchildren in Accra, Ghana, one of the fastest growing cities in SSA. METHOD: We performed a cross-sectional analysis among 502 (57% girls) schoolchildren aged 8-12 years across 50 (39% private) schools. Home- and school-level PM2.5 and BC exposures were estimated using recently developed spatiotemporal empirical models for Accra. Additionally, weeklong PM2.5 samples collected in school yards were compared with model-predicted exposures. Mixedeffects linear and logistic regression models were used to investigate the associations. RESULTS: The mean systolic and diastolic BP among the children were 107.5 (9.6) and 69.4 (7.1) mmHg, respectively. BP was higher in overweight/obese children (33%) and in public schools. 34% of the children had elevated BP, with a higher proportion in those living in poorer homes. Children's PM_{2.5} exposure at both home and school were 5-8 times the World Health Organization annual guideline of 5 μ g/m³, and BC levels were above the maximum value in the "good practice statement" for BC" (5.1 µg/m³). The measured PM_{2.5} was moderately correlated with corresponding modelpredicted values (r=0.58). In adjusted models, children living in more polluted areas (\geq 75th percentile) had 2.16 mmHg (95% CI: -4.13, -0.18) and 1.66 mmHg (95% CI: -3.11, -0.22) lower systolic and diastolic BP, respectively, compared to those in less polluted areas, but the odds of having elevated BP were similar in the two exposure groups.

CONCLUSIONS:Our interim analyses showed no evidence of pro-hypertensive effect of long-term exposure to $PM_{2.5}$ and BC pollution among schoolchildren in Accra. Childhood obesity and poverty may be the main determinant of BP in Accra children.

Keywords: Black Carbon, Children's environmental health, Childhood hypertension, Environmental Epidemiology, Ghana

Prevalence of hookah smoking and associated factors among male high school students in Iraq

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BACKGROUND AND AIM: The use of the hookah-smoking device is increasing in the Eastern Mediterranean region. The purpose of this study was to determine the prevalence of hookah use among male high school students in the region and to study different associated factors in order to provide local tobacco control officials with an understanding of this public health problem. METHOD: A convenient non-probability sampling study was conducted among students in three high schools in Al-Karkh district, Baghdad. The study included 847 male students aged 15–18 years old. Using a simple random technique to select the high schools from a list of schools. Bivariate, and multivariate logistic regression analyses of data were carried out for identifying the risk factors associated with hookah smoking among these high school adolescent males.

RESULTS:The overall prevalence of hookah smoking in the last 30days among male high school students was 46.1%. More than two-thirds (70.6%) of the students thought that hookah smoking was more socially acceptable than cigarette smoking. Factors such as having first heard about it from friends, and the presence of a hookah café near their residence were significantly associated (p> 0.05) with hookah smoking among the students. Similarly, being surrounded by friends who used hookah was also found to be significantly associated with hookah smoking, with an odds ratio of 0.18, 95% CI (0.087–0.394). Hookah smokers were less likely than non-hookah smokers to report its use as forbidden in Islam and more likely to say it is allowed in Islam.

CONCLUSIONS: We found an alarmingly high use of hookah smoking among male high school students in this study. Family members and peers had an important role in the prevention of hookah smoking among these students. There is a need for students to be educated about the toxicity of hookah tobacco smoking and its direct effect on their health.

Keywords: Prevalence, Hookah use, High school students, Risk factors, Iraq

Interaction between long-term air pollution exposure and neighbourhood unemployment on cognitive functions in Central-European aging population

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BACKGROUND AND AIM:Current evidence suggests that long-term air pollution (AP) exposure as well as living in disadvantaged neighbourhoods may be associated with impaired cognitive functions. However, little is known about the potential interactive effect of these factors. This study examined the joint effects of AP exposure and neighbourhood unemployment rate (NUR) on cognitive function in an urban aging population.

METHOD:Cross-sectional sample of the Czech arm of the HAPIEE cohort included 4,343 participants aged 45-69 years at baseline (2002-2005). Europe-wide land-use regression model was used to estimate 3-year (2000-2003) average concentrations of PM10 and PM2.5. NUR was measured for each basic administrative unit (N=128). Both AP and NUR were linked to participants' residential addresses. Cognitive assessment included memory, verbal fluency and concentration, from which we computed a factor score reflecting a general cognitive function. Hierarchical linear modelling was conducted to examine the effects of AP exposure (first level) and NUR (second level) on cognition. Cross-level interaction was estimated to test for possible effect modification. All models estimated standardised β coefficients adjusted for age, sex, education, marital status, individual deprivation, smoking, physical activity, chronic disease, and depression.

RESULTS:Impaired cognitive function was observed in participants living in areas with higher concentrations of PM10 (β =-0.202, p<0.001), PM2.5 (β =-0.226, p<0.001) and NUR (β =-0.087, p<0.001) compared to those living in less polluted and less disadvantageous areas. There was a significant cross-level interaction between AP and NUR (β =0.162, p<0.001) whereby the effect of AP on cognition was attenuated in neighbourhoods with higher NUR.

CONCLUSIONS:Our results suggest that living in both air polluted areas and socially disadvantaged areas has negative effect on cognitive performance. Complex interactions between environmental and social exposures should be further investigated.

Funding: European Union's Horizon 2020 research and innovation programme: No 857487 and The NPO "Systemic Risk Institute" (Programme EXCELES, No. LX22NPO5101).

Keywords: Particulate matter, Cognitive functions, Socio-economic deprivation, Aging, Multi-level analysis

MP-041[Neurologic and mental health outcomes » Neurodegenerative outcomes]

Muscular and nervous system emergency department visits during a hydrogen sulfide emergency in Southern Los Angeles County, CA, USA

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BACKGROUND AND AIM:In October 2021, thousands of residents in Carson, California began complaining of noxious odor and headaches. Hydrogen sulfide (H2S), a toxic odorous gas, was measured at concentrations up to 7000 parts per billion (ppb) and remained above California's acute air quality standard of 30 ppb for 4 weeks. Residents complained of various symptoms, from dizziness and nausea to muscle weakness, and want to understand the event's impact on health. Because existing research on the health effect of low-level H2S exposure has yielded conflicting results, we aimed to assess the acute neurological and muscular effects of this H2S emergency. Few studies have examined how H2S emergencies affect diverse communities like Carson.

METHOD: We calculated daily rates of emergency department (ED) visits for diseases of the nervous system and muscular system in Carson area ZIP codes (<8 km from Carson) and in Los Angeles County ZIP codes >20 km from Carson (control). Using controlled interrupted time series, we compared ED visit rates during the 4 weeks of the H2S incident in Carson to the predicted rates had this event not occurred, based on 2018-2021 ED trends, and controlling for ED visit rate changes in control areas of Los Angeles County.

RESULTS:We observed a 13% increase (rate ratio (RR): 1.13, 95% CI: 1.04, 1.22) in ED visit rate for diseases of the nervous system and a 9% increase (RR=1.09, 95% CI: 1.03, 1.15) for diseases of the muscular system in Carson during the 4 weeks of the event. Specifically, these increases were greatest for visits for chronic pain (RR=1.19, 95% CI: 1.05, 1.24) and osteoarthritis (RR=1.24, 95% CI: 1.06, 1.41).

CONCLUSIONS: Malodors, like H2S, are an understudied environmental justice issue. H2S releases can harm the nervous and muscular system, even at low and medium exposure levels.

Keywords: Chemical exposures, environmental justice

Mixture effects of particle components on asthma in children and adults in the United States between 2000 and 2016

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BACKGROUND AND AIM:Air pollutants including PM2.5 and ozone has been shown to adversely affect asthma exacerbation in people of all ages. However, few studies have investigated the long-term exposure of particle components in conjunction with nitrogen dioxide and ozone to assess their mixture effects. We aim to utilize weighted quantile sum regression to assess the cumulative effects of major particle components including organic carbon (OC), elemental carbon (EC), nitrate, sulfate, and ammonium, along with nitrogen dioxide and ozone, on counts of inpatient asthma hospitalizations for children ages 0 to 18 and adults ages 19 to 64 years.

METHOD: Inpatient records for asthma hospitalizations were collected from the State Inpatient Databases which included hospitals from 12 U.S. states ranging in years from 2000 through 2016. We also included temperature from Daymet and variables from the U.S. census to control for socioeconomic status. All variables were aggregated to the annual level.

RESULTS: We observed an increase of 6.4% (95%CI: 6.3%,6.6%) and 6.6% (95%CI: 6.4%,6.7%) in the number of asthma inpatient hospitalizations each year for each decile increase of the pollutant mixture in children ages zero to 18 and adults ages 19 to 64, respectively. Sulfate, nitrate, and ammonium contributed the most weight to the pollutant mixture.

CONCLUSIONS:Our results indicate that long-term exposure to pollutant mixtures result in increased asthma hospitalizations in both children and adults, and daily measurements of particle components data is needed to assess short-term exposure.

Keywords: Asthma, PM Components, NO2, Ozone, WQS

Neurobehavioral effects of gestational exposure to mixtures of non-persistent endocrine disruptors in preschoolers of the ECHO Program

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BACKGROUND AND AIM: Exposures to phthalates and synthetic phenols are common among pregnant women in the US. Previous studies on the neurotoxicity of these compounds primarily assessed individual compound effects on behavior, ignoring potential combined effects. We assessed associations between prenatal exposure to a mixture of phthalates and phenols with behavioral scores among preschool age children from three pediatric cohorts participating in the Environmental influences on Child Health Outcome (ECHO) Program.

METHOD: The study sample included 1426 mother-child pairs from three cohorts in the ECHO program with available biomonitoring data on 10 phenols and 11 phthalate metabolites during pregnancy, along with caregiver reported Child Behavioral Checklist Ages 1½ to 5 (CBCL) data. Using covariate-adjusted weighted quantile sum (WQS), we estimated the associations between the phenol/phthalate mixture and the CBCL total problem scores and two broadband scores of internalizing and externalizing problems. Missing covariate data were imputed using multiple imputation.

RESULTS: While the association between the phenol and phthalates mixture with the externalizing scores was positive in both sexes (beta = 0.02, 95% CI: -0.2; 0.26), it only reached statistical significance in males. A quantile increase in the WQS index was associated with a 0.04 (95% CI: 0.07; 0.0,) points increase in the externalizing score in males. The major contributors to this mixture effect were methylparaben (with a weight of 33%), Mono-hydroxyisobutyl phthalate (MHiBP, 11%) and Benzophenone-3 (10%). No statistically significant associations were observed with the Total or Internalizing composite scores in either sex or the combined group.

CONCLUSIONS: Our findings suggest that gestational exposure to synthetic phenol and phthalate metabolite mixtures may contribute to alterations in childhood externalizing behavior especially among males, especially acting out behaviors. These results contribute to the growing body of evidence on the potential cumulative effects of these compounds and highlight the need for policies that address mixture exposures.

Keywords: Mixtures, Endocrine disrupting chemicals, Phenols, Phthalates,

In-utero exposure to ambient PM2.5 and the risk of low birth weight in India

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BACKGROUND AND AIM:Low birthweight (LBW) attributable to fine particulate matter (PM2.5) exposure has become a global threat affecting the health of children, particularly in low- and middleincome countries (LMICs). Growing concerns have been raised regarding the association between inutero PM2.5 exposure and LBW, however little is known about which specific exposure window contributes to LBW. Here, we examined the association between PM2.5 exposure during different gestational phases on LBW in India.

METHOD: The birth weight records and socio-demographic details were collected from the National Family Health Survey version 5 (2019-2021). For the In-utero PM2.5 exposure, we used a satellite-derived national database at 1-km2 resolution (Dey et al.,2020). We used a generalized linear regression model adjusted with risk factors such as wealth index, religion, residence type (urban/rural), type of cooking fuel, mother's hemoglobin level, education, and BMI. Further, we estimated the interaction of the season of conception and type of cooking fuel (clean versus unclean) on the association.

RESULTS: The estimated mean values of PM2.5 exposure during the entire pregnancy and three trimesters were 61.47, 63.98, 58.33, and 59.07 μ g/m3, respectively. The LBW prevalence was increased with a 10 μ g/m3 increment in PM2.5 for the first trimester (OR = 1.022, 95% CI: 1.01, 1.04), the second trimester (OR = 1.017;1.0, 1.03), the third trimester (OR = 1.019; 1.01, 1.03), and the entire pregnancy (OR = 1.04; 1.02, 1.06). Further, the interaction analysis showed a higher OR of LBW prevalence under unclean fuel conditions than the clean fuel throughout the in-utero exposure. Mothers who conceived during the winter season showed a higher risk of LBW in their new-born. CONCLUSIONS:Our findings suggest that in-utero exposure to PM2.5 could be associated with the risk of LBW in the context of high pollution levels of PM2.5, and the trimester 1 and 3 were identified as potentially relevant exposure windows.

Keywords: Birth and pregnancy outcomes, LBW, PM2.5, in-utero exposure, air pollution
Association between long-term PM2.5 exposure and risk of Kawasaki disease in children: nationwide longitudinal cohort study

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BACKGROUND AND AIM: Based on the previous studies that have suggested air pollution as a potential risk factor for Kawasaki Disease, we examined the association of long-term exposure to childhood fine particulate matter (PM2.5) with the risk of Kawasaki disease (KD).

METHOD: We used the National Health Insurance Service-National Sample Cohort (NHIS-NSC) spanning from 2002 to 2019, consisting of one million beneficiaries representative of the entire population living in South Korea. Beneficiaries were systemically enrolled in the cohort from the time they were born and followed up until age 5. The onset of KD was defined as the first hospital visit record with a primary diagnostic code based on the International Classification of Disease (ICD-10: 30.3). We also defined the onset of KD with intravenous immunoglobulin (IVIG) prescription. As PM2.5 exposures, we used a machine learning-based ensemble prediction model with a spatial resolution of 1 km2 and allocated the district-specific annual average concentration of PM2.5 across all 229 districts in South Korea. We estimated the association between PM2.5 and the onset of KD with a time-varying Cox proportional hazard model with an adjustment for age, sex, socioeconomic status, region, and community level indicators.

RESULTS:Our study included 134,634 individuals aged five or younger (1,685 KD onsets and 685 KD onsets with IVIG prescription). The annual exposure to PM2.5 was associated with an increased risk of KD onset (HR 1.130; 95% CI 1.002 to 1.273 per 5 μ g/m³ increase) as well as with KD onset with IVIG (HR 1.422; 95% CI 0.963 to 2.100 per 5 μ g/m³ increase).

CONCLUSIONS: In this nationwide, population-based cohort study, long-term childhood exposure to

PM2.5 was associated with an increased incidence of KD in children. These results indicate the plausible mechanisms of air pollution and KD, and further studies are needed to confirm our findings.

Keywords: Particulate matter, Long-term exposure, Children's environmental health

Prenatal air pollution exposure and mitochondrial DNA copy number at birth, a systematic review and meta-analysis

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BACKGROUND AND AIM: Mitochondria play a crucial role in cellular bioenergetics and signaling cell fate. Mitochondrial DNA copy number (mtDNAcn), a widely used measure of mitochondrial function, may be impacted by air pollution exposure, particularly during sensitive life stages, such as in fetal development.

METHOD: We systematically searched two databases (PubMed and Embase) for English- language articles published through January 20th, 2023, that examined the association of prenatal air pollution exposure with birth mtDNAcn. We excluded full-text articles lacking complete information on air pollution exposure or mtDNAcn. We extracted data on the study population, air pollutant type, exposure duration and level, mtDNAcn measurement quality, and effect estimation. We evaluated study quality using a tailored Newcastle-Ottawa Scale and used random-effect models to combine effect estimates.

RESULTS:We ultimately included nine articles (out of 177 identified) with 2,955 participants from all continents. These studies were designed as cross-sectional, prospective, or experimental, with most studies having a medium-quality score. Birth mtDNAcn was measured from cord blood, the placenta, or both, all with real-time polymerase chain reaction but using different primers. PM2.5, with levels ranging from 6.2 to 167.0 mg/m³, was the most assessed air pollutant. Therefore, we conducted a meta-analysis of five studies (with significant heterogeneity, $I^2 = 80.78$, P<0.05) and found a -1.50% (95% CI: -2.78, -0.22) reduction in birth mtDNAcn by each 1 mg/m³ increase in prenatal PM 2.5 exposure throughout pregnancy. Other sporadically examined air pollutants included PM10, nitrogen dioxide, ozone, sulfur dioxide, carbon monoxide, and polycyclic aromatic hydrocarbons, with inconsistent associations with mtDNAcn. Meta- analyses on these air pollutants were not conducted due to the small number of studies (N<3).

CONCLUSIONS: In this systematic review, we found prenatal air pollution exposure to PM 2.5 was associated with lower birth mtDNAcn. Studies on the birth mtDNAcn effect of other air pollutants are still limited.

Keywords: air pollution, mtDNAcn, systematic review, meta-analysis, prenatal

Long-term effects of prenatal fluoride and lead exposure on educational delay in Mexico

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BACKGROUND AND AIM: Detrimental effects of prenatal fluoride exposure on children's cognitive development have been recently described. However, no studies have investigated associations between prenatal fluoride exposure and long-term effects on educational attainment. We aim to investigate the long-term impact of prenatal fluoride and lead exposure on a key predictor of social and economic well-being: school delay.

METHOD: We analyzed longitudinal data from 283 mother-child pairs in the Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) cohort. We measured maternal urinary fluoride concentrations adjusted for creatinine and averaged across trimesters, and educational attainment on their children between ages 10 and 18. We operationalized school delay by comparing the highest grade completed with the grade children should have completed by the time they were surveyed. RESULTS:Mean (SD) maternal urinary fluoride and blood lead concentrations were 0.91(0.44) mg/L and 5.28(3.3) µg/dL, respectively; 9.6% of children demonstrated school delay (6.3% one year, 2.1% two years, and 1% three years). Using Poisson multivariate regression, we found that a one standard deviation increase in urinary fluoride concentration was associated with an increased risk of school delay of 1.56 (95% CI: 1.06, 2.27) controlling for sex, maternal and child age, maternal education, socioeconomic status, and maternal lead in blood. In the same model, maternal blood lead level also predicted a higher risk of school delay, with a one standard deviation increase in blood lead associated with an increase in the risk of school delay of 1.35 (95% CI: 0.95, 1.89).

CONCLUSIONS:Both prenatal fluoride and lead exposure have independent detrimental effects on the level of educational attainment in children and adolescents. Findings suggest that prenatal fluoride exposure may increase the risk of school delay. This is the first study to document fluoride exposure on school outcomes.

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Keywords: fluoride, lead, prenatal exposure, epidemiology, education.

Association between nicotine urinary and exposure factors among children exposed to secondhand smoking in an urban household, Bangkok, Thailand

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BACKGROUND AND AIM: Tobacco use is the most important preventable cause of premature morbidity and mortality in young children. The purpose of this study was to investigate on children secondhand smoking among children in urban households and urinary nicotine metabolite concentrations are associated with exposure factors.

METHOD:Children aged 2-4 years provided a urine sample (n = 85). Parent completed the questionnaires. We focus on children secondhand smoking living at household all time in urban community. Urine sample were analyzed for nicotine metabolite concentration by using enzyme-linked immunosorbent assay kit (ELISA). In a univariable and multivariable analysis, we analyzed associations between exposure factors and the proportion of urinary nicotine metabolites. RESULTS:All young children had detectable nicotine metabolite concentrations (range: 0.01-6.88 ng/mL). The multiple logistic regression test presented an association between exposure factors and nicotine metabolite concentration. Time period of smoker (\geq 10 years smoking) presented a significant association with young children's nicotine metabolite concentration (p-value = 0.024, OR = 4.495, 95% CI 1.218–16.596).

CONCLUSIONS: Suggestions to reduce the risk of long-term tobacco exposure to children living in urban households include increased education, awareness, and management.

Keywords: nicotine urinary, children, secondhand-smoking, urban household

Urinary Organophosphate and Neonicotinoid Metabolites in relation to Sex and Adrenal Hormones among Adolescents living in Ecuador

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BACKGROUND AND AIM:Organophosphate (OP) and neonicotinoid (NNI) insecticides have caused adrenal and gonadal hormone disruption in animal and in vitro studies; limited epidemiologic evidence in humans exists. We assessed relationships between insecticide metabolites with adrenal and gonadal hormones in adolescents living in agricultural communities in Ecuador.

METHOD: We examined 522 adolescents (11-17y, 49% male) in 2016. We measured urinary concentrations of three OPs (3,5,6-trichloro-2-pyridinol [TCPy], malathion dicarboxylic acid [MDA], and para-nitrophenol [PNP]), two NNIs (acetamiprid-N-desmethyl [AND] and 5-hydroxy imidacloprid [OHIM]), and salivary 17 β -estradiol (boys only), dehydroepiandrosterone (DHEA), testosterone, and cortisol. We imputed concentrations below the detection limit using multiple imputation. Linear regression models assessed associations between In-metabolite and In-hormone concentrations (β =% hormone difference per 50% increase of pesticide concentration), and were stratified by gender. Curvilinearity was assessed by testing squared terms in the linear models. Bayesian kernel machine regression assessed interactions. All models adjusted for age, race, saliva time minus awakening time, BMI-for-age z-score and tanner score.

RESULTS: The organophosphate MDA had positive associations with testosterone (β boys=5.88% [1.21%, 10.78%], β girls=4.10% [-0.02%, 8.39%]), and borderline positive associations, in boys only, with cortisol (β boys=6.06 [-0.23%, 12.75%], The organophosphate PNP had negatively-trending curvilinear associations, among boys only, with testosterone (β ²boys=-0.17 (-0.33, -0.003), p=0.04) and DHEA (β ²boys=-0.49 (-0.80, -0.19), p=0.001). The neonicotinoid summary score (β boys=5.60% [0.14%, 11.36%]) and the neonicotinoid AND (β boys=3.90% [1.28%, 6.58%]) were positively associated with 17 β -estradiol. In girls, bivariate response associations identified interactions between the three organophosphate metabolites (MDA, PNP, and 3,5,6-Trichloro-2-pyridinol) on DHEA and testosterone concentrations. In boys, we observed an interaction between MDA and PNP for the DHEA association.

CONCLUSIONS: We observed evidence of endocrine disruption with organophosphate and neonicotinoid exposures in adolescents. Urinary organophosphate metabolites were associated negatively with DHEA and positively with testosterone concentrations, with stronger associations in boys than girls. Urinary neonicotinoids were positively associated with 17β -estradiol. Replication is warranted.

Keywords: endocrine disrupting chemicals, pesticides, environmental epidemiology, Children's

MP-050[Exposures » Other (to be specified with keywords in the keywords section)]

Preliminary Analysis of Chemical and Non-Chemical Stressors Collected from Mother-Child Pairs in the National Children's Study

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BACKGROUND AND AIM: Children are exposed to diverse chemical and non-chemical stressors found in their everyday community environment. These stressors, individually and in combination, are thought to contribute to their health and well-being during each developmental stage throughout their lifecourse. Our research approach considers how these complex interrelationships interact to affect health and well-being. The National Children's Study Vanguard Study database contains a wide array of environmental, survey, and outcome data collected from approximately 6,000 mothers who participated in the pilot studies from 2009-2014. This database provides a robust dataset to explore analytical approaches for combining and assessing both quantitative and qualitative information as it relates to explaining health outcomes for children in secondary data analyses.

METHOD: We used the nationally standardized PRAPARE (Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences) tool to organize our demographic and non-chemical stressors into social determinant of health clusters with associated scores. We examined relationships between PRAPARE scores with the chemical exposure information derived from maternal biomarker and residential measurements. All information was then examined to assess associations with selected children's health outcomes.

RESULTS:Because health outcomes are often associated with many stressors and demographic variables, we used supporting information from the literature to focus our preliminary analysis on birth weight. Birth weight has been associated with exposure to many chemical stressors including PAHs, phthalates, pesticides, metals, and other consumer product chemicals all of which were included in the NCS dataset.

CONCLUSIONS: This presentation will highlight our preliminary analysis to better understand cumulative exposures and risks.

Keywords: chemical, non-chemical, children, cumulative

An exposome-wide approach of organophosphate flame retardants in the Taiwanese population: Parent-child pairs interaction and potential health risk

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BACKGROUND AND AIM: Organophosphate flame retardants (OPFRs) are substitutes for polybrominated diphenyl ethers and are widely used as flame retardants and plasticizers in the commercial products. Human exposure to OPFRs has been raised the great concern due to associations with adverse health effects, especially in susceptible populations. In this study, total body burden and interaction of four exposure pathways of OPFRs were investigated for Parent-child pairs. METHOD:11 OPFRs of residential environmental matrices (air, dust and skin wipe), selected food samples and the corresponding urinary metabolites were measured for 89 healthy children and their paired parents. The Average daily dose of adults and children through indoor and outdoor inhalation exposure, house dust ingestion and dermal exposure were estimated respectively. The total daily intake of OPFRs was back estimated using urinary OPFRs metabolites. The correlations between the OPFRs in four major pathways as well as the external and internal dose were explored. RESULTS: The average daily exposure dose of Σ11OPFRs for adults and children via inhalation of indoor air ($5.08 \times 10-4$ to $9.17 \times 10-2 \mu g/kg$ bw/day), inhalation of outdoor air ($2.12 \times 10-4$ to $1.78 \times 10-2$ 2 µg/kg bw/day), ingestion of dust (1.11×10-5 to 8.45×10-3 µg/kg bw/day), dermal sorption $(7.50 \times 10^{-4} \text{ to } 1.05 \,\mu\text{g/kg bw/day})$ and ingestion of foods $(2.09 \times 10^{-2} \text{ to } 4.79 \times 10^{-1} \,\mu\text{g/kg bw/day})$ were estimated respectively, which suggested that dermal sorption is an important source of human exposure to OPFRs. Tributoxyethyl phosphate and Tri(1-chloro-2-propyl) phosphate showed the most abundant in all exposure pathways. The positive correlations of external (air inhalation and dermal sorption) and internal intake were found in TDCIPP and TBP.

CONCLUSIONS:Dermal absorption is the main exposure pathway of OPFRs but inhalation of indoor/outdoor air and ingestion of house dust cannot be ignored. Exposure to OPFRs in different age and sex groups in Taiwan posed no potential health risk through all exposure pathways.

Keywords: Exposures, Chemical exposures, Risk assessment

Pathways for India to reduce air pollution health burden and meet sustainable development goal 3.4 target

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BACKGROUND AND AIM: Whether India's recent efforts to reduce PM2.5 exposure would reduce health burden and what India should do to meet the sustainable development goal (SDG) 3.4 target of reducing non-communicable disease burden by one-third in 2030 (relative to 2015) are not known. Here we estimate the health benefits of reducing PM2.5 exposure following three pathways and set exposure reduction targets for India to meet SDG3.4 goal.

METHOD:We simulate PM2.5 exposure using the GAINS model in 2015 (baseline) and in 2030 for the scenarios - business-as-usual (BAU), advanced control technology (ACT), and sustainable development scenario (SDS). We project age-distributed population data based on the census and project the disease-specific baseline mortality based on the past trends. Finally, we estimate the mortality burden attributable to ambient PM2.5 for the baseline and near future apportioned to sectoral emissions.

RESULTS:We find that if India meets the national ambient air quality standard or the next WHO interim targets, IT) in 2030, 13 states from north-east and Peninsular India would achieve the SDG target. In a few states, the health burden would increase because the projected rise in baseline mortality and population would over-compensate the benefit of exposure reduction. We show that exposure reduction targets are unrealistic for many states even if the SDS scenario (the best among the three) is followed. In this scenario, regional contributions and the contributions from residential and commercial sectors and secondary precursors would drastically reduce. The burden would increase in the BAU scenario and marginally decrease in the ACT scenario.

CONCLUSIONS: India would substantially gain by meeting the clean air targets but would remain far away from meeting the SDG3.4 target in 2030. Policies aiming to reduce exposure alone would not be sufficient; baseline mortality needs to be reduced by strengthening the healthcare system to accelerate progress towards the SDG3.4 goal.

Keywords: SDG3.4, air pollution, health burden, India, pathways

The toxic effects with cotreatment of PM2.5 and high glucose in A549 Lung Cancer Cells

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BACKGROUND AND AIM: This study aimed to investigate the health risk of PM2.5, with/without high glucose exposure on lung cancer cells A549.

METHOD:In this experiment, PM2.5 and high glucose were firstly exposed to A549 cells, and then coexposed to selected toxic concentrations to measure cell growth, cell apoptosis and wound healing in A549 cells. The study involved exposing A549 lung cancer cells to varying concentrations of PM2.5 (control, 10, 20, 50, 100 μ g/mL) and glucose (control, 20, 40, 80, 120 mM). After analyzing the results, a concentration of 80 mM glucose and 50 μ g/mL PM2.5 were selected for co-exposure to assess whether the combined exposure to PM2.5 and high glucose levels would result in higher toxicity.

RESULTS:The results showed that 10-100 µg/mL PM2.5, or 20-120 mM glucose exposure significant decreased A549 cell lines growth and wound healing, but increased mortality compared with the control group. In addition, 50 µg/mL PM2.5, and 80 mM glucose co-treatment had similar results compared with only 50 ug/mL PM2.5, or only 80 mM glucose exposure, or control group. CONCLUSIONS:This study may provide a potential therapeutic or preventive approach for people with diabetes or residents located in areas with high PM2.5, exposure. According to the findings, both PM2.5 and glucose exposure caused a significant reduction in the growth of A549 cell lines and increased mortality when compared to the control group. Additionally, the combined exposure of PM2.5 and glucose intensified the negative effects on A549 cells. This highlights the importance of considering the impact of high glucose levels in combination with PM2.5 exposure.

Keywords: PM2.5, High glucose, A549 cells, would healing, health risks

Population attributable fraction of low birth weight risk factors in Japan

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BACKGROUND AND AIM:Low birth weight (LBW) is well-known to associate with significant health problems on later life; however, there are few studies on population attributable fraction (PAF) of LBW risk factors. Objective of this study is to evaluate associations between risk factors for LBW reported in previous studies of the Japan Environment and Children's Study (JECS) data, and to assess the magnitude of risk using the PAF.

METHOD:91,559 mother-child dyads data were extracted from the JECS data. Risk factors reported to associate with LBW in the previous JECS studies were used to calculate odds ratios for LBW using a logistic regression model. The PAF was calculated based on the calculated odds ratios.

RESULTS:Parity, history of adenomyosis, hypertension disorder of pregnancy, maternal age at birth, prepregnancy body mass index, gestational weight gain (GWG), maternal smoking and lead (Pb) exposure were all significantly related to LBW. The sum of the PAF of all factors was 79.4%. The largest PAF among the factors was the GWG (16.5%); whereas, the PAF of the environmental portion, i.e., the sum of Pb exposure (14.6%) and maternal smoking (12.1%), was greater than the PAF of the GWG.

CONCLUSIONS:Our findings indicate that the number of LBW possibly can be decreased by about 27% if Pb exposure is reduced to the lowest quantile and maternal smoking is removed. Further studies are inquired to clarify unknown risk factors for LBW.

Keywords: Birth outcomes, Children's environmental health, Environmental epidemiology, Heavy metals, Risk assessment

Contribution of blood DNA methylation to the association between smoking and lung cancer

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BACKGROUND AND AIM: Altered DNA methylation (DNAm) might be a biological intermediary in the pathway from smoking to cancer. In this study, we investigated the contribution of differential blood DNAm to explain the association between smoking and lung cancer incidence.

METHOD:Blood DNAm was measured in 2321 Strong Heart Study (SHS) participants. Incident lung cancer was assessed as time to event diagnoses. We conducted mediation analysis, including validation using DNAm and paired gene expression data from the Framingham Heart Study (FHS). We also conducted a bioinformatics analysis to assess the biological plausibility of the findings. RESULTS:In the SHS, current versus never smoking and pack-years single-mediator models showed, respectively, 29 and 21 differentially methylated positions (DMPs) for lung cancer (14 of 20 available,

and five of 14 available, replicated, respectively, in FHS) with statistically significant mediated effects. In the FHS, replicated DMPs showed gene expression downregulation largely in trans, and were related to biological pathways in cancer identified in the bioinformatics analysis. The multimediator model identified that DMPs annotated to the genes AHRR and IER3 jointly explained a substantial proportion of lung cancer.

CONCLUSIONS: The association of smoking with lung cancer was partly explained by differences in

baseline blood DNAm at few relevant sites. These findings contribute to the identification of potentially novel mechanisms of lung cancer, and provide evidence in favor of DNAm as a potential biological intermediary in the association between smoking and lung cancer. Experimental studies are needed to confirm the biological role of identified eQTMs and to evaluate potential implications for the prevention and control of lung cancer.

Keywords: Smoking, DNA methylation, cancer incidence, causal inference

Exposome Epidemiology for Suspect Environmental Chemical Exposures during Pregnancy Linked to Subsequent Breast Cancer Diagnosis

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BACKGROUND AND AIM: Breast cancer is now the most common cancer globally, and new approaches to identify suspect carcinogens are critical because research over the last 50 years has not translated to a strategy for individual breast cancer prevention. We developed an exposome epidemiology approach to use omics scale biomonitoring of pregnancy cohort biospecimens from women who subsequently developed breast cancer and women who did not to identify suspect chemical associations with subsequent breast cancer outcome.

METHOD:Second (T2) and third (T3) trimester archival serum samples from 182 women who subsequently developed breast cancer and 384 who did not develop were selected from the Child Health and Development Studies (CHDS) data from the California Cancer Registry. Environmental chemicals were annotated with the Toxin and Toxin-Target Database (T3DB) and used with data-dependent network analysis using xMWAS and pathway enrichment analyses using mummichog. RESULTS:Analyses showed consistent linkage in both T2 and T3 to inflammation pathways, including linoleate, arachidonic acid and prostaglandins, and identified new suspect environmental chemicals associated with breast cancer, i.e., an N-substituted piperidine insecticide and a common commercial product, 2,4-dinitrophenol (DNP), linked to variations in amino acid and nucleotide pathways in T2 and benzo[a]carbazole and a benzoate derivative linked to glycan and amino sugar metabolism in T3. CONCLUSIONS:The results identify new suspect environmental chemical risk factors for breast cancer and provide an exposome epidemiology framework for discovery of suspect environmental chemicals and potential mechanistic associations with breast cancer.

Keywords: Breast cancer, carcinogen, metabolic disruption, pregnancy, environmental chemical

Are hygiene, cosmetics and hair products associated with breast cancer? The MCC-Spain study

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BACKGROUND AND AIM: Breast cancer is the most common tumor in women worldwide and is hormone-sensitive. Cosmetics are widely used and include a wide variety of ingredients, some of them known to be mutagenic or have endocrine disruption properties. We investigated the association between different types of cosmetics and hygiene products in relation to breast cancer risk. METHOD: We included 1738 histologically confirmed breast cancer cases and 1910 female controls from the MCC-Spain study, a multicase control study conducted in Spain 2008-2013. Participants were asked in a face-to-face interview, about their use of cosmetics and hygiene products (perfumes, hair shampoo and conditioner, hair molding products, lotion for face, lotion for body, hand/foot cream, deodorant, nail polish) during the past 10 years, and also about socio-demographic, reproductive factors, nutrition and other relevant variables. We used logistic regression to calculate Odds Ratio (OR) and 95% Confidence Intervals (CI), using exposure variables in tertiles, and adjusting for possible confounders.

RESULTS:Participant used several cosmetics and hygiene products, ranging from 48% (nail polish) to 99.5% (hair shampoo/conditioner). Heavy users (3rd tertile, times/week) of hair shampoo and conditioner had an increased risk of breast cancer (OR=1.42; 95%CI 1.14-1.77), compared to non-users and low users as the reference (p-trend<0.05). We did not observe associations of breast cancer risk with any other products. A cumulative score based on number of cosmetics/products used was also not associated with cancer risk, observing an OR of 0.95 (95&CI 0.78-16.16 for the highest tertile).

CONCLUSIONS: We did not observe an overall association of use of cosmetic and hygiene products with breast cancer but observed an association between the use of hair products such as shampoo or conditioner and breast cancer risk. This specific association should be further investigated, since not much literature is available. **Keywords:** Cancer and cancer precursors, Chemical exposures, Endocrine disrupting chemicals

Pre-disease biomarkers of poly chlorinated biphenyls (PCB) and amyotrophic lateral sclerosis (ALS) risk

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BACKGROUND AND AIM:Polychlorinated biphenyls (PCB) are toxic, persistent chemicals that were used in pesticides and industrial material. Occupations using PCBs have been associated with amyotrophic lateral sclerosis (ALS), one study found some PCB congeners in blood associated with ALS, but samples were collected post-ALS onset. We evaluated the association of pre-disease PCB exposure and ALS risk in a nested case-control study.

METHOD:Using the Finnish Mobile Clinic, its Follow-Up Study, and Mini-Finland Health Survey cohorts, we identified 97 ALS cases and matched 194 alive controls based on cohort, age, sex, municipality, and serum freeze-thaw cycles. Serum was collected from participants from 1968-1979 and measured for 13 PCB congeners. We assessed the relationship between PCB concentration (individual congeners and groups) and ALS with conditional logistic regression adjusting for smoking, occupation, BMI, and cholesterol level.

RESULTS:ALS cases had a mean time-to-diagnosis of 25 years, and had a higher proportion of "bluecollar" workers and smokers compared to controls. Overall, we observed no consistent results when evaluating PCBs as individual congeners. However, the sum of all PCBs showed an inverse doseresponse association with ALS with an OR in the 4th quartile of 0.39 (95% CI: 0.15-1.03; p-value for trend: 0.03). The sum of non-dioxin-like PCBs (excluding congeners 118 and 156) showed a similar trend, while the trend was less pronounced for the sum of dioxin-like PCBs (118 and 156: 4th quartile OR: 0.89; 95% CI: 0.37-2.11; p-value for trend:0.09).

CONCLUSIONS: We observed an inverse-relationship between pre-disease PCB exposure and ALS incidence. A similar association was found in Finland for PCBs and Parkinson's disease possibly suggesting some common mechanisms or PCB- associated neuroprotective factors (e.g. fish oils) in both neurodegenerative conditions. The possibility of informative censoring (i.e. PCBs associated with death before age of ALS) and lack of repeated measures should be considered. Supported by T32ES007069, R01TS000315 and P30ES000002.

Keywords: Chemical exposures, biomarkers of exposure

Association of residential exposure to dioxin emissions with lymphoid malignancies in a prospective US based cohort of women

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BACKGROUND AND AIM: The etiology of non-Hodgkin lymphoma (NHL) and multiple myeloma (MM) is still unclear. Increased NHL risk has been found among individuals living in the vicinity of incinerators with high dioxin emission levels. However, limited evidence is available from prospective cohorts and for individual NHL subtypes. We aimed to assess the associations between exposure to dioxin emissions and incident NHL and MM in the US-based prospective Nurses' Health Study II (NHSII, 1989-2013).

METHOD: We estimated residential exposure to dioxin emissions using a nationwide database of dioxin-emitting facilities. The emission index was estimated as the inverse-distance-weighted sum of emissions from all facilities within 3, 5, or 10 km of a residence, expressed in units of gram [g] toxic equivalency quotient [TEQ]/year/km2; higher emission values indicate higher toxicity. We defined three emission index categories: (1) no exposure (reference), (2) >0-median, and (3) >median gTEQ/year/km2. We then applied time-varying Cox proportional hazards models, adjusting for potential confounders including age, race, lifestyle factors, and individual- and area-level socioeconomic status to calculate hazard ratios (HRs) and 95% confidence intervals (CIs) for risk of incident NHL or MM.

RESULTS: We observed 378 NHL and 48 MM cases during 2,371,385 person-years of follow-up. The study included mostly white, married, and/or non-smoking females who were on average aged 46 years over follow-up. Within all buffers, higher levels of dioxin emissions were associated with increased NHL and MM risk. For example, participants exposed to >0.03 gTEQ/year/km2 within a 10km buffer had a HR (95% CI, vs. unexposed participants) of 1.30 (1.00, 1.68) for NHL and of 1.53 (0.72, 3.27) for MM.

CONCLUSIONS: We found positive associations between residential exposure to dioxin emissions and risk of NHL (in aggregate) and MM in a prospective nationwide cohort of women. Forthcoming analyses by common NHL subtype will further elucidate these associations.

Keywords: Dioxin, non-Hodgkin lymphoma, multiple myeloma, industrial emissions

Air Pollution Exposure During Pregnancy and Placental Inflammation

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BACKGROUND AND AIM:Regulation of pro and anti-inflammation at various stages of development is imperative to placental growth, function, and an overall healthy pregnancy. Air pollution exposure at critical times during development in the form of PM2.5, NO2, and pyrene may dysregulate immune function and lead to systemic inflammation. This study examines the relationship between air pollution exposure at various time points throughout development and placenta inflammation. METHOD:Using estimates of residential ambient PM2.5 and NO2 concentrations, placental inflammation markers (IL-6, TNF-a) measured in placental tissue (N=277 births), and 1-hydroxy-pyrene [1-OHP] measured in the urine of pregnant women living in Rochester NY, in 3 trimesters. Multivariable, generalized additive and linear regression models were then used to examine the association between placental TNF-a, IL-6, PM2.5, and NO2 concentrations in the previous 2, 4, 8, 12, and 36 weeks and urinary 1-OHP in the 1st, 2nd, and 3rd trimesters, adjusting for maternal age, body mass index before pregnancy, and smoking status.

RESULTS:Each 1.6 µg/m3 increase in PM2.5 concentration in trimester 1 was associated with a 23% decrease in IL6 (95% CI: 6.8 %, 52.6%). Conversely, a 20% increase in urinary 1-OHP concentration in the first trimester was associated with a 7.13% increase in placental TNF-a concentrations (95% CI: 3.33%-10.95%), but not IL-6 0.46%, (95% CI: -1.96%-2.96). However, no associations were observed between other weekly averages of PM2.5 and NO2 concentrations and placental inflammation markers (TNF-a, and IL6) in other trimesters. Sensitivity analysis for medication and illness during pregnancy showed no change in the main effect.

CONCLUSIONS: Results from our study show a potential relationship between air pollution exposure and changes in placental inflammation markers (IL6 and TNF-a) during the first trimester of pregnancy.

Keywords: Pregnancy outcomes, Traffic-related

Non-persistent Chemicals in Urine and Glycemia during Pregnancy: The Healthy Start Study

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BACKGROUND AND AIM:Some non-persistent chemicals may alter glucose metabolism, but epidemiologic findings are inconsistent in pregnant women. We evaluated associations between 26 chemicals frequently found in consumer products and glucose-insulin traits among pregnant women. METHOD:Thirteen phthalate metabolites, six phenols, two parabens, and five organophosphate flame retardant metabolites were measured in mid-pregnancy urine (median gestational age 27 weeks) in 301 women participating in the Healthy Start Study, a mother-offspring cohort. Glucose, insulin, and Homeostatic Model Assessment-Insulin Resistance (HOMA-IR) were assessed concurrently using fasting blood. Results from 1-hour 50g glucose challenge tests (GCT) were abstracted from medical records. Linear regression models estimated associations between each chemical and each trait, adjusted for confounders including pre-pregnancy body mass index. Quantile-based g-computation was used to examine associations with the chemical mixture.

RESULTS:In single-pollutant models, most phthalate metabolites and bisphenol A were positively associated with fasting glucose, insulin, and HOMA-IR; bisphenol S was positively associated with GCT glucose. Each doubling of di(2-ethylhexyl) phthalate (DEHP) metabolites was associated with 0.63 – 1.57 mg/dL higher fasting glucose (mono(2-ethylhexyl) phthalate (MEHP): 0.63, 95% CI: 0.13, 1.12; mono(2-ethyl-5-carboxypentyl) phthalate (MECPP): 1.57, 95% CI: 0.84, 2.29) and 4.2-10.7% higher HOMA-IR (MEHP: 4.2%, 95% CI: 0.63%, 7.8%; mono(2-ethyl-5-oxohexyl) phthalate (MEOHP): 10.7%, 95% CI: 5.5%, 16.1%). In multi-pollutant models, each quartile increment in all chemicals was associated with higher fasting glucose (1.82 mg/dL, 95% CI: -0.75, 4.39), insulin (14.8%, 95% CI: -1.7%, 34.1%), and HOMA-IR (17.7%, 95% CI: -0.81%, 39.7%). MECPP and MEOHP explained the highest proportions of the mixture's positive associations.

CONCLUSIONS: DEHP exposure was positively associated with fasting glucose, insulin, and estimated insulin resistance among heathy pregnant women. If causality is confirmed, limiting DEHP exposure may reduce the risk of dysglycemia in pregnancy. This study was funded by the National Institutes of Health (grants R01ES022934, R01ES032213, R01DK076648, and UH3OD023248).

Keywords: Endocrine disrupting chemicals, Mixtures, Phthalates, Obesity and metabolic disorders

Associations between residential greenness and birth outcomes: results from the Korean Children's Environmental health Study

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BACKGROUND AND AIM: The amount of greenness around mother's residences has been reported to be positively associated with birth outcomes; however, findings are inconclusive. Hence, we investigated the association between residential greenness and birth outcomes in a birth cohort study in Korea.

METHOD: We used data from the Korean Children's Environmental health Study on singleton live birth (n = 4,714) from 2015 to 2019. Residential greenness, represented by the normalized difference vegetation index (NDVI), was obtained from satellite measurements. Multiple logistic regression models were used to evaluate the associations of NDVI exposure with preterm birth and low birth weight. Further, linear regression models were used to determine the associations of NDVI exposure with birth weight (BW), birth length (BL), birth weight to length ratio (BWtL), body mass index (BMI), and ponderal index (PI), controlling for individual and neighborhood factors.

RESULTS:There was no significant relationship between residential greenness and preterm births and low birth weight. An interquartile range (IQR) increment in the fraction of green space within 2000m of residence was statistically significantly associated with 0.138 increase birth length (95% Confidence Interval [0.072, 0.205]. On the other hand, there was a significant decrease in the ponderal index [β = -0.192, 95%CI:(-0.291, -0.092)], and BMI [β = -0.070, 95%CI:(-0.109, -0.032)] in the 2000m buffer. In multi-pollutant models, increase in residential greenness was associated with increase birth length [β = 0.093, 95%CI:(0.020, 0.165)] in 2000m. Whereas, there was a significant decrease in the ponderal index [β = -0.132, 95%CI:(-0.245, -0.019)], BMI [β = -0.049, 95%CI:(-0.092, -0.007)] in 2000m buffer. Results were generally robust with different buffer sizes and controlling for fine particles (PM2.5) and Nitrogen.

CONCLUSIONS:Our finding suggests beneficial impact of residential greenness on birth length. Exposure to greenness was also associated with lower anthropometric ratio, indicating lower risks of adiposity in newborn baby.

Keywords: Residential greenness, NDVI, birth outcome, cohort study, Ko-CHENS

PRegnancy and UrbaN Environment (PRUNE) cohort profile and built environment in infertile couples

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BACKGROUND AND AIM:Addressing the association between perceived physical environment and human fertility is necessary to understand the impact of built environment on reproductive health and developing effective interventions to improve human fertility. We assessed the association between perceived built environment and pregnancy in infertility patients.

METHOD: We constructed a prospective cohort study (PRegnancy and UrbaN Environment, PRUNE) recruiting 726 infertility patients (470 women and 256 men) who visited one of the two university-affiliated infertility centers for infertility treatment between October 2019 and July 2022. Using a mobile survey, we collected the information of demographic, clinical characteristics, residential address, perceived proximity to neighborhood green and blue space, and environmental noise. Adjusted risk ratios (aRR) were calculated for achievement of pregnancy within three months of survey participation.

RESULTS:Median age of women and men was 39 and 40 years, respectively. Majority of patients reported they have green (88.7%) and blue space (66.0%) within a 10-min walking distance. A fourth of patients (23.3%) had an annoying environmental noise. Adjusted risk ratio for pregnancy within 3 months was higher when they have green space within a 10-min walking distance (2.97, 95% confidence interval [CI]: 1.13, 7.82). The association between blue space within a 10-min walking distance (1.05, 95% CI: 0.72, 1.51) and pregnancy was close to null. Higher neighborhood noise was associated with lower probability of pregnancy (0.68, 95% CI: 0.46, 1.01) which did not reach statistical significance. The risk estimates of pregnancy within 1 year were close to null for green and blue spaces within a 10-min walking distance, and presence of annoying neighborhood noise. CONCLUSIONS:We observed some positive association between having green space within a 10-min walking distance and achieving pregnancy. This finding would provide evidence of potential impact of built environment on human fecundity.

Keywords: Built environment, Infertility, Cohort

Exposure to Ultrafine Particles and Cognitive Decline Among Older People in the United States

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BACKGROUND AND AIM: Some studies suggest that ambient particulate air pollution is associated with cognitive decline. However, the findings are mixed, and there is no relevant research examining the influences of ultrafine particles (UFP), which may have more toxicity than larger particles. We therefore conducted this study to investigate whether residential UFP exposure is associated with cognitive decline using data from the Alzheimer's Disease Research Centers in the United States. METHOD: This is a longitudinal study of participants who were aged 65 years and older and had normal cognitive status at baseline. Residential UFP exposure, expressed as particle number concentrations (PNC), was assessed in 2016-2017 using a nationwide land use regression model, and was assigned to each participant using their 3-digit residential ZIP codes. Cognitive functions including memory, attention, language, executive function, and global function were assessed annually using 15 neuropsychological tests from March 2015 to February 2022. Linear mixed-effects models were used to examine the associations after adjustment for covariates including baseline age, sex, APOE e4 status, race, education, smoking status, history of diabetes, and quartiles of neighborhood median household income.

RESULTS: This study included 5646 participants (mean age 76 years, 65% female). On average, each participant had 4 annual visits. When PNC was treated as a continuous variable, there were no statistically or clinically significant changes in annual decline of each cognitive function in relation to an interquartile range elevation in PNC (4026 particles/cm3). Similarly, when PNC was treated as a categorical variable including five exposure groups, there were no statistically significant differences in annual decline of each cognitive function annual decline of each cognitive function.

CONCLUSIONS: This study found no meaningful associations between residential UFP exposure and cognitive decline in global and domain-specific functions. There is a need for further research that assigns UFP exposure at a finer geographic scale.

Keywords: air pollution, particulate matter, long-term exposure, neurodegenerative outcomes, environmental epidemiology

Outdoor light at night and mortality in the UK Biobank: a prospective cohort study

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BACKGROUND AND AIM: More than 83% of the world's population lives under light-polluted skies while information about health effects of outdoor light at night (LAN) is limited. We examined the association of LAN with natural cause (NC) and CVD mortality using the UK Biobank (UKB). METHOD: We included 273,335 participants recruited between 2006 and 2010. Level of LAN was estimated at each participant's address using time-varying satellite data for a composite of persistent night-time illumination at ~1km2 scale. Information on causes of death until 12 November, 2021 was obtained through record linkage. Cox proportional hazards regression was used for data analysis. RESULTS: In the follow-up with an average of 12.4 years, 14,864 NC and 3,100 CVD deaths were identified. Compared with the participants exposed to the first quartile of LAN, participants exposed to the highest guartile showed an 8% higher risk of NC mortality (hazard ratio (HR): 1.08, 95% confidence interval (CI): 1.03-1.14) after adjusting for age, sex, social-economic status, lifestyle factors and body mass index. However, the association disappeared after further adjustment for PM2.5 and evening noise, with HRs (95% CIs) of 1.02 (0.97-1.07), 1.01 (0.97-1.07) and 1.03 (0.98-1.09), respectively, for the participants exposed to the second, third and fourth quartiles of LAN. No significant associations were observed between LAN and CVD mortality, either. CONCLUSIONS: We did not observe significant associations of LAN with NC and CVD mortality in this large nationwide cohort. The health effects of LAN remain unclear. Further studies are warranted to address this public health concern.

Keywords: Outdoor light at night, mortality, cardiovascular disease

Environmental Exposure to Risk Factors and Its Effects on Heart Rate Variability in Vulnerable and Susceptible Individuals

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BACKGROUND AND AIM: Heart rate variability (HRV) refers to the variation in time between successive heartbeats and is an important indicator of autonomic nervous system function. It has been shown that exposure to environmental hazardous substances, such as environmental risk factors, can have negative effects on HRV. Vulnerable and susceptible individuals, such as elderly individuals and those with pre-existing cardiovascular disease, may be particularly susceptible to these effects. However, there is still a need for further research to better understand the relationship between environmental exposures and HRV in these individuals.

METHOD: The study involved 40 participants, including those with existing cardiovascular and airway diseases, who wore an ECG monitor and personal air quality monitoring devices to collect data on ambient environmental risk factors. The data collected included PM1.0, PM2.5, PM10, CO2, air temperature, humidity, and TVOC. A Dual-Stage Attention-Based Recurrent Neural Network (DARNN) was trained using the collected data to predict changes in HRV for 5 minutes when exposed to environmental hazardous substances for 10 minutes.

RESULTS:Our deep learning study found a strong correlation between environmental risk factors exposure and reduced HRV in vulnerable individuals. These results emphasize the need to mitigate such exposure to prevent adverse health effects. The HRV prediction model performed best with a 100 ms criterion (81% accuracy), with humidity, PM2.5, PM1.0, and PM10 being the most important variables. Among these, humidity and PM2.5 had the greatest impact on model performance. CONCLUSIONS:Environmental risk factors can negatively affect HRV, especially in vulnerable and susceptible individuals such as the elderly and those with pre-existing cardiovascular disease. We use the DARNN model to predict changes in HRV due to environmental exposure, indicating its potential to identify high-risk individuals. However, it is important to consider changes in HRV due to individual risk factors as well, in addition to environmental factors.

Keywords: Heart Rate Variability, Vulnerable and Susceptible Individuals, Environmental Exposure, Recurrent Neural Network

Association between Long-term Noise Exposure and Bipolar Disorder: a Community-based Cohort Study in Taiwan

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BACKGROUND AND AIM: The statistics provided by the World Health Organization showed that about 45 million people worldwide are affected by bipolar disorder. Additionally, noise pollution is an urgent environmental issue in Taiwan, and only limited studies explored the relationship between noise exposure and bipolar disorder. Therefore, we aimed to explore the association between long-term exposure to noise and incidence of bipolar disorder using a cohort study in Taiwan. METHOD: We recruited 12,626 participants who resided in Main Taiwan Island from REVEAL-HBV, a community-based cohort study established in 1991. Participants' long-term noise exposure was estimated from noise information provided by the Taiwan EPA (2003-2017) followed by spatial interpolation using land-use regression models. The diagnosis of bipolar disorder was based on participants' medical claim data retrieved from National Health Insurance Health Database (NHIRD) in the follow-up period (2008-2017). Cox proportional hazards models were utilized to evaluate the relationship between noise exposure and bipolar disorder.

RESULTS: A total of 247 incidence of bipolar disorder was identified during follow-up with a mean follow-up time of 9.19 years. Higher noise exposure levels were found among bipolar disorder participants (mean noise level = 65.28 dBA) compared with those without diseases (mean noise level = 64.28 dBA). Noise exposure was significantly associated with an increased incidence of bipolar disorder (adjusted hazard ratio [HR] =1.03 per 1 dBA increment on noise; 95% confidence intervals = 1.01 -1.05); p-value < 0.01). Further stratified analysis on participants' residential townships showed a consistent result with the major findings (HR ranged from 0.97 to 1.05), although the statistical significance was marginal.

CONCLUSIONS:Long-term noise exposure was positively associated with bipolar disorder. Reduction on environmental noise exposure will alleviate the health burden related to bipolar disorder. This study was funded by the Taiwan National Science and Technology Council and Academia Sinica.

Keywords: Noise, Mental health outcomes, Long-term exposure, Incidence

MP-068[Air pollution » Particulate matter]

Effect of PM2.5 and Noise Exposure on the Risk of Blood Glucose Impairment in Pregnant Women

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BACKGROUND AND AIM: Fine particulate matter (PM2.5) and noise exposure have been linked to adverse health effects in various populations. However, their impact on glucose metabolism during pregnancy remains unclear. Therefore, this study aims to investigate the association between PM2.5 and noise exposure and oral glucose tolerance tests (OGTT) in pregnant women. METHOD: Data from China Medical University Hospital for the period of 2003-2019 were utilized in this study. Individual PM2.5 exposure was calculated using satellite-based spatiotemporal models based on subjects' residences. Ordinary Kriging models were used to determine annual average noise exposure with a resolution of 1-km. Univariable and multivariable linear regression models were employed. Additionally, restricted cubic splines were used to investigate the dose-response relationships. RESULTS: In the multivariable linear regression models, a significant positive association was found between PM2.5 exposure and OGTT-1h and OGTT-2h. The adjusted effect estimate of OGTT-1h and OGTT-2h for a 10 ug/m3 increase in PM2.5 was 4.11 mg/dl and 3.02 mg/dl for first trimester exposure, and 4.25 mg/dl and 3.93 mg/dl for the second trimester exposure, respectively. In addition, for each dBA increase in noise level, the effect estimate of OGTT-1h and OGTT-2h was found to increase by 2.73 mg/dl and 2.53 mg/dl glucose level, respectively (p-value < 0.05). CONCLUSIONS: Our study indicates that environmental factors, such as PM2.5 and noise exposure associated with blood glucose impairment in pregnant women. Further research is required to fully understand the mechanisms involved in these associations.

Keywords: Environmental epidemiology, Noise, Female

Maternal Factors Associated with Plasma Concentrations of Persistent Organic Pollutants Among Women from Pregnancy to Postpartum Period

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BACKGROUND AND AIM: This study aims to assess maternal factors (age, breastfeeding and weight) that may influence plasma concentrations of persistent organic pollutants (POPs) in women from pregnancy to postpartum period.

METHOD:97 Hispanic women (mean \pm SD = 30.47 \pm 5.67 years) with gestational diabetes mellitus (GDM) were enrolled in this study. Plasma concentrations of 41 POPs including 21 polychlorinated biphenyls (PCBs), 7 organochlorine pesticides (OCPs), 5 polybrominated diphenyl ethers (PBDEs), 2,2',4,4',5,5'-hexabromobiphenyl (BB-153), 7 perfluoroalkyl substances (PFASs) were measured from archived samples collected at 3rd trimester of pregnancy and 15-60 months postpartum. Multivariate linear regression model was used to assess associations of 1) maternal age and pre-pregnancy weight with the POPs concentrations at 3rd trimester; 2) maternal age, weight, and breastfeeding status with POPs concentrations at 15-60 months postpartum; and 3) maternal age, breastfeeding and weight loss after delivery with the longitudinal changes of POPs concentrations from pregnancy to postpartum period.

RESULTS:From pregnancy to postpartum period, plasma concentrations of PBDEs and PFASs were significantly increased, PCBs and OCPs significantly decreased among the 97 women. Higher age was associated with higher levels of PCBs (except PCB-28), OCPs (T-NONA and p,p'-DDE) and BB-153 at 3rd trimester (all p-values<0.05). Breastfeeding was associated with lower levels of 19 POPs (e.g., PCB-178, PBDE-28, OXYCHLOR and PFHxS) at postpartum visit (all p-values<0.05). Additionally, higher age, breastfeeding and less weight loss after delivery were significantly associated with the higher annual decrease of PCBs and OCPs concentrations from pregnancy to postpartum period (all p-values<0.05).

CONCLUSIONS: Women of older age had higher plasma concentrations of PCBs. The concentrations of lipophilic POPs declined more in women who breastfed their newborns, while declined less in women having more weight loss after delivery.

Keywords: Persistent Organic Pollutants, Maternal Age, Weight, Breastfeeding

Longitudinal effects of PFAS exposure on insulin sensitivity and β-cell function among women with gestational diabetes mellitus history

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BACKGROUND AND AIM:Per-and polyfluoroalkyl substances (PFAS) have been found to be associated with gestational diabetes mellitus (GDM) development. However, no studies have explored longitudinal effect of PFAS on metabolic decline. We investigated PFAS levels from pregnancy to postpartum on changes in diabetes-related traits over follow-up among women with GDM during pregnancy. METHOD:Data included 98 Hispanic women with GDM (mean age 32.3 ± 5.6 years at pregnancy) recruited during 3rd trimester of pregnancy and followed every 12-15 months up to 12 years after pregnancy. Oral and Intravenous glucose tolerance tests were conducted at each visit. Diabetes-related traits include fasting and 2-hr glucose and insulin, incremental 2-hr glucose area under the curve (AUC); insulin sensitivity (SI), acute insulin response (AIRg) and disposition index (DI) measuring β -cell function. Absolute plasma concentrations of PFAS levels (PFNA, PFOA, PFOS, PFHxS and MeFOSAA) were measured at the 3rd trimester of pregnancy and 15-60 months postpartum visits. Linear mixed effects models were used to investigate the association between PFAS exposure and longitudinal trajectories of diabetes-related traits, adjusting for age, weight, breastfeeding status, diet and physical activities as time-dependent variables.

RESULTS:Increased 1SD (2.42 ng/ml) of PFOA from pregnancy to postpartum was associated with annual decrease in DI (β =-0.01, p=0.03), SI (β =-0.02, p=0.01), AIRg (β =-0.02, p=0.006) and increase fasting insulin (β =0.02, p=0.008). Increased 1SD (0.5 ng/ml) PFNA was associated with annual decrease in DI (β =-0.01, p=0.03), SI (β =-0.02, p=0.01), AIRg (β =-0.01, p=0.02) and increase in fasting insulin (β =0.02, p=0.03). Increased 1SD (0.3 ng/ml) of MeFOSAA was associated with annual increase in 2hr incremental glucose AUC (β =0.12, p=0.01).

CONCLUSIONS: Higher PFAS exposure was associated with faster decline in insulin sensitivity, acute insulin secretion, β -cell function, and increase in glucose over time among Hispanic women with GDM, suggesting longitudinal effects of PFAS on metabolic decline for high risk groups.

Keywords: PFAS, gestational diabetes, long-term effect, insulin sensitivity.

MP-071[Respiratory and allergic outcomes » Allergies]

Prenatal polyunsaturated fatty acids and childhood atopic dermatitis

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BACKGROUND AND AIM: Atopic dermatitis is a common chronic inflammatory skin disease for which several environmental factors such as dietary practices have been identified. The aim of this prospective study was to evaluate the association between maternal dietary intake of polyunsaturated fatty acids (PUFA) and atopic dermatitis in their children up to 7 years of age.

METHOD:The study population consists of 557 mother-child pairs from the Polish Mother and Child Cohort (REPRO_PL). Based on the Food Frequency Questionnaire completed between the 20th–24th weeks of pregnancy, n-3 and n-6 PUFAs as well as n-6:n-3 fatty acid ratio were estimated using food composition tables. Children's health examinations at the age of 1, 2, and 7 years were performed by an allergist. Generalized Estimating Equations were performed in order to assess the prevalence of atopic dermatitis at three time points. Independent variables in the equation were n-3, n-6 PUFAs and n-6:n-3 PUFAs ratio. The model was controlled for selected confounders.

RESULTS: The prevalence of atopic dermatitis was 37%, 26% and 21% at age of 1, 2 and 7 years, respectively. Higher n-6:n-3 fatty acid ratio was correlated with higher prevalence of atopic dermatitis at age of 7 years (p<0.07). Neither prenatal n-3 nor n-6 PUFAs alone were significantly associated with child atopic dermatitis.

CONCLUSIONS: The ratio between maternal dietary n-6 and n-3 PUFA intake possibly influences the risk of developing atopic dermatitis in children. These results may contribute to the existing knowledge on the impact of maternal diet during pregnancy for children's optimal health, however further studies are needed before drawing conclusions and creating clinical practice guidelines.

Keywords: Allergies, Food/nutrition,

Maternal demographic, socioeconomic and environmental characteristics and adverse pregnancy outcomes, A structural equation model

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BACKGROUND AND AIM: There is a growing number of international studies that confirms that the first 1000 days of life period is a crucial window of development that may be affected by several environmental stressors as maternal and fetal living conditions. Therefore, beyond the individual and contextual socio-economic level, the living environment "neighborhood" has emerged as an important determinant to investigate health disparities, particularly for pregnant women and adverse pregnancy outcomes. Most of the studies use these variables independently even though they all have potential interrelationships.

METHOD: Through a structural equation model (SEM), we examined the association between residential amenities, environmental nuisance, Mother's socio-economic characteristics and pregnancy outcome (birthweight and gestational age at birth) in Mobifem cohort, constituted with pregnant women living in the eurometropolis of Strasbourg in France. We use amenity, environmental nuisance and socioeconomic deprivation as latent variables. Amenity were estimated from the number of equipments in a buffer zone of 500m and 250m around the home address (diversity of shops, playgrounds, sports facilities, green spaces). Environmental nuisance were estimated from daily mean concentrations of PM10, PM2.5 and NO2; level of noise pollution in the neighbourhood. Demographic and socioeconomic characteristics were estimated from the socio-economic statue, her employment situation, of the mother, her age, her weight, the french deprivation index (fdep), and a local deprivation index (adapted for the city of Strasbourg through a principal component analysis). RESULTS:A direct association between socioeconomic deprivation and adverse birth outcome estimate and inverse associations between adverse birth outcome and green space were observed. the associations between adverse birth outcomes and socioeconomic deprivation were direct. CONCLUSIONS: The main results suggest that unfavorable environmental amenities and increased nuisance exposure during the pregnancy might contribute to adverse birth outcomes, especially LBW and prematurity, especially for unfavorable socio-economic environments.

Keywords: birth outcomes, social determinants, amenity, Environmental exposure, structural équation model

Socio-economic determinants of exposure to endocrine disrupting chemicals in pregnant women: Taiwan Maternal Infant Cohort Study

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BACKGROUND AND AIM: Exposure to endocrine disrupting chemicals (EDCs) is rigorously studied in associations with various health outcomes, however less attention is paid to its socio-economic determinants. This study investigates how EDCs levels in pregnant women may differ on residence, individual- and area-level income, and other socio-economic factors.

METHOD:Maternal urine collected in third semester was analyzed for phthalates, nonylphenol, bisphenol A (BPA), parabens and benzophenones. Individual socio-economic variables were linked to average annual household income of neighborhood/village (area-level income) via participants' postal codes. EDCs metabolites concentration were treated as continuous dependent variables adjusted for molar weight and creatinine. Associations between socio-economic factors and EDCs levels were estimated for the four main Taiwan regions (South, East, Central and North) using linear regressions models with interaction between individual-level factors and area-level income as quadratic term. RESULTS:The most distinct individual household income gradient was observed for BPA:

median(range) of 11.10(0.44, 61.50) nmol/g creatinine in the lowest income and 1.44(0.46, 30.90) nmol/g creatinine in the highest income groups in the South region. However, reverse gradient was observed in the East: BPA median(range) of 3.43(0.17, 17.40) nmol/g creatinine in the lowest income and 7.43(0.34, 50.60) nmol/g creatinine in the highest income groups. After adjustment for age, education, religion and ethnicity non-significant interactions between individual- and area-level income were detected in areas with higher average household income for phthalates, nonylphenol, BPA in the South and East, and for parabens in the East.

CONCLUSIONS: Reduced differences in EDCs exposure across the regions could be due to the high population density and unimpeded flow of consumer products in Taiwan, which may explain the non-significant findings. South and East regions indicated potential income inequalities in EDCs exposure.

More specific socio-economic indicators and environmental settings related to EDCs exposure should be considered in the future investigations of the associations with child health outcomes.

Keywords: Endocrine disrupting chemicals, phthalates, socio-economic factors

Prenatal PFHxS Concentrations are Negatively Associated with Infant Birthweight and Weight at Two Years of Age

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BACKGROUND AND AIM: An inverse association between prenatal exposure to per-and-polyfluoroalkyl substances (PFAS) and lower birthweight has been suggested, but less is known on which PFAS are most associated and their influences on child weight after infancy. This study assessed the association between prenatal PFAS concentrations and birthweight and weight at two years of age in a racially and ethnically diverse birth cohort.

METHOD:Six PFAS (PFOS, PFOA, PFUnDA, PFHxS, PFDA, PFNA) were measured in maternal serum collected during pregnancy (12±3 weeks gestation) from 796 individuals in Kaiser Permanente Northern California participating in the NIH Environmental influences on Child Health Outcomes (ECHO) program. We used linear regression models to assess associations between individual PFAS concentrations (natural log transformed) and infant birthweight (grams and sex-specific birthweight-for-gestational-age z-scores) and child weight at two years (kilograms, n=630). Models were adjusted for maternal age, pre-pregnancy body mass index (BMI), race/ethnicity, neighborhood socioeconomic status, and parity. Infant sex and gestational age at birth were included for birthweight and two-year old weight models.

RESULTS:Participants were 30 ± 5 years old at pregnancy and racially/ethnically diverse: 19% Asian, 4% Black, 40% Hispanic, 32% White and 5% Multiracial/other. Their infants were born on average 39 ± 2 weeks and weighing 3361 ± 543 grams. Median PFAS concentrations (>60% detection) ranged between 0.2-2.5 ng/mL with PFOS having the highest median. Although an inverse relationship with infant birthweight was suggested for all PFAS analytes, only PFHxS reached statistical significance (β = -72.1 grams 95% CI [-112.7, -31.5], p=0.001; β = -0.02 standard deviation 95% CI [-0.3, -0.1], p=0.0001). Only PFHxS was associated with weight at two years of age (β = -0.2 kilograms, 95% CI [-0.4, -0.1], p=0.01).

CONCLUSIONS: Prenatal PFHxS concentrations were associated with lower birthweight and child weight at two years of age. Analyses are underway to investigate the influence of prenatal PFAS exposure on long-term childhood BMI trajectories within this population.

Keywords: Birth outcomes, Environmental Epidemiology, Obesity, Endocrine disrupting chemicals

Association between exposure to heavy metals in atmospheric particulate matter and sleep quality

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BACKGROUND AND AIM:Recent studies have demonstrated that long-term exposure to particulate matter is associated with poor sleep quality. However, there are no studies linking the constituents of particulate matter and sleep quality. This study aimed to investigate the association between exposures to heavy metals in particulate matter and sleep quality.

METHOD: This cross-sectional study was performed using data from the Korean Community Health Survey performed between August and October 2018 in adults aged 19 to 80 years. Sleep quality was evaluated using Pittsburgh Sleep Quality Index (PSQI). Poor sleep quality was defined as PSQI \geq 5. The one-year average concentrations of heavy metals (lead, manganese, cadmium, and aluminum) in particulate matter with diameter \leq 10 µm between November 2017 and October 2018 was obtained from Air Korea and linked to the survey data based on each individual's district (gu)-level residential address.

RESULTS: Multivariable logistic regression models were used to investigate the associations between airborne concentrations of heavy metals and poor sleep quality. A total of 32,051 participants were studied. Increases in log-transformed lead (odds ratio, 1.14; 95% confidence interval, 1.08–1.20), manganese (1.31; 1.25–1.37), cadmium (1.03; 1.00–1.05), and aluminum concentrations (1.17; 1.10-1.25) were associated with poor sleep quality.

CONCLUSIONS: We show, for the first time, exposures to airborne lead, manganese, cadmium, and aluminum were associated with poor sleep quality.

Keywords: Particulate matter, heavy metals, sleep quality
Interactions between maternal arsenic exposure and folate pathway genes on the risk of spina bifida: A case-control study in Bangladesh

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BACKGROUND AND AIM: The pathogenesis of spina bifida involves complex gene-environment interactions, and folate pathway genes are the main targets of interest. High prenatal arsenic exposure increases the risk of spina bifida in experimental animals, possibly by its disruption of folate metabolism. However, few population health studies have examined the effect modification of arsenic-induced spina bifida by genetic polymorphisms involved in folate metabolism.

METHOD: We assessed genotypes of 108 infants with spina bifida (myelomeningocele or meningocele), 113 controls, and their mothers (126 cases and 136 controls) in a case-control study between December 2016 to August 2019 in Dhaka, Bangladesh using Illumina Global Screening Array (v1.0). We measured toenail arsenic concentrations using inductively coupled plasma mass spectrometry. We tested the interactions between 30 candidate single nucleotide polymorphisms (SNPs) mapped to folate pathway genes and maternal toenail arsenic concentrations, and the interactions between all SNPs located 50 kb upstream and downstream of the candidate genes and maternal arsenic with setbased methods.

RESULTS:Infants with rs11191454 (G allele, AS3MT) and rs7085104 (G allele, AS3MT) had higher odds of spina bifida among mothers with higher than median toenail arsenic concentrations (aOR: 2.93, 95% CI: 1.29-6.63 for rs11191454; aOR 2.53, 95% CI: 1.30-4.91 for rs7085104), but not among mothers with lower arsenic concentrations. Meanwhile, mothers carrying rs2228611 T allele (DNMT1) had higher odds of spina bifida under higher toenail arsenic concentrations (aOR 2.01, 95% CI: 1.06-3.82), but the association reversed under lower arsenic concentrations. The AS3MT SNPs interact with higher maternal toenail arsenic concentrations in iSKAT (p-for-interaction=0.023). CONCLUSIONS:We found that polymorphisms of folate pathway-related genes, specifically maternal DNMT1 and infant AS3MT polymorphisms, interacted with higher arsenic exposure to increase the risk of spina bifida.

Keywords: Birth outcomes, children's environmental health, environmental epidemiology, heavy metals

Associations of phthalate exposure with incidence of metabolic syndrome and its component parameters – A prospective study

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BACKGROUND AND AIM: The association between phthalate exposure and metabolic syndrome (MetS) have been reported but rarely been examined in prospective study. This longitudinal study investigated the association between phthalates exposure and the risk of MetS.

METHOD: This cohort study used data collected by Taiwan Biobank in Taiwan general population in 2008–2021. The participants aged 30–70 years without MetS were included. After a mean 4.25 years of follow-up, changes of five components of MetS (i.e., blood glucose[Δ glucose] and glycated hemoglobin [Δ HbA1c], systolic and diastolic blood pressure [Δ SBP and Δ DBP], waist circumference [Δ WC], serum triglyceride [Δ TG], and high-density cholesterol [Δ HDL]) and the incidence of MetS were determined. Levels of 10 urinary phthalate metabolites were detected using liquid chromatography/tandem mass spectrometry and corrected by urine creatinine levels into μ g/g creatinine before data analyses. Multivariable logistic regression models and general linear models were used to analyze data.

RESULTS:Of 790 participants averagely aged 48.9 years, 49% were males. After adjustment for cofounders, none of the phthalate metabolites was significantly associated with MetS incidence, Δ glucose, or Δ WC. However, several phthalate metabolites were positively associated with Δ HbA1c: 5-hydroxy-hexyl phthalate(MEHHP), mono-2-ethyl-5-carboxy-pentyl phthalate (MECPP), mono-2-carboxy-methyl-hexyl phthalate (MCMHP), mono-iso-butyl phthalate (MiBP), and sum of MiBP and mono-n-butyl phthalate(MnBP) (Σ DBP) (β [95% confidence interval (CI)]: 0.04[0.01, 0.07], 0.04[0.00, 0.07], 0.02[0.00, 0.04], 0.04[0.01, 0.07], 0.04[0.01, 0.07], respectively). Mono-2-ethylhexyl phthalate (MEHP), MECPP, molar sum of di-2-ethylhexyl phthalate metabolites (Σ DEHP), and molar sum of Σ DEHP and mono-benzyl phthalate (MBZP) (Σ longchain) (β [95% CI]: -0.65[-1.22, -0.07], -0.88[-1.72, -0.05], -1.04[-1.90, -0.17], -0.97[-1.85, -0.09], respectively) were negatively associated with Δ HDL. Besides, MEHP and MCMHP was positively correlated with Δ SBP and Δ DBP, respectively; MiBP was negatively correlated with Δ TG.

CONCLUSIONS: In this four-year follow-up study, increased phthalate exposure was not significantly associated with MetS incidence, but DEHP exposure might increase the increment of HbA1c and decrement of HDL.

Keywords: phthalates, Obesity and metabolic disorders, Environmental epidemiology, Incidence, Epidemiology

Childhood Exposure to Perfluoroalkyl Substances in relation to Child Adiposity

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) have been used in industrial and consumer products since the 1950s. While epidemiological studies have found associations between some harmful health effects and PFAS exposure, including increased serum lipids and decreased infant birth weight, the evidence linking PFAS to obesity remains unclear. Furthermore, most studies have focused on long-chain PFAS, which have been prohibited, rather than emerging PFAS used by recent manufacturers. In this cross-sectional study, we aim to evaluate the associations between childhood PFAS exposures and health effects related to obesity.

METHOD:17 different PFAS were measured in 595 children aged 6 to 9 in 2018. Various biomarkers were also measured, including lipid profiles, fasting insulin, fasting glucose, adiponectin, leptin, and insulin growth factor-1. We also recorded their BMI, body fat percentage, and waist-height ratio. One-way ANOVA was used to analyze the difference in serum biomarkers linked to metabolic dysfunction among different PFAS concentration quantiles. Spline regression was used to analyze the association between PFAS and findings in physical examination.

RESULTS: Among the participants, 99 children were classified as underweight, and 103 as overweight or obese. 13 of the 17 PFAS were detected in over 70% of the participants. ANOVA analysis revealed an association between increased long-chain PFAS levels and increased serum lipids, consistent with previous research. We also found a difference in adiponectin and homeostatic model assessment insulin resistance (HOMA-IR) in both long- and short-chain PFAS exposure, indicating an increased risk for future metabolic diseases. However, no clear trend was observed between any specific PFAS and obesity.

CONCLUSIONS:Our study shows potential associations between specific PFAS exposure and biomarkers linked to metabolic dysfunction in children. However, given the complex mixture of PFAS that humans are exposed to, further investigation is crucial to determine the contribution of the entire mixture and the different PFAS.

Keywords: PFAS, Obesity and metabolic disorders

Maternal serum per- and polyfluoroalkyl substances during pregnancy and breastfeeding duration

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) are endocrine-disrupting chemicals that may affect breastfeeding duration. We examined associations between maternal PFAS concentrations during pregnancy and breastfeeding cessation. We also investigated potential effect modification of this relationship by parity status.

METHOD: Among 555 women who initiated breastfeeding in the Healthy Start study (2009-2014), we quantified maternal serum concentrations of 5 PFAS during mid- to late-pregnancy (mean 27 weeks of gestation). Participants self-reported their breastfeeding practices through 18-24 months postnatally. Among all participants and stratified by parity, we estimated associations between maternal PFAS concentrations and breastfeeding discontinuation by 3 and 6 months, using Poisson regression, and breastfeeding duration, using Cox regression.

RESULTS:Median PFAS concentrations were similar to those in the general U.S. population. Associations between PFAS and breastfeeding duration differed by parity status. After adjusting for covariates, among primiparous women, associations between PFAS and breastfeeding cessation by 3 and 6 months were generally null, with some inverse associations. Among multiparous women, there were positive associations between perfluorohexane sulfonate, perfluorooctane sulfonate, perfluorooctanoate (PFOA), and perfluorononanoate and breastfeeding cessation by 3 and 6 months. For example, per In-ng/mL increase in PFOA, the risk ratio for breastfeeding discontinuation by 6 months was 1.45 (95% CI, 1.18, 1.78). Hazard ratios reflected similar patterns between PFAS and breastfeeding duration.

CONCLUSIONS: Among primiparous women, we did not find evidence for associations between PFAS concentrations and breastfeeding duration. In contrast, among multiparous women, PFAS serum concentrations were generally inversely associated with breastfeeding duration, though estimates may be biased due to confounding by unmeasured previous breastfeeding.

Keywords: Female, Endocrine disrupting chemicals, Outcomes

Rainfall patterns, water-related diseases, malnutrition and mortality in Low- and Middle-Income Countries (LMICs): a systematic review

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BACKGROUND AND AIM: The objective of this study was to understand and evaluate the strength of evidence on the association between rainfall (including low rainfall and heavy rainfall events) and health outcomes in Low- and Middle- Income Countries (LMICs).

METHOD:A systematic review was carried out, searching 7 databases for epidemiological studies that quantified an association between rainfall and health outcomes in LMICs. Final screening was undertaken by 2 independent reviewers. All studies were evaluated to assess quality. The strength of evidence for each health outcome was disaggregated by 3 exposures: "Rainfall as a continuous measure"; "Heavy Rainfall".

RESULTS:23,679 results were screened. 177 papers met the inclusion criteria. Health outcomes included diarrheal diseases (n= 119); malnutrition (n=35); mortality (n=21); helminth infections (n=6), and eye infections (n=4).

Studies were heterogenous in design, rainfall exposure and lags, making it difficult to draw conclusions. The evidence on diarrheal diseases was the strongest. A fairly strong positive association was found between heavy rainfall and all-cause diarrhea. Studies on undernutrition tended to investigate the relationship between anthropometric measurements and exposures over long timeframes (e.g., prior growing season), finding mainly mixed results for increasing rainfall, and a weak positive relationship with low rainfall. Studies often lacked a clear hypothesis. Although multiple pathways for rainfall effects are possible, these were not well reflected in the study designs. CONCLUSIONS:Despite the high number of studies on the health effects of rainfall in LMICs, the limitations in the data (often from cross-sectional surveys) and study designs, limit the strength of evidence for many health outcomes. Specifically, studies frequently used inappropriate exposures or lags to reflect the causal pathways. Greater efforts in future studies should be directed to incorporate causal pathways into models, better defining low rainfall periods, and conceptualising the interaction between rainfall and inter-related health outcomes.

Keywords: Environmental epidemiology, Methodological study design, Waterbourne diseases, Food/nutrition, Mortality

MP-081[Chemical exposures » Phenols]

Urinary concentration of phenols and parabens, and biomarkers of oxidative stress in pregnant women

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BACKGROUND AND AIM: The aim of this study is to investigate the associations between urinary concentration of phenols and parabens, and biomarkers of oxidative stress in pregnant women in Korea

METHOD: We analyzed urinary samples of 242 pregnant women from "No Environmental Hazards for Mother-Child pairs" cohort study which was conducted from 2022 to 2023 in Korea. All urinary samples were analyzed to determine the concentrations of five phenols (BPA, BPF, BPS, TCS, and BP-3) and four parabens (MP, EP, PP, and BP) using LC-MS/MS. The oxidative stress biomarkers were malondialdehyde (MDA) and 8-Oxo-2-deoxyguanosine (8-OHdG). A multiple linear regression model was used after adjusting for maternal age, maternal pre-pregnancy body mass index, and gestational week.

RESULTS:The detection rates of phenols (BPA, BPF, BPS, TCS, and BP-3) were 78.5, 42.1, 98.8, 71.5, and 71.5%, respectively, and the geometric mean levels ranged from 0.133 to 0.416 μ g/g creatinine. The detection rates of parabens (MP, EP, PP, and BP) were 100, 99.6, 31.0, and 100%, respectively, and the geometric mean levels ranged from 0.332 to 32.046 μ g/g creatinine. In the univariate model, MP was not a significant predictor of MDA level (B = 0.08, p = 0.054), but it showed significant results in a multivariate model (B = 0.053, p = 0.048). BP was a significant factor for 8-OHdG in both the univariate (B = -0.406, p < 0.001) and multivariate models (B = -0.397, p < 0.001). CONCLUSIONS:Exposure to parabens is significantly associated with increased oxidative stress. Therefore, efforts are needed to reduce the exposure to plastic materials including parabens in pregnant women..

Keywords: PHENOL, PARABEN, OXIDATIVE STRESS, PREGNANT WOMEN

MP-082[Chemical exposures » Endocrine disrupting chemicals]

Urinary concentration of polycyclic aromatic hydrocarbons and volatile organic compounds are associated with biomarkers of oxidative stress in pregnan

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BACKGROUND AND AIM:According to previous epidemiological studies, exposure to polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) is associated with increased oxidative stress biomarkers that mediate diverse adverse health effects across body organ systems. This study aimed to confirm the association between urinary PAHs and VOCs concentrations and oxidative stress.

METHOD: We recruited 242 pregnant women from 2022 to 2023 and collected spot urine samples in the first trimester. Four PAHs (1-OHP, 2-NAP, 1-PHE, and 2-FLU) and two VOCs (t, t-MA and BMA) were analyzed in the urine samples using LC-MS/MS. The oxidative stress biomarkers were malondialdehyde (MDA) and 8-oxo-2-deoxyguanosine (8-OHdG). Univariate and multivariate linear regression analyses were conducted after adjusting for maternal age, maternal pre-pregnancy body mass, and gestational weeks

RESULTS: The detection rate of PAHs (1-OHP, 2-NAP, 1-PHE, and 2-FLU) ranged from 77.3 to 100%, and the geometric mean ranged from 0.049 to 2.388 μ g/g creatinine. The detection rates of VOCs (t, t-MA and BMA) were 99.6 and 99.6%, and the geometric mean levels were 44.298 and 2.816 μ g/g creatinine, respectively. The t, t-MA was a significant variable of MDA, which reflects the increased radical oxygen activities during inflammation (B = -0.162, p < 0.001).

CONCLUSIONS: Exposure to VOCs is significantly associated with higher levels of oxidative stress. Pregnant women should pay attention to the use of consumer products that emit PAHs and VOCs in daily life.

Keywords: polycyclic aromatic hydrocarbons, volatile organic compounds, oxidative stress, malondialdehyde

The Impact of COVID-19-related Visiting Restrictions on Effectiveness of Discharge Planning: A retrospective Hospital-based Cohort Study

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BACKGROUND AND AIM:Discharge planning is an individualized discharge preparation by an interdisciplinary team, with collaboration of the patient and family. However, visiting restrictions were implemented worldwide during COVID19 pandemic, and little is known about the impact on the effectiveness of discharge planning. Thus, we aim to explore the outcomes of discharge planning during the pandemic, by measure of 14-day unplanned hospital readmission after discharge. METHOD:This retrospective study is a single-center cohort of adult patients admitted to ordinary medical wards between April 1st and July 31 in 2019 and 2022. The strictest visiting restrictions were adopted in this interval in 2022. Those with medical/care needs were recruited for discharge planning. We analyzed the association between discharge planning and risk of 14-day unplanned hospital readmission by binary logistic regression. Additional sensitive analyses were performed among patients with cancers, aged over 65 and without COVID-19 at admission. We also compared the time from discharge to hopsital readmission by the Wilcoxon rank-sum test.

RESULTS:In total, 4419 patients in 2019 and 6894 patients in 2022 were included. Patients in 2022 were older, with higher propotion of nursing home residents and cancers. When adjusted for all potential confounders, the adjusted odds ratio(aOR) for discharge planning and risk of 14-day unplanned hospital readmission increased from 2.31(1.61-3.30) in 2019 to 7.28(4.60-11.54) in 2022. Sensitivity analysis among patients with cancers, aged over 65 and without COVID-19 at admission showed similar results. There was no statistically significant difference in time from discharge to readmission (7.11(4.09-10.24) in 2019 and 6.94(4.24-10.55) in 2022, p=0.744), whether patients were recruited in discharge planning or not.

CONCLUSIONS: Vsiting restrictions had negative impact on discharge planning, according to its association with higher risk of 14-day unplanned hospital readmission in 2022. Therefore, it's suggested that health care authorites make the necessary plans to revise discharge planning during the pandemic.

Keywords: Outcomes, Policy and practice

Associations of prenatal exposure to flame retardants and birth outcomes in the Puerto Rico Testsite for Contamination Threats (PROTECT) cohort

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BACKGROUND AND AIM: Preterm birth disproportionately impacts pregnancies in Puerto Rico and the exposure to organophosphate flame retardants (OPFRs) is widespread. Therefore, the aim of this study was to examine the associations of OPFRs with birth weight z-scores and gestational age. METHOD: In a subset of 146 pregnant women from the PROTECT cohort study, based in Northern Puerto Rico, we measured four OPFR metabolites in urine measured twice during pregnancy. These OPFRs are bis (2-chloroethyl) phosphate (BCEtP), bis (1-chloro-2-propyl) phosphate (BCPP), bis (1, 3dichloro-2-propyl) phosphate (BDCPP), and diphenyl phosphate (DPhP). Gestational age and birth weight were extracted from medical records. We used multivariable linear regression to estimate covariate adjusted associations between urinary OPFR metabolite concentrations and birth outcomes. RESULTS: In unadjusted models, we observed a subtle increase in gestational age and a nonstatistically significant decrease in birth weight z-scores associated with all OPFRs. After covariate adjustment, these associations remained the same. For a 10% increase in DPhP, gestational age increased by 0.22 weeks (β: 0.22, 95% CI: -0.12, 0.55). For a 10% increase in both BDCPP (β: 0.12, 95%CI: -0.21, 0.45) and BCPP (β: 0.12, 95% CI: -0.27, 0.47), gestational age increased by 0.12 weeks. For a 10% increase in BCPP (β:-0.02, 95% CI: -0.25, 0.21) and BDCPP (β: -0.02, 95%CI: -0.23, 0.18) there was a -0.02 decrease in birthweight z-scores.

CONCLUSIONS: In this cohort, urinary OPFRs were not associated with gestational age and birth weight, yet additional research is needed to elucidate its full impact on birth outcomes. OPFRs are emerging chemicals, and little is known about their effect on birth outcomes. A better understanding of environmental risk factors for adverse birth outcomes will help in the development of targeted intervention and prevention strategies.

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Keywords: endocrine disrupting chemicals, environmental epidemiology

Scenarios of healthier urban transport regimes – An agent-based modeling case study of Amsterdam

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BACKGROUND AND AIM: With ever more people living in cities worldwide, it becomes increasingly important to understand the positive and negative impacts of the urban habitat on livability, health behaviors and health outcomes. However, implementing interventions that tackle the exposome in complex urban systems can be costly and have long-term, sometimes unforeseen and indirect, impacts. Hence, it is crucial to not only assess the health impact of interventions, but also its costeffectiveness and the social distributional impacts of possible urban exposome interventions before implementing them.

METHOD:Spatial agent-based modeling can capture complex behavior-environment interactions, exposure dynamics, and social outcomes in a spatial context. We present our work on agent-based modeling of transport interventions in the context of the city of Amsterdam. The goal of our model is to capture the health impacts of multiple hypothetical transport intervention scenarios, such as car-free zones, replacement of parking places with active transport infrastructure, and separation of active and motorized transport routes. Our agent-based modeling approach entails the integration of a behavioral model of people's mobility choices and dynamic physical models of environmental stressors (e.g. air pollution).

RESULTS: Together these sub-models result in an exposure interaction that approximates personal behavioral and environmental exposure for different population groups within an urban environment, e.g. based on demographics, the neighbourhoods they live in or on their social economic circumstances. Consequently, the accumulated health impacts for different interventions and population groups are assessed using exposure-response functions.

CONCLUSIONS: We present our model architecture, the strength and limitations of the method, and our findings on effects of transport interventions.

Keywords: Agent-based Modeling, Exposome, Urban Transport Planning, Health Impact Assessment, Scenario Analysis

MP-086[Exposures » Occupational exposures]

Line List Analysis of Occupational Exposure to COVID-19 in Newfoundland and Labrador, Canada

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BACKGROUND AND AIM:COVID-19 has disproportionately impacted various occupational groups, especially those that worked on the frontline, performed essential work and had to travel. This can create a stressful and unsafe working environment due to the increased risk of COVID-19 infections. So, this study aimed to analyze a COVID-19 line list and explore the distribution and incidence of COVID-19 among various occupational groups in Newfoundland and Labrador, Canada. METHOD:A Newfoundland and Labrador COVID-19 line list was constructed to contain all 2,143 cases from March 14, 2020 (first case) to December 15, 2021. The variables included demographical, laboratory, clinical, and immunization-related information. SPSS V.26® was used to screen the data, generate descriptive statistics, and perform statistical testing.

RESULTS:Out of the 2,143 COVID-19 cases, the occupational groups identified in the line list were industrial [mining, warehouse, and construction] (245), healthcare (144), office [administrative and remote work] (31), school/daycare (21), retail (27), and food service (8) workers. The COVID-19 incidence rates of industrial and healthcare workers in the province were 892 and 627 cases per 100,000 persons, respectively. The other occupational groups had COVID-19 incidence rates of 100 to 250 cases per 100,000 persons each. Both healthcare and industrial workers had higher COVID-19 incidence rates than the general Newfoundland and Labrador population (429 cases per 100,000 persons). The relative risks for COVID-19 among both groups compared to the rest of the population were 1.57 (healthcare) and 2.32 (industry).

CONCLUSIONS: Based on the relative risk, healthcare and industrial workers had a greater risk of COVID-19 infection than the rest of Newfoundland and Labrador during the early phase of the pandemic. These findings will help inform workplace and general policies to manage infectious disease outbreaks and create safer working environments. Future investigations can also be made into the source of infection at these workplaces.

Keywords: COVID-19, Epidemiology, Infectious diseases

Association between neighborhood walkability and chronic kidney disease: A longitudinal cohort study in Taiwan

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BACKGROUND AND AIM:Physical activity is essential for overall well-being. Walkable neighborhood can promote physical activity levels across a broad population. However, the association between walkability and health, particularly chronic kidney disease (CKD), is relatively poorly documented. We explored the association between neighborhood walkability and CKD in a Taiwanese population. METHOD:A total of 27,665 participants without CKD who enrolled in a standard medical examination program in Taiwan between 1996 and 2017 were included in our study. Walkability was measured using three domains: point of interest (POI), transit stations, and impedance. POI and transit stations measured densities of goods providers and public transportation within a 640m walking distance from the participant's address. Impedance measured increasing walking impedance. CKD diagnosis was based on the estimated glomerular filtration rate computed from serum creatinine measured in the medical screening program. We used a time-varying Cox regression model to investigate the effects of neighborhood walkability on the incidence of CKD.

RESULTS:The study identified 1,332 CKD cases with a total follow-up of 162,423.75 person-years. Residents living in the fourth quartile of POI had a 31.1% lower risk of developing CKD compared to those living in the first quartile of POI [hazard ratio (HR): 0.679; 95% confidence interval (CI): 0.548, 0.842]. In addition, compared with the participants exposed to the first quartile of impedance, participants exposed to the fourth, third, and second quartiles of impedance had a hazard ratio of 1.06(0.92,1.21), 1.26(1.10,1.45) and 1.24(1.07,1.44) for CKD development, respectively. Residents living in the fourth quartile of transit station had a 40.1% higher risk of developing CKD compared to those living in the first quartile of transit station [HR: 1.40; 95% CI: 1.11,1.77]. CONCLUSIONS:Higher POI and lower impedance were associated with a lower incidence of CKD. Further studies are warranted for the association of transit station with CKD.

Keywords: Walkability, Chronic kidney disease, Cohort, Taiwan

Exposure to neighbourhood walkability and mortality: A longitudinal cohort study

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BACKGROUND AND AIM:Good walkability has been proposed as a broad strategy for promoting physical activity. However, little is known about the association between walkability and health, especially in the context of Asian regions with high population densities. Our study aims to investigate the association between neighborhood walkability and mortality in Taiwanese adults.

METHOD: We selected 362,740 participants (\geq 18 years old) from Taiwan who joined a standard medical examination program between 2001 and 2016, and followed them until 31 July 2021. Three walkability measures were estimated within a walking distance of 640m of participant's addresses: point of interest (POI), transit stations, and impedance. Mortality data was obtained from the National Death Registry maintained by the Ministry of Health and Welfare in Taiwan. A time-varying Cox regression model was used to investigate the association of neighborhood walkability with death from natural-cause and specific causes.

RESULTS:This study identified 14,351 deaths over 5,327,780.58 person-years of follow-up. Compared with living in areas with the first tertile of POI and transit station, living in areas with higher numbers of POI and transit stations were associated with a lower risk of natural-cause mortality, with hazard ratios(HRs) (95% confidence intervals(CIs)) of 0.95 (0.91, 0.99) and 0.89 (0.86, 0.93) for second and third tertiles of POI, and 0.95 (0.91, 0.99) and 0.92 (0.89, 0.96) for second and third tertiles of transit station, respectively. In addition, compared with living in areas with the first tertile of impedance, living with the third tertile of impedance was associated a higher risk of natural-cause mortality, with HRs(95%CI) of 1.07 (1.02, 1.11). We also found protective effects of POI and transit station on death from cardiovascular diseases and cancer.

CONCLUSIONS:Better neighborhood walkability was associated with a lower risk of mortality. Our findings reinforced the importance of neighborhood walkability in urban planning and health guideline development.

Keywords: Adults, Walkability, Mortality, Cohort, Taiwan

Associations Between Maternal Negative Life Events Measured During the COVID-19 Pandemic and Child Sleep Health

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BACKGROUND AND AIM: Healthy sleep supports growth and development throughout the lifespan. Maternal stress has been linked to child sleep health. Both stress and sleep alterations have increased during the COVID-19 pandemic. We examined associations between maternal stress measured during the pandemic and child sleep health, and identified susceptible groups.

METHOD: Analyses included 307 maternal-child pairs enrolled in a multi-ethnic longitudinal cohort, with maternal stress and child sleep health ascertained between March 1, 2020 and March 1, 2021. Mothers completed the Crisis in the Family Systems-Revised (CRISYS-R), where stress was indexed by a negative life events (NLE) score across 11 stress domains (e.g., financial strain, legal, housing, home/community safety, etc.). Mothers reported child's sleep disturbance (SlpDist) and sle

EP-related impairment (SlpImp) using validated PROMIS short forms. We used multivariable-adjusted regressions to evaluate associations between NLE score and child sleep outcomes, adjusting for maternal age, education, race/ethnicity, child age, sex, and duration since March 1, 2020. Effect modification by race/ethnicity was examined.

RESULTS:Mothers were primarily ethnic minorities (48% Black, 34% Hispanic, 18% White). Black children were more likely to have SlpImp t-scores above the United States norm (t-score=50), compared to other racial/ethnic groups (p=0.03). Maternal NLE score was significantly associated with SlpDist t-score (β =0.71, p=0.02) and SlpImp t-score (β =0.76, p=0.02), after adjusting for covariates. Home safety (β =4.03, p=0.05) and other home issues (β =4.52, p<0.001) domains were associated with SlpDist. Home safety (β =6.47, p<0.01), legal (β =4.82, p=0.01), and authority (β =5.10, p=0.04) domains were associated with SlpImp. Stratified analyses showed that the relationship with NLEs was most significant among Hispanic (p=0.03 for SlpImp) and Black participants (p=0.05 for SlpDist, p=0.06 for SlpImp).

CONCLUSIONS: Maternal stress was associated with child sleep quality during the COVID-19 pandemic, particularly in Black and/or Hispanic groups. Interventions targeted at alleviating maternal stress in these groups may improve child sleep health.

Keywords: Non-chemical stressors, Children's environmental health, Mental health, Other outcomes (Sleep health), Environmental epidemiology

Effect of combined agricultural and sustainable diet policies on air pollution, dietary patterns and health in the UK

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BACKGROUND AND AIM: There are opportunities to align agricultural policies that reduce air pollution emissions with dietary sustainable policies, while reducing greenhouse gas (GHG) emissions. We assessed the potential effects of combined agricultural and dietary policies on air pollution exposure, dietary patterns and health in the UK.

METHOD: We modelled a range of current and future policy options to reduce air pollution (PM2.5, NOx) from agriculture in the UK using the atmospheric chemistry transport model EMEP4UK in 2020, 2030 and 2050. We assessed the potential effects of aligned dietary policies (meat/dairy taxes, fruit/vegetable subsidies, substituting meat/dairy with plant-based analogues) by applying UK-specific price elasticities and market share data to diet survey data. The effects of changes in PM2.5 exposure and changes in dietary consumption (including red meat, fruits and vegetables) on mortality and morbidity were quantified using a life table model augmented by calculations of disease prevalence for a range of health outcomes using published exposure-response functions.

RESULTS:Overall in England, population-weighted PM2.5 exposure was decreased by 2.4% compared to business-as-usual scenario in 2030 with high ambition mitigation uptake to achieve Net Zero for GHG emissions. Reduction rate slightly improved (3.1%) with additional policy, replacement of farmed animal products with lab/plant alternatives. Implementing fiscal measures and innovations in production of meat alternatives would accelerate existing positive trends in UK diets, with forecasted decreases in meat (30%) and dairy (32%) and increases in fruits and vegetables (14%). GHG emissions were reduced under all scenarios. The combined agricultural and dietary scenarios resulted in large reductions in mortality, improvements in life expectancy and reductions in the prevalence of cancers, circulatory and respiratory conditions.

CONCLUSIONS: There is considerable potential for agricultural policies to improve health in the UK. The health and environmental benefits of such action could be enhanced using complementary policies aimed at improving the sustainability of diets.

Keywords: Air pollution, Particulate matter, Food/nutrition, Modeling, Health co-benefits

The association between environmental noise and adiposity in a Central-European population sample: the Kardiovize study

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BACKGROUND AND AIM: The effect of environmental noise exposure on cardiovascular diseases have been established before, but less is known about the impact of noise on adiposity, one of the main drivers of cardiometabolic diseases. This study aimed to investigate the association between environmental noise exposure and diverse adiposity biomarkers in Central-European urban population. METHOD: Cross-sectional population-based sample from Czechia included 2033 participants aged 25-64 years (examined in 2013-2014, 54.70% women). The environmental noise exposures were obtained from the geographical prediction modelling for the 2nd report of Strategic noise mapping in the Czech Republic (2012), conducted in accordance with the Environmental Noise Directive (END) requirements and methodology. Global combined (road, railway, and airport) Lden (day-eveningnight) noise levels were calculated for each residential building at its centroid, and mean, median and standard deviation values were obtained for each street. Four adiposity biomarkers (BMI, body fat percentage, waist circumference, and visceral fat area) were assessed. Linear regression analyses with an adjustment for sex, age, education, income, lifestyle factors, stress, and depression were applied. RESULTS: The average noise exposure was 53.79 dB, ranging from 42.50 dB to 66.97 dB. The difference between the highest vs. lowest quartile of noise exposure was for BMI 0.96 kg/m2 (95%CI: 0.35-1.56), body fat 1.48% (95%CI: 0.51-2.44), waist circumference 2.30 cm (95%CI: 0.79-3.80) and visceral fat 7.52 cm2 (95%CI: 2.92-12.12).

CONCLUSIONS:CONCLUSION: The results suggest positive associations between environmental noise exposure and several adiposity measures. Future studies are needed to confirm the association and to investigate the underlying physiological and psychosociological mechanisms.

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Keywords: noise, obesity and metabolic disorders

Short-term exposure to PM2.5 from vegetation fire events and mortality in Upper Northern Thailand

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BACKGROUND AND AIM:Recently, several epidemiological studies documented that short-term exposure to air pollution from vegetation fire events poses detrimental health effects across Southeast Asia. However, few studies have been conducted to examine the association between PM_{2.5} originated from vegetation fire events and health effects in this area due to scarcity of PM_{2.5} information. The objective of this study was to investigate the association between vegetation fire PM_{2.5} and mortality in Upper Northern Thailand (UNT).

METHOD: We obtained mortality records during 2017-2021 from the Strategy and Planning Division Office, Ministry of Public Health Thailand which covers UNT population for 657 sub-districts. Each record included age, sex, mortality date, and cause of mortality. Vegetation fire PM_{2.5} was collected from System for Integrated modeLling of Atmospheric coMposition (SILAM) model, which was estimated based on Fire Radiative Power (FRP) data of Moderate Resolution Imaging Spectroradiometer (MODIS) satellite at a 0.1×0.1 resolution. The daily PM_{2.5} was averaged within each sub-district. Data were restricted to burning periods (January to April) for this study. We performed a time-stratified case-crossover analysis using a generalized linear model to investigate the association between vegetation fire PM_{2.5} and mortality. Stratification analysis was also conducted for the specific cause of mortality.

RESULTS:There were 59,800 deaths in Upper Northern Thailand during the study period. Overall, we observed a statistically significant increase in all-cause mortality for each 10 µg/m³ increment in vegetation fire PM_{2.5} on the same day (RR:1.005 (95% CI: 1.000, 1.011)). With stratification analysis, vegetation fire PM_{2.5} was also associated with respiratory mortality (RR: 1.029 (95%CIs: 1.008, 1.050)), but not cardiovascular (RR: 1.018 (95%CIs: 0.998, 1.039)) or stroke mortality (RR: 1.013 (95%CIs: 0.983, 1.044)).

CONCLUSIONS: This study indicates that short-term exposure to $PM_{2.5}$ from vegetation fire events has immediate effects on mortality in UNT.

Keywords: Vegetation fire events, PM2.5, Mortality, Upper Northern Thailand

Causal associations between gut microbiome and Hypertension

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BACKGROUND AND AIM: The association of intestinal microbiome and hypertension has been observed in several studies, but not proven by a causal relationship. We conducted a two-sample Mendelian randomization (MR) analysis to investigate the causal relationship between gut microbiome and hypertension.

METHOD:A two-sample Mendelian randomization study was conducted using inverse variance weighting(IVW), weighted median, weighted mode, and MR-Egger regression. We selected single nucleotide polymorphisms (SNPs) related to gut microbiome and hypertension from a large Genome-Wide Association Studies (GWAS) study. Dataset based on the UK Biobank served as outcome with a large sample of hypertension. Dataset of intestinal microbiomes of European descent from genome-wide association studies (GWAS) was used as an exposure.

RESULTS:The IVW method found strong evidence to suggest a causal relationship between the intestinal microbiota and hypertension risk (beta=-0.002, standard error [SE]=0.0004, p=0.003). The regression test of MR-Egger showed that the directional pleiotropy was unlikely to be a bias (intercept=0.002, SE=0.007, p=0.697). and the MR-Egger study showed relation between the intestinal microbiota and the hypertension risk (beta=-0.002, SE=0.001, p=0.03). The weighted median analysis also have indications of a causal relationship between the intestinal microbiota and the hypertension risk (beta=-0.001, p=0.01). The MR results calculated using IVW, the weighted median and the weighted mode methods were consistent.

CONCLUSIONS:Our results indicated that MR analysis support a causal relationship between intestinal microbiome and hypertension risk.

Keywords: microbiome, Epidemiology, Causal inference, Cardiovascular diseases

Role of Gut Microbiota between Metal Fumes and Intestinal Permeability

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BACKGROUND AND AIM: Welding workers expose metal particles which may enter the body through inhalation or ingestion. Gut microbiota is recognized as having many different effects on human health. Heavy metals may harm the microbiotas directly and cause the gut-leaky syndrome. This study explores the relationship among exposure to metal fume particles, gut microbiota, and intestinal permeability.

METHOD: This is a cross-sectional study with a total of 76 workers. We divided two groups by Fe and Mn in fecal supernatant according to the mail composition of the welding rod, which consisted of 24 high-internal-dose subjects and 52 low-internal-dose controls in a shipyard in northern Taiwan in 2022. The concentration of heavy metals, gut microbiota, and intestinal permeability biomarkers was assessed via feces samples. ICP-MS detected metals. Gut microbiota was analyzed by full-length 16S rDNA sequencing. ELISA kits detected biomarkers for intestinal permeability. All statistics were conducted in SPSS version 22.0.

RESULTS:All concentrations of fecal metals except Se are significantly higher in the high-internal-dose group. In the phylum level of gut microbiota, we found that Al, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd, Hg, and Pb caused a significant decrease in Actinobacteria. At the genus level, Al, V, Cr, Fe, Co, Ni, Cu, Zn, Cd, and Pb caused a significant decrease in Oscillibacter. At the species level, Al, V, Cr, Fe, Co, Ni, Cu, Zn, Cd, and Pb caused a significant decrease in Oscillibacter_valericigenes. Fecal zonulin is significantly higher in the high-internal-dose group, but fecal calprotectin is lower in this group. Some microbiota species were associated between metals and the two biomarkers of intestinal permeability. CONCLUSIONS:The results demonstrated that heavy metals in welding fume decrease the diversity of gut microbiota and influence the richness of specific microbiota. Also, the gut microbiota modulates metals and intestinal permeability.

Keywords: heavy metals, microbiome, occupational exposures

Immortal time bias in the association between fecal occult blood test and metabolic syndrome: A cohort study

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BACKGROUND AND AIM: This study aims to investigate the relationship between the fecal occult blood test in Korean adults and the metabolic syndrome to identify if fecal occult blood test can provide more clinical information.

METHOD: This study is a cohort study of the population of adults aged 20 years or older who visited the Korea Medical Institute from 2011 to 2019 and received a health checkup. Subjects responded to the question of whether or not to undergo a screening test on a questionnaire. In the data of 3,195,823 visits among 1,542,807 adults aged 20 years or older, Cox proportional hazard model analysis on the association between metabolic syndrome and whether or not to undergo a fecal occult blood test was used. Time-fixed Cox, time-dependent Cox, and landmark analysis were conducted to exclude the immortal time bias.

RESULTS:As a result of identifying the relevance of fecal occult blood test-related syndrome in adult subjects aged 20 years or older, time-fixed Cox analysis showed the risk of related syndrome decreased by 6% in subjects compared to those who did not undergo fecal occult blood test. As a result of time-dependent Cox analysis, compared to the untested group, the comparative risk of metabolic syndrome remained significant at 0.94 (95% CI 0.94-0.95) after adjusting for age and sex. CONCLUSIONS:In conclusion, in a study on fecal occult blood test and metabolic syndrome in Korean adults, the risk of metabolic syndrome was lower in subjects who did undergo fecal occult blood test than in those who did not.

Keywords: Fecal occult blood test, metabolic syndrome, immortal time bias

A Study on the Association between Body Mass Index and Diabetes Incidence according to the Gamma-Glutamyl Transferase Level in Korea

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BACKGROUND AND AIM:Gamma-glutamyltransferase (GGT) has been widely used as a marker for excessive alcohol intake and various hepatobiliary diseases such as alcoholic hepatitis, and fatty liver. This study sought to analyze how the between body mass index (BMI) and diabetes mellitus (DM) incidence changes according to GGT levels in the Korean people.

METHOD: This study was conducted on participants of the Korean Cancer Prevention Study-II. As a general population cohort developed by the Seoul Metabolic Syndrome Research Project in 2005, 121,053 participants were included in the final analysis among the total 160,407 participants whose blood samples had been obtained. Those with prediabetes at the time of registration and those with missing values on blood tests or questionnaires were excluded. Out of 121,053 participants, 18,116 (14.9%) with diabetes.

RESULTS:A total of 121,053 participants were studied, consisting of 77,312 men and 43,741 women. BMI was classified into 4 groups of lower than 21.3 kg/m², 21.3–23.5 kg/m², 23.5–25.6 kg/m², and higher than 25.6 kg/m², GGT was also classified into 4 groups of lower than 16.0 mg/dL, 16.0–24.0 mg/dL, 24.0–41.0 mg/dL, and higher than 41.0 mg/dL, and the incidence rate of DM was compared between the gender groups. In all groups, the incidence rate of DM increased with GGT. In particular, the highest incidence rate of DM was observed in BMI (Q4) and GGT (Q4) (men: 13.19%, women: 15.78%)

CONCLUSIONS: In Korean adult men and women, the incidence between BMI and the risk of DM tended to increase in the group with higher GGT levels.

Keywords: Epidemiology, Exposures, Outcomes, Obesity and metabolic disorders

MP-097[Respiratory and allergic outcomes » Asthma]

Estimated Travel Time and Distance to Trial Site: Modifiers of St

EP-Up Treatment Efficacy in Black Adults with Poorly Controlled Asthma

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BACKGROUND AND AIM:Access to trial sites in RCTs remains a critical issue known to exacerbate health disparities, especially in the case of asthma. While asthma disproportionately affects Black individuals, they are often underrepresented in clinical trials due to barriers to participation such as access to trial site. As a result, treatments and interventions may not be adequately tested or tailored to the needs of these communities, further widening the gap in health outcomes. Here, we evaluate whether access to care in the Best African American Response to Asthma Drugs (BARD) trial modifies the treatment efficacy of adding a long-acting beta-agonist (LABA) to inhaled glucocorticoids among Black adults.

METHOD: We re-assessed data from 195 adults randomized to a sequence of adding LABA to baseline ICS (1xICS+LABA), double-ICS with LABA (2xICS+LABA), quintuple-ICS (5xICS), and double-ICS (2xICS). Treatment preference was determined via the number of treatment-period-specific asthma exacerbations. Using Origin-Destination Cost Matrix network analysis, we calculated estimates of travel distance and time from each individual's geocoded residence to their trial site. We evaluated treatment effect modification by travel distance and time using mixed effects models. RESULTS: Overall, we found that participants' access to trial sites varied substantially; for instance, among the Boston sample, estimated travel time and distance ranged from 3.09-65.47 minutes and 1.04-68.28 km, respectively. In mixed effect model analysis, we found that both time and distance conferred more exacerbations [1.02 events (95% CI: 0.98 - 1.07), 1.14 events (95% CI: 1.10 -1.27), respectively], though neither significantly altered treatment preference in these data. CONCLUSIONS: Our analysis revealed that estimated travel distance was associated with the number of asthma exacerbations during each treatment periods among adults. However, neither estimated travel distance nor estimated travel time significantly altered treatment preference or effectiveness in this data. Considering trial site accessibility can enhance the design and generalizability of RCTs findings.

Keywords: Asthma, Healthcare Access, Randomized Clinical Trials, LABA, ICS

Spatial distribution of blood lead concentration in preschoolers from Arica, Chile

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BACKGROUND AND AIM: The city of Arica, northern Chile, has a history of heavy metal contamination of anthropogenic origin. Our study aimed to describe lead screening results in children attending educational establishments.

METHOD: We analyzed secondary data from 1,313 preschoolers with blood lead concentration measured using the rapid LeadCare technique who attended educational establishments between 2018 and 2019. We used information about soil lead concentration (n=394) from a study of the soil chemical quality in 2008 available on the web. We characterized the blood lead concentration according to sociodemographic variables. Using RStudio software, we geocoded and assigned the soil lead value to preschool children based on their residence. We used the density Kernel function to calculate the spatial pattern of the intensity of blood lead concentrations $\geq 3.5 \,\mu$ g/dl. RESULTS:15.7% of the preschoolers had lead levels above the limit of detection (LOD). The prevalence of blood lead concentration \geq 3.5 µg/dl was 14.9%, and \geq 5 µg/dl was 4.7%. The proportion of children with blood lead $\geq 5 \mu g/dl$ was higher in those residing in neighborhood units with lead soil concentrations \geq 400 mg/kg compared to those residing in sectors with concentrations < 400 mg/kg (Prevalence ratio = 2.1; 95% confidence intervals 1.04, 4.32). The spatial analysis showed a geographic pattern of high concentration of preschoolers with a blood lead level $\geq 3.5 \,\mu\text{g/dl}$. CONCLUSIONS: The findings reveal a crude association between blood lead levels \geq 5 µg/dl and soil lead levels. Since there is no safe level of exposure, it is necessary to mitigate potential sources of exposure in order to protect children's health.

Keywords: Children's environmental health, Hazardous waste, Spatial statistics

MP-099[Other » Other (to be specified with keywords in the keywords section)]

Association of Water, Sanitation and Hygiene Facilities and Children's Stools Disposal Methods in Myanmar

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BACKGROUND AND AIM: Unsafe children's stool disposal has been a significant public health problem globally. The purpose of this study is to identify the association between water, sanitation and hygiene facilities (WASH) and unsafe children's stool disposal methods in Myanmar.

METHOD: This is the secondary analysis of the 2015-2016 Myanmar Demographic and Health Survey(MDHS), the first and latest survey conducted in Myanmar. The mothers were questioned about how they disposed of the last passed faeces of the youngest child. The only way to dispose of a child's faeces safely is to assist the child to use the toilet on his or her own, for very young children, rinsing the faeces into a toilet or burying as all other methods are regarded as unsafe.WASH facilities included in this study are sources of drinking water, type of toilet facilities and toilets being shared or unshared with others.

RESULTS: The dataset contains of 4,699 children younger than 5 years of age residing with mothers. Ultimately, nearly half of the children's faeces were disposed of unsafely. Approximately 80% of households have access to improved sources of drinking water. Half of the households have improved sanitation facilities while more than 60% have shared toilet facilities with others and furthermore, 11% of the households have no sanitation facilities at all. In the Chi-Square test, sources of drinking water, toilet facilities and shared toilet facilities were significantly associated with methods of disposal of children's stools with p<0.05. But, even in households with improved WASH facilities, unsafe disposal methods are still observed.

CONCLUSIONS: This study indicated that WASH facilities are one of the main determinants of unsafe children's stool disposal. But improved sanitation facilities alone are not sufficient for safe disposal. Other determinants should be taken under consideration to implement safe disposal of children's stools.

Keywords: WASH facilities, Drinking Water, Toilets, Unsafe Disposal Methods, Children's stools

Bioaerosols' Size Fractions and associated Respiratory morbidities in Elementary School in Ibadan, Nigeria

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BACKGROUND AND AIM: Exposure to bioaerosols have been linked to increased respiratory morbidities in schools children. In Nigeria, there is dearth of information on the size distribution of bioaerosols and their deposition site within the airways. This study determined the bioaerosols' size distribution and prevalence of associated respiratory morbidities among elementary school pupils METHOD: A six-stage cascade impactor was used to sample indoor air in occupied classrooms in nine randomly selected schools. Regions between the human primary bronchus and alveolar duct were sampled for fungal respirable fractions (FRF) and bacterial respirable fractions (BRF). The BRF and FRF were estimated and dichotomised into high (> median) and low (\leq median) categories. Bacterial 16s RNA and fungal ITS genes of extracted genomic DNA of 100 isolates were amplified by PCR, sequenced, and analysed. A standardised questionnaire was adapted to elicit information from 554 randomly selected pupils on respiratory morbidities. Data were analysed using Mann-Whitney U and multivariate logistic regression model at a0.05.

RESULTS:Respirable fractions made up 67.5% of the total bacterial and 77.8% of the total fungal aerosols. Dominant bacteria and fungi fractions were recorded at the aerodynamic size fractions of 2.1-3.3 μ m and 0.65-1.1 μ m, respectively. Allergy causing fungal species identified by 95% similarity included Aspergillus funmigatus, Candida neurogosa and Penicillum antarcticumza while bacterial species included Staphylococcus aureus, Escherichia coli, Klebsiella, Bacillus and Cladosporium. Exposure to high BRF and FRF was significantly associated with current rhinitis (aOR = 1.78, 95%CI: 1.11–2.85 and aOR = 1.83, 95%CI: 1.14–2.93) and current wheeze (aOR = 2.77, 95%CI: 1.73–4.43 and aOR = 1.88, 95%CI: 1.18–3.00), respectively.

CONCLUSIONS: Exposure to high levels of BRF and FRF was associated with respiratory health outcomes. Measure aimed at dipping the levels of indoor bioaerosols' fractions and the prevalence of associated respiratory morbidities should be instituted.

Keywords: Indoor air quality, Elementary schools, Microbial aerosols, Aerosol size distribution

A study of methanol poisoning outbreak from pickled liquor in three communities, Chonburi, Thailand

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BACKGROUND AND AIM:On 20 Oct 2019, the Department of Disease Control was notified that there were 14 patients having chest tightness, nausea, hematemesis after ingesting new formula pickled liquor mixed with a toad went to Chonburi Hospital, and one of them died. Then, the Joint Investigation Team conducted the investigation on 21–22 Sep 2019 to verify the diagnosis, identify severity factors, and provide recommendations.

METHOD: We reviewed medical records and conducted a descriptive study. Implicated liquor was sent to determine toxic substances levels. An analytic study was performed to identify factors associated with severity among the patients. The liquor distribution point and the production process were also investigated.

RESULTS:Of 25 liquor drinkers living in 3 communities in Chonburi, 22 cases (88.0%) were identified; 5 of them died. Fifty percent of them were hospitalized; 31.8% required hemodialysis. The median age was 42 years old (IQR=16.3). The median latent period was 17 hours. The most common symptom was confusion (40.9%), followed by nausea/vomiting (36.4%) and abnormal vision (18.2%). Most of the cases had high anion gap. Methanol levels in two liquor samples were extremely high (36.2 g/dl). High amount of liquor drinking was significantly associated with cases' severity (Adjusted coefficient 4.5x10-4, 95%CI 2.7x10-5-8.8x10-4). The seller illegally mixed the pickled liquor and distributed the liquor door-by-door. The components of the pickled liquor cannot be identified.

CONCLUSIONS: A confirmed cluster of methanol poisoning caused by methanol contaminated picked liquor ingestion. No toad was involved. The case fatality rate was in the average of other previous outbreaks. Permanent visual impairments were detected. The amount of pickled liquor drinking was statistically significant among severe and non-severe cases. Health education on methanol poisoning and strengthen enforcement on selling illegal liquor are recommended.

Keywords: Epidemiology, Toxicology, Foodborne diseases

Exposure Assessments of Photoinitiators: the Dietary Intakes from the Migrations in Paper-Based Food Packaging

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BACKGROUND AND AIM:Photoinitiators can pose threats to the human body, and the migration and exposure level of potentially harmful chemicals from paper-based food packaging, such as benzophenone (BP), isopropyl thioxanthone (ITX), and 4-methylbenzophenone (4-MBP), is still uncertain. Meanwhile, the decomposition products of PIs may also exist as the non-intentionally added substances (NIAS) in food packages. Hence, it is an important issue for food safety to estimate daily exposure to PIs. However, though paper bags are constantly used, there is limited research on PIs in paper bags or their migration to food. In addition, there are no regulations for PIs in either coated, or uncoated paper bags and wrappers. Thus, this study aims to assess the exposure of specific PIs in paper bags and determine their specific migration level to food.

METHOD: The PIs, such as benzophenone (BP), isopropyl thioxanthone (ITX), 4-methylbenzophenone (4-MBP), and 4-phenylbenzophenone (PBZ), were dissolved in acetonitrile as the stock solution. The PIs were prepared in the range of 0.1 to 20.0 μ g/mL for calibration curves. FastPr

EP-based extraction coupled with GC-MS was used for sample analysis. The inlet temperature was set at 300°C, and the injection value was 1µL. The column temperature was initially set at 70°C, and gradually increased by 10°C/min to 300°C, and then hold for 7 min. Selective ion monitoring (SIM) mode used for particular PIs identification.

RESULTS: The study has shown that BP has the highest frequency and strongest abundance among the PIs. The general existence of PIs in paper bags indicates that it is necessary for the governmental agency to carefully establish regulations and the Tolerable Daily Intake (TDI) for PIs to protect people from adverse health effects.

CONCLUSIONS: Migration test of PIs and decomposition products identification were also conducted in this study. We intend to establish analytical method and regulation foundation for PIs in Taiwan.

Keywords: Photoinitiators, Migration, Exposure assessment

Dietary Habits and β-Adrenergic Agonists in Urine of Representative Population in Taiwan

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BACKGROUND AND AIM: Except ractopamine in the United States, β -adrenergic agonists are illegal feed additives in most countries. Hence, there are fewer relative research about not only distribution but dietary exposure. This study aimed to establish the distributions of 8 kinds of β -adrenergic agonists among a representative of population in Taiwan and to find out the association between the diet habits (types of food especially meat) and the detection rates of 8 kinds of β -adrenergic agonists. METHOD: The representative samples used in this study came from Human Biomonitoring in 2019. The cases were enrolled from population which residents are over 7 years old and registering in the main island of Taiwan and Penghu area, and the sampling methods referred NAHSIT enrollment. The chosen specimen was urine. After urine was pretreated, LC/MS/MS would be used to detect 8 kinds of common β -adrenergic agonists as analytes. Then the detected results would be combined with the variables about poultry-related products ingestion in nutrition and diet questionnaire for analysis by using Fisher's exact test and Logistics regression.

RESULTS: The detection rate of clenbuterol was much higher than the other 7 kinds of β -adrenergic agonists. The results showed that 4 feet poultry ingestion positively related to clenbuterol detection rate, and meat product would increase the risk of tulobuterol detection. Similarly, offal ingestion had positive association with detection of tulobuterol and fenoterol. In the other hands, vegetable ingestion and terbutaline detection were negatively correlated.

CONCLUSIONS: The detection rates of β -adrenergic agonists were positively associated with some types of foods such as 4 feet poultry, meat products and offal. However, the nutrition and diet habits questionnaire we used wasn't designed for specific sources of β -adrenergic agonists. Hence, for clenbuterol with a particularly high detection rate, it might need to trace the exposure sources in the future.

Keywords: β-adrenergic agonist, human biomonitoring (HBM), diet habits
Emerging foodborne contaminants in infant formula: Integrating mixtures risk assessment based on probabilistic and sensitive approach

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BACKGROUND AND AIM: The environment and baby food are contaminated with multiple endocrine disrupting chemicals (EDCs), which are also intentionally added to baby care products. These complex mixtures of EDCs may pose a cumulative risk to newborn health. Our goal was to characterize and prioritize infant concurrent exposures to mixtures of EDCs in infant formula and identify the potential for health risk.

METHOD:11 groups of endocrine disrupting chemicals (EDCs) were analyzed in 58 infant formula samples purchased from major supermarkets. Two scenarios of the consumption data were assumed based on the Taiwan National Food Consumption database and labeling recommendations. Hazard Index (HI) and combined total margin of exposures based approaches were applied to identify health risk for the concurrent exposures to EDCs mixtures. The method of grouped weighted quantile sum regression allows for mixtures of EDCs to be considered in the model such that different magnitudes and directions of associations are possible for each group of EDCs using a probabilistic approach. RESULTS:Five target effects, including liver and kidney function, neurodevelopment, thyroid function, development and reproduction were assayed for EDCs mixtures. The magnitude of the risk for early childhood referred to the adverse effect of thyroid gland, and the following was reproduction, neurodevelopment and liver. The prioritizing risk of thyroid function in infant feeding was attributed to polybrominated diphenyl ethers (PBDEs) and thiocyanate; of reproduction were oPFRs, PBDE and Hexabromocyclododecane.

CONCLUSIONS:Our approach provides for characterizing and prioritizing the cumulative risks of reallife EDCs mixtures during infant feeding. This study may be helpful to develop regulatory standards and a framework for EDCs mixtures having additive health effects.

Keywords: Endocrine disrupting chemicals, mixtures, cumulative risk, Children's environmental health

Socioeconomic status as a moderator in the association between diet and the food environment: findings from the CIVISANO-project

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BACKGROUND AND AIM:Globally the prevalence of obesity has increased dramatically over the last decades. A social gradient has been observed whereby social economic status (SES) and other factors influence the development of obesity. There is a link with the food environment, which plays an important role in shaping people's diet. This role is hypnotized to differ according to SES and be more influential among those with a lower SES. Therefore this study aimed to determine whether associations between the food environment and diet were moderated by SES.

METHOD:Survey data on demographics, diet, physical activity and the food environment was obtained from 564 respondents aged 25 to 65 years from Flanders, Belgium. Spatial data on the food environment was collected through a retailer database. Using ArcGIS the density of healthy food and unhealthy food outlets in 500m and 1000m buffers and their proximity to respondents' homes was calculated. The Modified Retail Index (mRFEI) was also calculated. Regression models with interaction terms were adjusted for age and sex.

RESULTS:SES moderated the association between fruit- and vegetable (FV) intake, the mRFEI in the 1000m buffer (p=-0.02;CI -3.88,-0.17) and the perceived availability of FV (p=0.04;CI 0.01,0.52). Moderation was also present in the association between snacks, the proximity of healthy food outlets (p=-0.0001;CI -0.0002,-0.00001) and the density of healthy food outlets in the 1000m buffer (p=0.42;CI 0.19,0.64). The association between the density of unhealthy outlets in the 1000m buffer (p=-0.04;CI 0.08,0.003) and sugar-sweetened beverages was also moderated by SES. For fast-food consumption, no moderation was observed.

CONCLUSIONS:Our findings suggest that people in distinct socioeconomic positions react differently to their food environment. Although moderation was not present for all outcomes and indicators. More in-depth research, especially qualitative research, is needed to examine the complex relationship between SES and the food environment.

Keywords: Food/nutrition,Socio-economic factors, Obesity and metabolic disorders

MP-106[Other » Other (to be specified with keywords in the keywords section)]

Exploring the Role of SGLT2 Inhibitors in Preventing and Managing Diabetic Complications

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BACKGROUND AND AIM: Based on statistics from the International Diabetes Federation (IDF), the global population of individuals with diabetes is expected to exceed 600 million by 2045. As a chronic disease, diabetes leads to the development of multiple complications. As a result, the effectiveness of current glycemic medications in controlling blood glucose levels and reducing the risk of complications among diabetic patients has become a significant concern among healthcare professionals and patients alike.

METHOD:This study utilizes data from the National Health Insurance Research Database (2011-2020) to compare the incidence rates of complications among patients with type 2 diabetes treated with SGLT2 inhibitors, GLP1 agonists, and DPP4 inhibitors. And we also compare which antidiabetic drugs of SGLT2, GLP1, and DPP4 are more effective in reducing the incidence of multiple complications. RESULTS:The finding shows that both GLP1 and SGLT2 exhibit significantly better protective effects than DPP-4 in stroke, heart failure, and diabetic chronic kidney disease. The incidence rate ratios for stroke were 0.33(GLP1 vs DPP4) and 0.44(SGLT2 vs DPP4), for heart failure were 0.54(GLP1 vs DPP4) and 0.44(SGLT2 vs DPP4), respectively. The statistical significance of controlling for multiple comorbidities has not yet been achieved.

CONCLUSIONS: Although there was no significant difference in the control of multiple comorbidities, SGLT2 and GLP1 have shown promising results in controlling single complication in diabetes patients. For indication patients, this provides an alternative treatment option.

Keywords: Type 2 diabetes, SGLT2, complication

Seasonal impact and Risk factors of Concurrent Spontaneous Pneumomediastinum and Pneumorrhachis in Adolescents

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BACKGROUND AND AIM:Although uncommon, available evidence suggests pneumorrhachis (PR) complicated by spontaneous pneumomediastinum (SPM) in adulthood is usually benign and self-limiting. This study aimed to review our experience and identify the seasonal impact and risk factors of PR in adolescent patients with SPM.

METHOD:Between September 2007 and September 2017, SPM in patients aged \leq 18 years was retrospectively reviewed. The clinical features and outcomes between SPM patients with and without PR were analyzed.

RESULTS:In total, thirty consecutive occurrences of SPM in 29 patients were finally identified and classified into SPM (n=24) and SPM plus PR (n=6) groups. No significant differences in received interventional exams, prophylactic antibiotic administration or restriction of oral intake between the two groups were found. Both groups were treated with hospitalization predominantly, whereas the SPM plus PR group tended to have longer length of hospital stay (median 5.5 vs. 3 days, p = 0.08). PR was observed more frequently in patients with abnormal serum C -reactive protein (CRP) level (> 5mg/L), identified predisposing factors, and those with more severe grade of SPM (p =0.005, 0.001 and <0.001 respectively). A tendency of increased prevalence in the summer season (4 cases; 66.7%) and 2 (33.3%) with recent respiratory infection history and 2 (33.3%) with asthmatic patients was shown in the SPM plus PR group (p = 0.06).

CONCLUSIONS: Although patients with pneumorrhachis retained a higher CRP level, more identified predisposing factors, and prolonged inpatient care, conservative management without an extensive work-up would be an appropriate and favorable strategy in adolescents of SPM concurrent with PR. In addition, PSP tends to cluster seasonally. Further large scale prospective studies are needed to clarify the onset of SPM with or without PR as well as other weather conditions being involved.

Keywords: Climate, Respiratory outcomes, Incidence

MP-108[Built environment » Other (to be specified with keywords in the keywords section)]

Heat and cold impacts on mortality by Local Climate Zone in London and South East, England

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BACKGROUND AND AIM: The Local Climate Zone (LCZ) classification provides coherent and consistent descriptions on form and function of urban morphology relevant to climate weather worldwide. We assessed heat and cold impacts on mortality by LCZ in London and South East regions and explored the attribution of the cause-specific mortality related to heat and cold to proxy of UHI intensities. METHOD: Daily time series of cause-specific mortality by sex, age group, Index of Multiple Deprivation deciles and temperature (UKCP18 HadUK Gridded Climate Observations, 1x1km) were assembled by LCZ in London, 2007-2016. Time-series analysis was conducted using unconstrained distributed lag model (0-1d lag and 0-13d lag for heat and cold) with adjustment for day-of-week, season and secure trend (natural cubic splines with 7 df per year), PM10, Ozon (lag 0-1d) and flu. Autocorrelation and overdispersion were adjusted. Quantification of heat/cold risk assumed log linear threshold model above/below the cut-off point (95th/5th centile).

RESULTS:437,505 deaths in ten LCZs in London were analysed. Most of the deaths occurred in Open low-rise (LCZ 6, 74.9%) and Open mid-rise (LCZ 5, 16.9%). Cold and Heat thresholds ranged 3.1-3.85 °C and 18.64-19.88 °C in Dense trees (LCZ A) to in Compact mid-rise (LCZ 2). Relative risk (RR) of cardiovascular disease deaths for heat is lower in open mid-/low-rise (LCZ 5-6) than large low-rise or sparsely built area (LCZ 8-9). Opposite for RR of respiratory deaths. Analysing only for those aged 75+ years showed little difference from the main finding.

CONCLUSIONS:Our initial results from time-series analysis suggested LCZ-specific temperatureresponse functions especially for deaths from CVD and respiratory diseases. This case study demonstrated fair potential that LCZs can be utilised in public health researches as a common measure of UHI intensity in worldwide setting. Further developments using case crossover study design and building characteristics is needed.

Keywords: Urban heat island, heat, cold, Local Climate Zones,

MP-109[Policy » Research translation to affect policy and practice]

Impact of COVID-19 on neighbouring communities of large-scale mining industry and recommendations for its management

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BACKGROUND AND AIM:In December 2019, China officially notified the World Health Organization (WHO) about a conglomerate of pneumonia cases, a virus later labeled SARS-CoV-2 or the COVID-19 disease. In Chile, this illness produced its first casualty in March 2020, unleashing a series of state measures. Until March 2023, COVID-19 has killed 64.301 people according to the official figures of the Ministry of Health in Chile.Currently, a number of preventive measures have been established throughout all national industries, particularly in the mining sector. Given that Chile is the biggest producer of copper in the planet, with Antofagasta and Atacama concentrating most mining companies, it is interesting to analyze the coverage of all these measures on the mining industry, paying particular attention to the particular characteristics of health, economy, and communities. METHOD:Through a descriptive analysis, a multi-criteria analysis of risks with territorial coverage, this study discusses the gaps between the observed and the recommended, raising this situation as a multivariable problem with potential coverage through different angles.

RESULTS: This study discusses, likewise, the current situation of mining community management, the socioeconomic contexts in Antofagasta and Atacama, and the management of COVID-19 in mining sectors in Chile and the rest of the world. Results show that a territorial approach is useful for decision making in mining, in order to take measures according to local needs and adding data in the pandemic strategy.

CONCLUSIONS: The authors recommend for the industry to incorporate geographical analysis during community issues such as the COVID-19 pandemic

Keywords: environment, communities, mining, COVID-19

El Niño-Southern Oscillation, thermal conditions, and some specific health outcomes in Taiwan

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BACKGROUND AND AIM:As a result of climate change, extreme weather events have become more frequent. El Niño-Southern Oscillation (ENSO) in the tropical eastern Pacific Ocean affects temperature and precipitation in Asia Pacific Region. The objectives of this study were to investigate the relationship between Oceanic Niño Index (ONI) and high temperatures in 15 regions in Taiwan, and the relationship between Universal Thermal Climate Index (UTCI, based on human heat balance model) and health outcomes.

METHOD:ONI data for the Niño 3.4 region was obtained from NOAA/National Weather Service. The UTCI data was acquired through an open-source dataset computed using the ERA5 reanalysis product of the European Centre for Medium-Range Weather Forecasts (ECMWF) from 2008-2019. The daily health specific mortality records were obtained from Taiwan. International classification of disease ICD10 codes were used for classification of diseases including, I50.0: congestive heart failure, I50.1: left ventricular failure and I50.9: heart failure, unspecified. Linear regression models for ONI and temperature were applied. A Poisson regression model was used to describe the incidence of the health outcomes in relation to UTCI.

RESULTS: The results show a positive relation between 95th percentile average daily temperature and ONI during June, July, and August in the southern and mid-western regions of Taiwan (the correlation coefficients for Changhua, Chiayi, Nantou, and Pingtung are 0.096[0.0093 0.18], 0.21[0.091 0.32], 0.45[0.19 0.71] and 0.090[0.024 0.16] respectively. Furthermore, there is a weak positive relation between average monthly temperature and ONI during winter and spring. The results of the health data analysis indicate an increased relative risk of mortality of these diseases during cold conditions in Taiwan.

CONCLUSIONS: It is possible to predict extreme heat with ONI during summer in Taiwan. In most of the regions, cold conditions indicate an increased risk of cardiovascular health outcomes. Acknowledgement: Forte funded the study (2019-01552) through Belmont AWARD-APR project.

Keywords: climate, temperature extremes, mortality, risk assessment

Effect Of Meteorological Factors On Children's Asthma In Taichung City

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BACKGROUND AND AIM:Asthma is a common chronic respiratory disease in children, and it is a highly heterogeneous disease. In addition to being positively correlated with air pollution and environmental allergens, recent studies have found that meteorological factors are more closely related to asthma exacerbations (AE) in children than air pollution. Nowadays, the problems of climate change and global warming are becoming more and more serious. In Taichung, Taiwan, the temperature trend in the past 30 years has increased by about 0.32°C per 10 years, second only to 0.41°C in Taipei, the second highest in Taiwan. At the same time, few studies have focused on the lagged effect between meteorological factors and asthma, especially in Taiwan. Therefore, this study explored the impact of meteorological factors on children's asthma in Taichung City, Taiwan.

METHOD: This study collected asthma clinic data from the Taiwan Health and Welfare Data Science Center and meteorological data from the Central Weather Bureau from 2009 to 2018. First, descriptive statistical analysis of the year and seasons was carried out. Secondly, the correlation between environmental factors was analyzed using Spearman correlation analysis. Finally, using the Poisson generalized linear regression model combined with a distributed lag nonlinear model, the lagged and nonlinear effects of the year-round and different seasonal meteorological factors on children's AE were analyzed after adjusting the confounders.

RESULTS: We expected an increased relative risk (RR) of AE at high and low temperatures. The lagged effect is longer at low temperatures and shorter at high temperatures. The RR of AE is also increased in low humidity and high diurnal temperature range.

CONCLUSIONS: Meteorological factors are one of the causes of AE in children. Children should be protected from exposure to adverse weather conditions to reduce the risk of AE.

Keywords: Temperature variability, Asthma, Children's environmental health, Environmental epidemiology

MP-112[Other » Other (to be specified with keywords in the keywords section)]

Effect of snow on the emergency medical service response times of out-of-hospital cardiac arrest in Japan, 2009-2019 (JCS-ReSS)

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BACKGROUND AND AIM:Out-of-hospital cardiac arrests (OHCAs) have been a major public health concern and emergency medical service (EMS) response time is a risk factor for prognosis of OHCA. Extreme weather such as snow can increase EMS response time. However, there has been no studies about the association between EMS response time and snow. This study aims to examine the association between snow and EMS response time for the OHCA patients in Japan.

METHOD:Prefecture-level, winter-specific (December, January, February), daily EMS response time from 2009-2019 were obtained from the Utstein registry; a prospective nationwide population-based registry of all OHCA patients in Japan. EMS response time and snow depth were considered as the dependent and independent variables, respectively. EMS response time was dichotomized into "prolonged" (EMS response time > 6.5 minutes) and "not-prolonged", based on previous studies. Subsequently, a multivariate logistic regression model was implemented in examining the prefecturespecific EMS response time and snow association. Covariates of average ambient temperature, year, days of the week, holidays and the daily number of OHCA were adjusted in the model. Prefecturespecific analysis were pooled using a random effect meta-analysis in obtaining the pooled estimates. We further examined the association by subgroups which are composed of heavy-snow prefectures and less-snow prefectures.

RESULTS:We observed statistically significant positive association between EMS response time and snow depth (Pooled Odds Ratio (OR) of prolonged EMS response time: 1.019; %CI, 1.014-1.024 per 1 cm snow depth). In subgroup analysis, the effect estimates in less-snow prefectures (OR: 1.027; 95%CI, 1.021-1.034) is significantly higher than in heavy-snow prefectures (OR: 1.007; 95%CI, 1.005-1.010).

CONCLUSIONS: Snow depth was associated with prolonged EMS response time. The results suggest regional heterogeneity in the effect of snow depth.

Keywords: Cardiovascular diseases, Environmental epidemiology

Long- and medium-term ambient air temperature and sudden cardiac death in a prospective US cohort

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BACKGROUND AND AIM:Temperature has a well-established association with all-cause and cardiovascular mortality. Sudden cardiac death (SCD) and temperature have been studied in the short-term context, focusing on the hours and days leading up to the event, but there has been little investigation of medium- and long-term temperature trends and SCD. Therefore, the objective of this study was to investigate if there is an association between ambient air temperature and SCD in the long- and medium-term.

METHOD:Participants from the Nurses' Health Study, a prospective cohort of married woman nurses in the US, began enrollment in 1976. Confirmed cases of SCD were identified using medical records and next-of-kin reports. Interpolated temperature data from the Oregon State University PRISM group were appended to geocoded participant addresses. We explored the linearity of temperature and SCD using cubic splines prior to our regression analyses. Time-varying Cox proportional hazards models adjusted for individual and neighborhood socioeconomic variables, individual risk factors, and cardiovascular comorbidities were used to examine the association between 1- and 12-month moving average temperature and SCD.

RESULTS:During the study period from 1986-2013, there were 382 cases of confirmed SCD. There was no evidence of nonlinearity in our exposures. With the minimum temperature in the interval serving as the referent temperature, an interquartile range increase in the 1-month moving average temperature was associated with a 43% decrease in the odds of SCD (HR=0.57, 95% CI 0.56, 0.58) and for the 12-month moving average temperature a 25% decrease in the odds of SCD (HR=0.75, 95% CI 0.73, 0.78).

CONCLUSIONS:Both the 1-month and 12-month moving average temperatures were associated with SCD. This effect is more prominent at lower temperatures. Changing climates that drive temperature swings may increase exposure to cold temperatures, thereby increasing the risk of SCD.

Keywords: Cardiovascular diseases, Other-Sudden Cardiac Death, Environmental epidemiology, Long-term exposure

MP-114[Climate » Temperature]

Assessing the impact of high temperatures on kidney disease in Australia: Past and future burden

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BACKGROUND AND AIM: The burden of high temperature-attributable kidney disease (BoKD) is increasingly important due to the dual impacts of global warming and the rising prevalence of kidney disease. This study aims to quantify the high temperature-related BoKD in all Australian states and territories, and project changes in the attributable BoKD under climate change scenarios. METHOD: We estimated the annual average of fatal and non-fatal BoKD for each of the 2,310 statistical level 2 areas in Australia from 2003 to 2018. A multivariate meta-regression model was used to estimate the exposure-response association, based on meta-predictors and relative risks from published international literature. We then predicted future high temperature-attributed BoKD between 2026-2065, using gridded temperature projections data from eight downscaled climate models. The future projections were evaluated under two greenhouse gas emissions scenarios (RCP4.5 and RCP 8.5), accounting for population ageing under different projection series, and adjusting for human adaptation.

RESULTS:Between 2003 and 2018, high temperatures were responsible for 3.1% (SD: 0.4%) of the total observed BoKD in Australia, equating to an annual loss of 1,654 years of healthy life or 7.4 disability-adjusted life years (DALYs) per million. The projected future temperatures are expected to contribute to a consistent rise in BoKD across all jurisdictions. The projected increase in high temperature-attributable BoKD by 2060 is 213.8% under the higher-emission RCP8.5 scenario, even after adjusting for human adaptation. The Northern Territory, which has a relatively warmer climate and a high level of BoKD amongst vulnerable populations, had the highest rate of high temperature-attributable BoKD in both the baseline and future decades.

CONCLUSIONS: This study highlights the urgent need for public health interventions that address the adverse health effects of a warming climate on kidney disease.

Keywords: Climate, Temperature extremes, Environmental epidemiology

Summer temperature and hospitalization due to urinary tract infection in the elderly: a nationwide sample cohort study in South Korea

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BACKGROUND AND AIM:Recent previous studies have investigated the association between ambient temperatures and major kidney diseases, such as chronic kidney disease and end-stage kidney disease; however, despite its clinical importance and plausible mechanisms, the impact of temperature on urinary tract infection (UTI) in the elderly has rarely been studied.

METHOD: We constructed a longitudinal cohort to examine the relationship between hospitalization due to UTI and exposure to summer temperatures (June to August), based on the Korean National Health Insurance System - National Sample Cohort, which includes around one million beneficiaries that are representative of the population living in South Korea from 2002 to 2019. A conditional logistic model was performed to estimate the risk of summer temperatures on hospitalizations for UTI via the emergency room in the elderly (beneficiaries aged 65 or older). The hospital admissions for UTI were defined using the primary diagnostic codes (ICD-10: N10, N30, and N390).

RESULTS:A total of 12,067 hospital admissions for UTIs were observed during the study period. In the total population, there was an association between the summer population and hospital admissions for UTIs with a hazard ratio (HR) of 1.03 (95% CI: 1.00, 1.06). The association was more prominent in the low-income groups (HR: 1.06) and females (1.03) than in the high- or mid-income groups (1.00-1.03) and the males (1.02). In addition, the association was more evident in the recent periods (2011-2019 with HR: 1.05), compared to the earlier period (0.95).

CONCLUSIONS: We revealed a relationship between ambient temperature and hospital admissions for UTI in South Korea based on the population-representative national sample cohort. Our results provide scientific evidence for establishing evidence-based guidelines and heat action plans for patients with UTIs.

Keywords: temperature, urinary tract infection, cohort study

Health effects of the disabled due to climate change and air pollution: a study protocol

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BACKGROUND AND AIM:Climate change and air pollution might have a greater adverse effect on people with disabilities (PWD), who are medically and health-vulnerable groups, than non-disabled (ND). This study aims to evaluate the risk of mortality and morbidity according to climate change and air pollution among PWD by disability type and severity compared to ND.

METHOD: We made the study cohort from a 5% random sample of the whole South Korean population (approximately 120,000 PWD out of a total of about 2.5 million people) from the Korea National Health Insurance System Database from 2002 to 2019. City-level of long-term exposure metrics using monthly averaged PM2.5, PM10, NO2, SO2, and O3 concentration from 2006 to 2019 were individually linked with the cohort participants. Applying Cox proportional hazard model, we will estimate the effect size of air pollution on both PWD and ND. Additionally, we plan to estimate the relative risk of mortality on PWD compared to ND due to daily maximum temperature as heat waves and daily minimum temperature as cold waves using time-series analysis as an ecological study. For outcomes, mortality, hospitalization, and emergency room visits for cardiovascular disease including ischemic heart disease or respiratory disease will be assessed. The hazard ratios of air pollution exposure and the relative risks of extreme weather events for the various disease-specific mortalities and morbidities will be presented.

RESULTS: All analyses will be performed by classifying PWD into 15 disability types and severity levels based on Korean law.

CONCLUSIONS: The estimated health effects of the PWD will provide an opportunity to realize environmental justice in the field of environmental health.

Keywords: Environmental justice, Methodological study design, Environmental epidemiology, Big data

A nationwide comparative analysis of temperature effect on mortality and morbidity in Japan

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BACKGROUND AND AIM: The impact of temperature on morbidity remains largely unknown. Moreover, extensive evidence indicates contrasting patterns between temperature-mortality and temperature-morbidity associations. A nationwide comparison of the impact of temperature on mortality and morbidity in more specific subgroups is necessary to strengthen understanding and help explore underlying mechanisms by identifying susceptible populations. This study aims to quantify and compare the impact of temperature on mortality and morbidity in 47 prefectures in Japan. METHOD: We applied a two-stage time-series design with distributed lag nonlinear models and mixed-effect multivariate meta-analysis to assess the association of temperature with mortality and morbidity by causes (all-cause, circulatory, and respiratory) at prefecture and country levels between 2015-2019. Subgroup analysis was conducted by sex, age, and regions.

RESULTS:The patterns and magnitudes of temperature impacts on morbidity and mortality differed. For all-cause outcomes, cold exhibited larger effects on mortality, and heat showed larger effects on morbidity. At specific temperature percentiles, cold (1st percentile) was associated with a higher relative risk (RR) of mortality [1.45; (95% confidence interval [CI]: 1.39-1.52] than morbidity (1.26; 95% CI: 1.20, 1.34), as compared to the minimum mortality/morbidity temperature. Heat (99th percentile) was associated with a higher risk of morbidity (1.39; 95% CI: 1.36, 1.42) than mortality (1.04; 95% CI: 1.02, 1.06). For cause-specific diseases, mortality due to circulatory diseases was more susceptible to heat and cold than morbidity. However, for respiratory diseases, both cold and heat showed higher risks for morbidity than mortality. Subgroup analyses suggested varied associations depending on specific outcomes.

CONCLUSIONS: Distinct patterns were observed for the association of temperature with mortality and morbidity, underlying different mechanisms of temperature on different endpoints, and the differences in population susceptibility are possible explanations. Future mitigation policies and preventive

measures against non-optimal temperatures should be specific to disease outcomes and targeted at susceptible populations.

Keywords: Environmental epidemiology, Cardiovascular diseases, Respiratory outcomes, Mortality

Which comes first: asthma or anxiety?

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BACKGROUND AND AIM:Asthma is a frequent chronic respiratory condition worldwide. This condition has been linked to psychological disorders in both ways, as effect or cause, but evidence is contradictory. The present study leverages a large, national longitudinal cohort study to evaluate if children who develop asthma in early in childhood are more likely to subsequently develop asthma, or if in contrast, children with asthma develop anxiety in the following decade

METHOD: The study included 9369 children from two different cohorts (baby (B) and child (K)) at two age points each (4-5 and 14-15 years old) from the Longitudinal Study of Australian Children (LSAC). Parental report of physician-diagnosed asthma plus medication use and/or wheezing symptoms defined asthma cases. The Strengths and Difficulties Questionnaire (SDQ) was used for anxiety assessment.

RESULTS:We found a unidirectional association between asthma in children aged 4–5 years and future anxiety development in weighted generalized linear adjusted models (B cohort OR(CI 95%)= 1.54 (1.14–2.08); K cohort OR(CI 95%)= 1.87 (1.40–2.49). Children with asthma (no anxiety at 4 years) had a higher prevalence of anxiety in adolescence compared with non-asthmatics (B cohort: 26.8% vs 17.6%. K cohort: 27.7% vs 14.3%). A higher proportion of adolescents with wheezing and no medication developed anxiety than those taking asthma medication (B cohort: 38.9% vs 27.7%. K cohort: 32.1% vs 23.1%). Anxiety in childhood was not associated with the development of asthma from 6 years old to adolescence.

CONCLUSIONS: Australian children with asthma have a greater risk of developing anxiety between 6 and 15 years of age. Mental health screening as part of the regular monitoring of asthmatic children may help to identify those cases with a high risk to develop anxiety. Psychological support may be beneficial to prevent increased risk of anxiety and/or promote optimal management of this condition.

Keywords: Asthma; Anxiety; Children; Adolescents; Longitudinal.

Extreme heat exposure and risk of hospitalization and mortality in hemodialysis patients in the conterminous United States

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BACKGROUND AND AIM:Climate change may disproportionately impact individuals living with chronic conditions. In this study, we examined the association between exposure to extreme heat events and risk of hospitalization and mortality among end-stage kidney disease (ESKD) patients undergoing hemodialysis treatment. We additionally examined effect modification by climate region, sex, age, and race/ethnicity.

METHOD: We obtained patient data from 20% random sample of Fresenius Medical Care hemodialysis clinics in the conterminous United States (US). Extreme heat was determined using the 95th percentile threshold as a cutoff using a 30-year baseline during the warmer months, May-September. We used clinic zip code to link the extreme heat event metric with the individual hemodialysis patients. Climate region was assigned using US climate region categories developed by the National Oceanic and Atmospheric Administration. We used a case-crossover analysis to estimate the risk of hospitalization and mortality among hemodialysis patients following exposure to extreme heat events. RESULTS:A total of 621 clinics were included in our analyses. We will provide a national perspective on association between exposure to extreme heat events and increased risk of hospital admission and mortality among ESKD patients. We will further show how this association varies by climate region, sex, age, and race/ethnicity.

CONCLUSIONS: This work expands our understanding of the role of extreme heat exposure on hospital admissions and mortality in patients with ESKD. By uncovering potential disparities within the ESKD population, our results will inform future interventions, including early heat warning systems, and help ESKD communities adapt to the growing threats of climate change.

Keywords: Temperature extremes and variability, Mortality, Hospitalization

Daily deviation from historical temperature and mortality in seven cities in South Korea

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BACKGROUND AND AIM: While mean temperature was widely used to investigate health effects of climate change, few studies examined temperature differences from historical temperature. We aimed to examine the association between daily deviation from historical temperature due to climate change and daily mortality.

METHOD:Daily mean temperature and number of non-accidental death from 7 metropolitan cities (Seoul, Busan, Daegu, Incheon, Daejeon, Gwangju, and Ulsan) in Korea between Jan. 1, 2006 and Dec. 31, 2019 were used. Daily deviation from historical temperature (Δ T) was calculated by subtracting the mean temperature of the same day in 1960-1990 from the daily mean temperature on the day. Distributed lag non-linear model examining the cumulative association of Δ T with mortality for lag up to 7 days was constructed, adjusting for daily mean temperature, humidity, and time trend. In addition, we examined the association between the absolute value of Δ T (a Δ T) and mortality. RESULTS:The mean Δ T ranged from 1.0±2.7°C (Busan) to 1.3±2.9°C (Daegu). The associations between daily Δ T and mortality were generally U-shaped, except in Gwangju and Incheon. The relative risk (RR) of mortality in Seoul for increased temperature was less than 1 up to Δ T of 4°C, and the RR at 6.5°C was 1.034 (95% Confidence Intervals: 1.003, 1.081) compared to 0°C. The RR for decreased temperature was less than 1 down to -9.5°C of Δ T and was not statistically significant. The a Δ T generally showed J-shaped associations, with a threshold of a Δ T around 3°C.

CONCLUSIONS: The present study shows that daily deviation from historical temperature is associated with mortality independent of the effect of daily temperature. The findings provide evidence of the health effect of temperature variability due to climate change.

Keywords: mortality, temperature deviation

Effect of temperature on dengue in 291 Southeast Asian locations: a regionally representative analysis

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BACKGROUND AND AIM:Dengue fever is a major public health concern in Southeast Asia, where the disease is endemic and poses a significant burden on healthcare systems. Temperature is a critical factor in dengue transmission as changes in temperature can affect the behavior, and the rate of virus replication within the mosquito. This study aims to investigate the association between temperature and dengue fever in Southeast Asian countries.

METHOD: We obtained monthly dengue cases from 291 locations across eight (8) Southeast Asian countries including Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, the Philippines, Singapore, Thailand, and Vietnam with varying observation periods ranging from 1998-2021. We implemented a generalized additive mixed model coupled with a distributed lag non-linear model in estimating the association between temperature and dengue.

RESULTS: The overall cumulative association between temperature and dengue infection was noted to depict an inverted U-shaped curve. Compared with the median temperature (25.7°C), temperature above 25.7°C showed a significant increase in dengue risk with the highest risk at temperature 28°C (RR = 1.567; 95% CI: 1.471, 1.669). In addition, the 1st percentile (15.3°C) and 99.9th percentile (31.8°C) temperatures showed significant reductions in reported dengue cases with RR = 0.003 (95% CI: 0.002, 0.005) and RR = 0.663 (95% CI: 0.500, 0.879), respectively.

CONCLUSIONS: Southeast Asia wide-, temperature-dengue association was noted to have an inverse U-shaped curve, with the risks peaking at temperature 28°C and approaching the null from both ends.

Keywords: infectious diseases, temperature, temperature extremes, environmental epidemiology

Uncovering Urban Heat: Measuring high temperature exposure and its determinants in homes and neighborhoods in Accra, Ghana

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BACKGROUND AND AIM:Urban densification and climate change in sub-Saharan Africa (SSA) may expose urban residents to higher average and episodic extreme temperatures. Empirical assessments of neighborhood and indoor temperature at fine spatial and temporal scales in SSA cities are virtually non-existent. We investigated urban heat islands and their effects on indoor temperature in Accra, Ghana, to investigate built environment determinants of heat exposure in homes and neighborhoods. METHOD:We measured temperature at 147 representative outdoor (neighborhood) sites and in 120 homes near 48 of the residential sites. Measurements were conducted at 70 min intervals between August 2022 to August 2023, capturing all seasons and times of day with iButton thermochron loggers. Humidity was measured at a subsample of 10 sites. Data on each dwelling's characteristics, such as rooftop material, and factors such as the presence of air conditioning, were also collected to investigate their impact on indoor temperature.

RESULTS:In preliminary analyses, mean (standard deviation) indoor temperature was $29.7\pm1.9^{\circ}$ C, on average $1.9\pm2.9^{\circ}$ C warmer than nearby outdoor temperatures, $28.5\pm3.4^{\circ}$ C, with a median (IQR) correlation between them of r = 0.61 (0.42-0.73) across dwellings. Temperatures inside dwellings in high-density, low-income neighborhoods ($30.7\pm1.8^{\circ}$ C) and commercial areas ($30.1\pm1.7^{\circ}$ C) were higher than in peri-urban and rural homes ($28.4\pm1.9^{\circ}$ C) despite similar outdoor temperatures ($27.7-28.3^{\circ}$ C) across land-use categories. Compound homes experienced higher average temperatures ($30.8\pm1.5^{\circ}$ C) than other dwelling types ($29.1\pm1.8^{\circ}$ C) even after accounting for rooftop materials. CONCLUSIONS:Our preliminary findings show that despite correlation between indoor and outdoor temperatures exposure, the former varies more than the latter in corresponding neighborhoods. Dwelling type, e.g. compound homes vs apartments, may influence this discrepancy with implications for urban planning, building design, and policy intervention in Accra.

Keywords: Climate, Built environment, Temperature variability, Environmental disparities

Relation of PM2.5 and high temperature exposures with birth outcomes among women in Harris County, Texas, 2018–2020

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BACKGROUND AND AIM: While the literature points toward associations of fine particulate matter (PM2.5) and extreme heat exposures with preterm birth (PTB) or term low birth weight (TLBW), most studies in the U.S. were conducted on East and West coasts and relied on exposure data that lacked spatiotemporal specificity.

METHOD: We conducted a retrospective cohort study using birth records of 120,020 singleton live births in Harris County, Texas (11/2018–12/2020). Census tract-level daily PM2.5 concentrations and mean air temperature were estimated using the "XGBoost-IDW Synthesis" model. Women were assigned exposure estimates based on their census tract of residence at delivery and daily exposures were averaged across their entire gestational period. We dichotomized PM2.5 and temperature at the 90th percentile to explore the impact of relatively high exposures. We applied modified Poisson regression using generalized estimating equations (to account for correlation among women living in the same census tract) and adjusted for sociodemographic characteristics to estimate risk ratios (RR) and 95% confidence intervals (CI) for associations of prenatal PM2.5 or temperature exposures with PTB (gestation <37 weeks) and TLBW (gestation ≥37 weeks and birthweight <2,500-g). Stratified analyses explored the differential impact of exposures on PTB and TLBW by race/ethnicity. RESULTS: Overall, women with the highest prenatal PM2.5 exposures had an elevated risk of PTB (RR=1.32, 95%CI=1.25,1.40) but not TLBW (RR=1.08, 95%CI=0.95,1.22). Women with the highest prenatal mean temperatures had increased risk of PTB (RR=3.06, 95%CI=2.94,3.19) and TLBW (RR=1.75, 95%CI=1.57,1.95). We observed little evidence of racial/ethnic differences in most associations.

CONCLUSIONS: This study adds to the evidence that prenatal PM2.5 and high temperature exposures are associated with PTB and TLBW in this diverse urban population. Our results do not provide strong evidence that these exposures contribute to racial/ethnic disparities. Future analyses will explore interactions between PM2.5 and temperature, as well as between environmental exposures and non-chemical stressors.

Keywords: Air pollution, Particulate matter, Temperature, Birth outcomes, Environmental disparities.

Association between short-term exposure to the summer temperature and hospital admission due to acute kidney injury: a national health insuranc

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BACKGROUND AND AIM: Several recent studies have examined the association between heat and acute kidney injury (AKI); however, the generalizability of these results was limited because of the non-representative nature of the study populations.

METHOD: This study constructed a longitudinal cohort study based on the National Health Insurance Service – National Sample Cohort in South Korea. This sample cohort was representative of the population living in South Korea and included around one million beneficiaries from 2002 to 2019. We performed a conditional logistic regression to estimate the association between ambient temperature and the hospital admission due to AKI through an emergency room in the summer (June to September).

RESULTS: Our cohort contained 2,914 hospital admissions for AKI as the primary discharge diagnosis code. We revealed a positive association between the summer temperatures and an increased risk of hospital admissions for AKI, and the association differed by sex, income levels, and urbanibity. CONCLUSIONS: The results of this study provide beneficial implications for public health policies and air pollution guidelines to mitigate healthcare burden attributable to AKI.

Keywords: short-term exposure, hospital admission, a national health insurance cohort study, acute kidney injury

The seasonal attack patterns in asthmatic children are influenced by the climate regions in Taiwan

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BACKGROUND AND AIM:Asthma is the most common chronic disease in children globally, and its acute attack is affected by seasonal change. There are few studies group asthmatic children according to their seasonal attack pattern. This study aims to identify the seasonal attack patterns of asthmatic children in Taiwan, and their association to the climate regions.

METHOD:During 2016-2017, the Taiwanese children's allergic condition, hereditary and residential environmental factors were surveyed from one elementary and one middle schools in each of the 22 cities/counties across the island. Exposure data of air pollutants, ambient temperature, and relative humidity were collected from nearby air monitoring stations. The monthly attack scores of those with current asthma were analyzed using principal component analyses and classified into different attack subtypes. Generalized Estimating Equation was used to examine the climatic effects on each asthma attack subtypes, in tropical region and subtropical region respectively.

RESULTS:A total of 11,585 school children were surveyed, and 6.6% of them reported asthma attack in the past 1 year. Four seasonal attack patterns were identified, namely, spring, summer/fall, winter and perennial. The prevalence of current childhood asthma was lower in tropical Taiwan, particularly in winter and spring attack subtypes. The warm and humid climate were associated with lower odds of winter and spring attack only in tropical Taiwan, but not subtropical Taiwan.

CONCLUSIONS: Current asthmatic children exhibit different seasonal attack patterns, which are influenced by their residential climatic region. In different climate regions, development of appropriate preventive strategies can be facilitated by considering the individual subtypes of childhood asthma.

Keywords: Children's environmental health, Asthma, Climate, Temperature

Metal exposure from e-cigarette use: characterization and comparison of biomarkers among sole e-cigarette users, smokers, dual users, and non-users

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BACKGROUND AND AIM: Metals have been detected in electronic cigarette (e-cigarette) aerosol inhaled by the user. Few studies have assessed metal biomarkers and compared concentrations between users of different types of e-cigarette devices (MODs, PODs), and to smokers, dual users, and non-users. The objective was to assess metal concentrations in blood, urine, saliva, and exhaled breath condensate (EBC) across user groups.

METHOD: We recruited 95 participants from April 2019 to March 2020 (41 e-cigarette users (24 POD, 17 MOD users)), 15 dual users, 9 smokers, 30 non-users). Sociodemographic characteristics, e-cigarette use and device characteristics were collected by survey. Bio-specimen samples were analyzed for heavy metals using ICP-MS. ANOVA and linear regression models on log-transformed metal concentrations to calculate geometric mean ratios (GMR) were performed.

RESULTS:E-cigarette users were found to have significantly higher Ni and Cr metal concentrations in urine compared to non-users, dual users, and cigarette smokers. According to e-cigarette device types, POD users had higher urine Ni and Cr GMRs compared to non-users (GMR Cr: 1.56 (95%CI 1.41, 1.73), GMR Ni: 1.37 (95%CI 1.12, 1.68)); higher Fe in urine (p = 0.03) and in blood (GMR: 1.11 (95%CI 1.04, 1.19) was also observed. MOD users were found to have the higher Ni (p < 0.001) and Cr (GMR: 1.34 (95% CI 1.11, 1.63)) metal concentrations in blood. E-cigarette users, dual users, and cigarette smokers were all found to have significantly higher As concentrations in saliva and EBC compared to non-users, with cigarette smokers having the highest concentrations. CONCLUSIONS:E-cigarette use represents a relevant contribution to metal exposure as exclusive e-

cigarette users had higher metal biomarkers levels compared to non-users, and to cigarette smokers and dual users. Differences in device type also determine exposure to certain metals. With ecigarettes rapidly evolving, surveillance of metal exposure and establishing standards are warranted to prevent involuntary metal exposure.

Keywords: heavy metals, electronic cigarettes, tobacco control, environmental epidemiology, biomarkers of exposure

Bottled Water Consumption and Per- and Polyfluorinated Alkyl Substances (PFAS): Findings from the MetaAIR Study and NHANES 2003-2018

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BACKGROUND AND AIM: Contamination of drinking water with per- and polyfluoroalkyl substances (PFAS) is a growing concern, especially in areas experiencing drought or water insecurity. Populations with concerns about water quality often choose bottled water over tap water, though there are fewer regulations in place for monitoring PFAS contamination in bottled water. This study aims to examine the relationship between bottled water consumption and PFAS levels in young adults in Southern California and to compare results to a nationally representative US population sample. METHOD: Plasma PFAS (PFOA, PFOS, PFNA, PFHxS, PFDA, PFPeS, and PFHpS) were measured in young adults (n=124, 57% Hispanic) recruited into the MetaAIR study for one visit between 2014-2018. Participants in eight two-year National Health and Nutrition Examination Survey (NHANES) cycles between 2003-2018 who were \geq 12 years old, not pregnant, and had available serum PFAS (PFOA, PFOS, PFNA, and PFHxS) data (n=15,276) were included. In both studies, water consumption was assessed using 24-hour dietary recalls. Bottled water consumption was evaluated as a percentage of total water consumed. All analysis were performed using linear regression and adjusted for age, sex, race/ethnicity, education, and NHANES analyses were adjusted for study design. RESULTS: Each 10 percentage-point increase in bottled water consumption was associated with a 2.1% (95%CI: 0.37-3.9%) increase in PFOA, and a 5.4% (95%CI: 0.32-11.0%) increase in PFPeS in MetaAIR. Bottled water consumption was also positively associated with PFOA, PFOS, PFNA, and PFHpS in MetaAIR, though these associations were not statistically significant (p>0.05). In NHANES, positive but non-statistically significant associations were observed between bottled water consumption and PFOA and PFNA in seven of the eight included cycles (2003-2016), and between bottled water and PFOS in six cycles (2003-2010, 2013-2016).

CONCLUSIONS: Bottled water may be a source of PFAS exposure. Strengthening quality standards for all water sources is critical to preventing PFAS contamination of drinking water.

Keywords: PFAS, water quality, environmental epidemiology

MP-128[Chemical exposures » PFAS]

A Statistical Association for Toxicity of Individual Perfluorinated *n*-Alkyl Acid Components in Co-Exposures to Multiple PFAS

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BACKGROUND AND AIM: Exposures to per- and polyfluoroalkyl substances (PFAS) often transpire as co-exposures to multiple PFAS entities, some without toxicological information. The present work describes a statistical association that may help to fill the gap. The association was established between the number of fluorine atoms in perfluoro-*n*-alkyl acids and PFAS toxicity. METHOD: Using data from national and international agencies which identify key studies, critical health effects, and points of departure (PODs), a categorical regression model was developed (*p*-value < 10[^]-4) that links individual PFAS chemicals to observed toxicity. Various effects were considered. They included critical health effects associated with PFAS exposures: hepatic, endocrine, developmental, and immunological.

RESULTS: The regression model suggested an exponential dependence on the number of fluorine atoms adjusted for study duration. The sizes of other effects, including types of critical health effects and types of PODs, were small and did not statistically significantly influence the dependence. Immunological critical health effects were confounded by other effects, like study duration and test species, making it impossible to delineate their contribution at the present level of knowledge. CONCLUSIONS: The available information suggests that toxicity of the tested perfluoro-*n*-alkyl acids depends exponentially on the degree of fluorination adjusted for chemical's subclass and study duration. This information may be used to delineate the magnitude of health effects attributable to individual PFAS components in epidemiologic studies of co-exposures to multiple PFAS. Further laboratory studies are desirable to confirm or refute the observed dependence. Disclaimer: the findings and conclusions in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry and should not be construed to represent any agency determination or policy.

Keywords: PFAS, polyfluoroalkyl, co-exposures, mixtures

Association of serum per- and polyfluoroalkyl substances with age-related macular degeneration among U.S. adults: NHANES 2005–2008

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BACKGROUND AND AIM:Age-related macular degeneration (AMD) is a leading cause of blindness in older adults. Despite possible links of environmental factors, such as exposure to air pollution and metals, to AMD risk, the role of per- and polyfluoroalkyl substances (PFAS), ubiquitous persistent neurotoxic chemicals, in etiology of AMD remains unclear. We examined the cross-sectional association between serum PFAS and AMD in US adults using data from National Health and Nutrition Examination Survey (NHANES) 2005-2008.

METHOD:A total of 1722 participants aged 40 years or older with complete data on PFAS, AMD, and covariates were included. PFAS, including perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS), and perfluorooctane sulfonic acid (PFOS), were measured in serum. AMD was diagnosed based on retinal image examination. The associations of PFAS (tertile groups: low, medium, high) with AMD were evaluated using survey-weighted logistic regression models adjusted for sex, race/ethnicity, age, age2, education, smoking pack-year, BMI, and seafood consumption. Mixture effects were also evaluated with overall PFAS burden calculated by item response theory (IRT) scoring. Effect modification by age, sex, race/ethnicity, and seafood consumption was evaluated.

RESULTS:Serum PFOS concentration was positively associated with AMD, with an odds ratio (OR) (95% CI) of 1.99 (1.05, 3.79) for the high versus low group. The associations of PFAS mixture with AMD were not monotonous: positive associations with ORs (95% CIs) of 2.18 (1.18, 4.04) and 1.88 (0.96, 3.68) for the medium and high groups, respectively. Effect modification was found for the association between PFAS mixture and AMD, with stronger associations among participants aged <60 years, males, Non-Hispanic White, and those with high seafood consumption.

CONCLUSIONS:Our findings suggest that exposure to PFAS, particularly PFOS, may be a risk factor for AMD. Future research is needed to explore the mechanisms underlying the association between PFAS exposure and ocular health.

Keywords: Chemical exposures, Environmental epidemiology, Multi-pollutant, Outcomes, PFAS

Association between urinary parabens and insulin resistance in the general population of Taiwan

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BACKGROUND AND AIM:Parabens are preservatives used in the cosmetics and are widely used in people's daily lives. However, few epidemiological studies have been investigated on the correlation between obesity and insulin resistance. Therefore, we aimed to explore the association between parabens exposure and insulin resistance, adipokines and obesity.

METHOD:Our study used the 2013 data of the cross-sectional representative general population generation from Taiwan Environmental Survey for Toxicants, with a total of 341 subjects, to investigate the exposure of parabens and the association between parabens and insulin resistance, obesity and adipokines.

RESULTS:Our study showed the participants aged 40–65 are the most. 24.1% and 26.3% of the participants were overweight and obese. 75.5% of adults didn't smoke and most of them were non-drinkers. Then, linear regression Stratified by Gender, we found that urinary propylparaben concentration in male was positively correlated with adiponectin (β =1.78, p=0.044). However, the urinary ethylparaben (EtP) concentration in females was negatively associated with adiponectin and Adiponectin-Leptin ratio (β =-1.65, p=0.016; β =-0.43, p=0.044) and positively associated with triglyceride-glucose index (TyG index) and triglyceride-body mass index (TyG-BMI) (β =0.20, p=0.012

 β =11.7, p=0.001). Furthermore, we found that parabens concentration in males were negatively associated with HOMA-β and TyG-BMI (methylparaben = OR: 0.16, 95%CI: 0.03, 0.82; butylparaben = OR: 0.10, 95%CI: 0.02, 0.61) by using logistic regression. As for females, EtP concentration was positively correlated with TyG index (OR: 3.86, 95%CI: 1.01, 14.7).

CONCLUSIONS: In our study, we found parabens can affect the sensitivity of insulin and adipokines in body. However, the differences in mechanisms between different genders still need to be explored. Besides, our study design was cross-sectional, we couldn't clearly make sure the causal relationship. Therefore, we need conduct a long-term study to further explore the association between parabens exposure and insulin resistance and obesity.

Keywords: Endocrine disrupting chemicals, Exposure assessment, Obesity and metabolic disorders

Health Risk Assessment for Ingestion Exposure to Endocrine Disruptors in Lip Products

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BACKGROUND AND AIM: Endocrine disruptors are substances that can interfere with the normal functioning of the endocrine system, which regulates hormones in the body. Some studies have suggested that endocrine disruptors may be linked to health problems like hormone-related cancers, reproductive problems, and developmental disorders. Many endocrine disruptors are synthetic chemicals commonly used in consumer products, including cosmetics such as lip products. Studies have found that lip products, including lipsticks, lip glosses, and lip balms, can contain varying endocrine disruptors such as parabens, phthalates, triclosan, etc. However, the information regarding the distribution of EDcs in lip products in Taiwan was limited. Hence, there is a need to fully understand the extent of the risk posed by endocrine disruptors in lip products in Taiwan and to develop strategies for reducing or eliminating these chemicals from lip products in the market. METHOD:Sample collection was conducted from the Taiwan beauty market, followed by sample pretreatment, and eventually analyzed using Gas Chromatography-Tandem Mass Spectrometry (GC-MS/MS).

RESULTS: The results show that various kinds of EDCs were found in different types of lip products in Taiwan. The findings of this study were compared with existing regulations and subsequently conducted health risk assessment with the associated exposures.

CONCLUSIONS: Endocrine disruptors can cause various hormonal and reproductive diseases, making monitoring their levels in lip products crucial. A more comprehensive health risk assessment is provided for consumers and government reference by testing popular lip products on the market.

Keywords: Endocrine disruptors, Lip products, GC-MS/MS, SPME, Health risk assessment

Serum levels of perfluoroalkyl substances (PFAS) and exposure determinants in adolescents: A population-based study in Korea

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BACKGROUND AND AIM:Research is limited on how PFAS-associated household products use differs by parental socioeconomic status (SES), particularly during the sensitive period of adolescents. Therefore, the aim of this study was to examine whether the combination of parental SES and use of Household Products was associated with the serum PFAS levels among adolescents.

METHOD:Methods Data were obtained from a cross-sectional study of 781 adolescents who participated in the Korean National Environmental Health Survey during 2018–2020 and for whom serum PFAS exposure and Household products data were available. We measured the most abundant five PFAS including perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS),

perfluorohexane sufonic acid (PFHxS), perfluorodecanoic acid (PFDeA), and perfluorononanoic acid (PFNA) among adolescents. Multiple linear regression analysis was used to evaluate the association between PFAS exposure and household products (frying pans, coating containers, coating pot) as well as parental SES (alone and in combination).

RESULTS: Mother's education level was inversely associated with serum PFOS concentration in adolescents, but no association was detected in serum PFOA concentration. Mothers with higher education level and lower use frequency of coating containers had significantly lower serum PFOS concentrations among adolescents than those without lower education level and lower use frequency of coating containers (adjusted β = -2.19, 95% CI = -4.23 - 0.15).

CONCLUSIONS: This study suggests that the combination of mother's education level and use of household Products in mothers may play an important role in PFOS exposure among adolescents, and it should be considered that providing education to parents for reduce PFAS exposure.

Keywords: SES(socio-economic status), education, PFAS, Adolescent, Household product

Prenatal exposure to perfluoroalkyl substances and lung function in mid-childhood: Results from Project Viva

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BACKGROUND AND AIM: The fetal lung rapidly grows and develops prenatally, making this a potentially vulnerable window for exposure to exogenous chemicals. Animal studies suggest that exposure to PFAS prenatally may adversely affect lung maturation, but there are limited epidemiological studies.

METHOD:In Project Viva, an on-going cohort study of mother-child pairs recruited in Massachusetts (1999-2002), we examined the association between prenatal PFAS exposure and childhood prebronchodilator (i.e., baseline) lung function (N=546), and also post-bronchodilator lung function in a sub-cohort (N=375) to evaluate fixed lung obstruction. We used multivariable linear regression to assess the associations of 6 PFAS (i.e., PFOA, PFOS, PFNA, PFHxS, MeFOSAA, and EtFOSAA) measured in maternal plasma during early pregnancy [mean (SD) 9.9 (2.3) weeks gestation] with forced expiratory volume (FEV1), forced vital capacity (FVC), FEV1/FVC, forced mid-expiratory flow (FEF25-75), and BDR in mid-childhood [mean (SD) 8 (0.9) years], with base models adjusted for child age, sex, and height.

RESULTS:Baseline FEV1, FVC, and FEV1/FVC [mean (SD) 1.47L (0.30), 1.79L (0.34), 83% (7), respectively] increased following inhaler use [mean (SD) 1.53L (0.31), 1.80L (0.33), 85% (7), respectively]. Each IQR increase in PFHxS was associated with lower FEV1/FVC (β -0.51%, 95%CI - 0.93, -0.10) after inhaler use. Higher concentrations of all PFAS (except PFNA) were associated with lower BDR, although confidence intervals included the null [e.g., BDR -0.60% (95%CI -1.22, 0.01) per IQR PFHxS]. Contrary to our a priori hypothesis, each IQR increment in PFOA was associated with higher FVC before (β 26.1mL, 95%CI 5.3, 46.9) and after (β 23.8mL, 95%CI 1.6, 46.0) inhaler use. CONCLUSIONS:We found that children with higher prenatal PFHxS had decreased childhood lung function, particularly after inhaler use. We otherwise found no consistent evidence for an adverse effect of prenatal PFAS on childhood lung function. Future studies will benefit from exploring the impact of exposure to the mixture of PFAS.

Keywords: respiratory outcomes, children's environmental health, environmental epidemiology

MP-134[Chemical exposures » Heavy metals]

Associations of a Toenail Metal Mixture with Adult Attention and Memory in the Gulf Longterm Follow-up (GuLF) Study

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BACKGROUND AND AIM: Many metals share common mechanisms of neurotoxicity and joint exposures to multiple metals in a mixture can compound their individual neurotoxic effects. This study examines potential synergistic effects of metal exposures as well as an overall mixture of arsenic (As), chromium (Cr), manganese (Mn), and lead (Pb) on attention and memory in men from the Gulf Long-term Follow-up (GuLF) Study.

METHOD: We measured toenail concentrations of 13 metals/metalloids using inductively coupled plasma mass spectrometry in 413 non-smoking men from the GuLF Study. Previous work in this cohort identified inverse associations between toenail As, Cr, Mn, and Pb concentration and performance on tests of sustained attention (Continuous Performance Test [CPT]) and working memory (Digit Span Test [DST]). We used Bayesian kernel machine regression to evaluate interactions among specific metals, and the overall metal mixture, with attention and memory adjusting for covariates (education, age, smoking, marital status, and alcohol consumption). RESULTS: While estimates were imprecise, we observed inverse relations between increasing quartiles of the overall 4-metal mixture and performance on the CPT (sustained attention) and DST (working memory). Increasing all metals in the mixture from the 50th to the 75th percentile resulted in a - 0.07 (-0.19, 0.05) decrease in reverse DST score and a - 0.05 (-0.11, 0.01) decrease in CPT D' score. Sustained attention deficits were driven by toenail As and Cr concentration. Working memory deficits were driven by toenail Mn. No evidence of non-linearity or metal interactions was observed. CONCLUSIONS: Our findings suggest that higher exposure to arsenic and chromium is associated with lower sustained attention and manganese with decreased working memory. We did not observe strong evidence of synergistic interaction for either outcome across the metals examined. Further research is

warranted given the cross-sectional design and sub-clinical nature of the neurobehavioral test outcomes.

Keywords: Heavy metals, Mixtures, Neurologic outcomes

MP-135[Chemical exposures » Heavy metals]

Longitudinal Glycemic Trajectories in Relation to Toxic and Essential Metals among Mexican Americans

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BACKGROUND AND AIM:Both toxic metal exposures and disruptions in essential metal homeostasis are associated with various adverse health effects, including type 2 diabetes mellitus (T2D). Mexican Americans are at greater risk of metal exposures and have higher rates of T2D compared to other racial/ethnic groups, yet they remain underrepresented in environmental health research. We sought to evaluate time trend associations between continuous glycemic traits and baseline urinary toxic and essential metals as well as their mixtures among 616 Mexican American adults living in Southern Texas.

METHOD:Utilizing data from a longitudinal cohort, 616 Mexican American adults, aged 35 to 69 years, were followed for 3 years with 6 repeated examinations (baseline, 3, 6, 12, 24, and 36 months). Urinary toxic and essential metals were assessed by inductively-coupled plasma mass spectrometry at baseline. Stratified by baseline diabetes status, linear mixed-effects models were used to estimate per month changes in hemoglobin A1c, fasting plasma glucose, and post-load glucose in relation to urinary metal levels. Principal component analysis (PCA) was utilized to assess the effects of the metal mixtures.

RESULTS: Among individuals who were normoglycemic at baseline, higher arsenic was associated with a higher per month increase in fasting plasma glucose and post-load glucose after adjustment. Additionally, higher copper, molybdenum, nickel, selenium, and tin were associated with a higher per month increase in post-load glucose. Mixture analyses by PCA yielded appreciably similar results to the individual metal analysis.

CONCLUSIONS: In this under-represented, high-risk sample, exposure to toxic metals, alterations in

essential metal homeostasis, and metal mixtures were associated with glycemic deterioration over time. As type 2 diabetes rates continue to climb, it is vital to discern any modifiable risk factors for primary prevention, especially among underserved populations.

Keywords: Heavy Metals, Mixtures, Endocrine disrupting chemicals, Type 2 Diabetes,
Association between prenatal cadmium exposure and child development: The Japan Environment and Children's study

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BACKGROUND AND AIM:Cadmium is a heavy metal that can be found in soil, air, food, and water. Cadmium has toxic effects on the kidneys, bones, and respiratory system. In animal study and epidemiological study, prenatal exposure to cadmium has been found to affect the mental development of children, but inconsistent results have been found in different studies. We attempted to clarify this inconsistency by analyzing the relationship between the cadmium concentration in maternal blood during pregnancy and child development in participants of a nationwide birth cohort study, the Japan Environment and Children's Study.

METHOD:Prenatal cadmium concentrations in blood from mothers in the second or third trimester were determined by inductively coupled plasma mass spectrometry. Child development was evaluated using "Ages and Stages" questionnaires. The effects of cadmium were investigated by performing logistic regression analyses, multinomial logistic regression analyses and generalized linear mixed model using the child development parameters as dependent variables and the cadmium concentrations in maternal blood as the independent variable.

RESULTS:Significant associations were found between child development and the cadmium concentration 6 months, 1 year, and 1.5 years after birth. However, the effect had disappeared at 2 years after birth or later. The number of developmental delays was positively associated with the cadmium concentration after adjusting individual difference.

CONCLUSIONS: The results indicate that prenatal exposure affects child development but the effect decreases with age.

Keywords: Cadmium, JECS, child development, ASQ-3

Association between phthalates exposure and oxidative stress biomarkers in women with recurrent pregnancy loss: results from TREPLES

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BACKGROUND AND AIM:Some studies revealed that phthalate exposure increased oxidative stress biomarkers (OSB) in pregnant women. However, little is known about whether a similar phenonium occurred in women with recurrent pregnancy loss (RPL). The purpose of this study was to determine the relationship between urinary phthalate exposure and OSB in RPL groups.

METHOD: We used our established study, the Taiwan Recurrent Pregnancy Loss and Environmental Study (TREPLES), a hospital-based case-control study conducted from 2013 to 2022. The LC-MS/MS method was used to measure the urinary levels of 11 phthalate metabolites and the oxidative/nitrosative stress biomarkers (such as, 8-OHdG, 8-NO2Gua). Besides, we estimated the daily intake (DI) of phthalates based on the back-calculation method.

RESULTS: The patients with RPL had a significantly higher median of 8-NO2Gua and HNE-MA (5.72, 29.82) than the control groups (3.77, 21.54, respectively). After adjustment of age and time to pregnancy, the sums of DEHP (Σ DEHPm), and DBP metabolites (Σ DBPm), were significantly positively associated with urinary MDA (r=0.30 and 0.40) and Σ OSB (r=0.31 and 0.40) in the control group, but not in the RPL group. We found significant positive associations among Σ DEHPm, the DI of DEHP and Σ 8-NO2Gua and HNE-MA (r=0.16 and 0.21, P<0.01) in the RPL group, respectively. Besides, the Σ DBPm and the DI of DnBP were significantly positively associated with the Σ 8-NO2Gua and HNE-MA (r=0.26 and 0.29, P<0.01), respectively.

CONCLUSIONS: Our findings supported the hypothesis that phthalate exposure increase certain oxidative/nitrosative stress biomarkers in women with RPL.

Keywords: Phthalates, recurrent pregnancy loss, oxidative stress biomarkers

MP-138[Exposures » Occupational exposures]

Role of advanced glycation end products in the association between metal fume particulate matter exposure and oxidative stress

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BACKGROUND AND AIM: Few studies have explored the association between metal fumes particles and glycation end products and whether they will affect AGEs through the mechanism of oxidative stress. This study explores the relationship between exposure to metal fume particles and the circulating plasma AGEs through the mechanism of oxidative damage.

METHOD: We applied a longitudinal design and recruited 49 welders and 20 administrative staff from a shipyard in northern Taiwan from 2014 to 2015. Air sampling in the personal breathing zone was performed during the Monday shift before blood and urine sample collection on Tuesday morning. Heavy metals (chromium (Cr), manganese (Mn), iron (Fe), nickel (Ni), copper (Cu), zinc (Zn), and cadmium (Cd) was measured from personal air and urine samples using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). In addition, blood samples from each participant were collected after fasting overnight for AGEs analyses. All statistics were conducted in SPSS version 26.0 (IBM Corporation).

RESULTS:The concentration of PM2.5, as well as Cr, Mn, Fe, Ni, Cu, Zn, and Cd in the PM2.5, were higher in welders than those of administrative staff. After adjustment for all confounders, no significant differences in urinary 8-OHdG and 8-iso-PGF2a between welders and administrative workers. The concentration of AGEs was higher in welders than in administrative staff. After adjustment for all confounds through a generalized estimating equations (GEE) analysis, no associations of numerous urinary metals with oxidative stress were found. Adjusted for age, work type, and smoking habit, urinary Ni (β =0.169, 95% CI: 0.006 to 0.332, p<0.05) was positively associated with AGEs.

CONCLUSIONS: The component of welding fume particles, such as metals, have different potency of oxidative stress and are associated with AGEs. However, the mediation effect between metal exposure biomarkers and AGEs is worth be clarified in future studies.

Keywords: Air pollution, Particulate matter, Heavy metals

Association between serum manganese and bone mineral density: a nationwide crosssectional study in South Korea

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BACKGROUND AND AIM: Manganese (Mn) is one of the trace elements essential to the human body. However, excessive exposure causes detrimental health effects in several ways, and one possible toxicity is impaired bone homeostasis. Few studies have examined the relationship between Mn exposure and bone metabolism, yet no definite conclusions have been drawn, especially among Asian ethnicity. This study aimed to investigate the association between Mn level and bone mineral density (BMD) in the South Korean population.

METHOD:National population-based cross-sectional study of South Korean adults using KNHANES IV (2008-2009), a survey assessing the health and nutritional status of South Koreans, was constructed. Two thousand four hundred sixty adults aged ≥ 20 years were selected as the study sample after excluding ineligible participants. We included BMD of the total hip, femur neck, and lumbar spine (L1~L4) as outcome variables. Multiple linear regression models with stratification analysis according to gender and menopausal status were used to investigate the association between serum Mn and BMD.

RESULTS:The mean serum Mn concentration of the study sample was 1.34 µg/dL. A fully adjusted linear regression model demonstrated a positive association between serum Mn and femur neck BMD (β [SE] = 0.0136 [0.006]; p = 0.027). In contrast, subgroup analysis showed menopausal women had decreased femur neck BMD (β [SE] = -0.0282 [0.012]; p = 0.023) and lumbar spine BMD (β [SE] = -0.0370 [0.017]; p = 0.026) as Mn level increased after covariates adjustment. No significant association was found in men or premenopausal women.

CONCLUSIONS: We observed a significant association between serum Mn and BMD. Our results suggest that, unlike the overall population, high Mn exposure may negatively affect bone metabolism in menopausal women.

Keywords: Environmental epidemiology; Heavy metals, Female

Association between paraben exposure and renal function index among the general Taiwanese

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BACKGROUND AND AIM: Exposure to consumer chemicals has been associated with chronic kidney disease (CKD) among humans, but their associations with estimated glomerular filtration rate (eGFR) are inconsistent. We aimed to assess the relationship between paraben exposure and renal function including the serum level of blood urea nitrogen (BUN), and the urinary levels of microalbumin, albumin, protein, and creatinine from a population-based study.

METHOD: We enrolled 361 participants (\geq 18 y, N = 269; <18 y, N = 92) who provided questionnaire information as well as blood and urine samples from a nationally representative study. Urinary parabens including methylparaben (MeP), ethylparaben (EtP), propylparaben (PrP), and butylparaben (BuP) are measured by liquid chromatography/ tandem mass spectrometry. From the renal function index, we measured the serum level of BUN, and the urinary levels of microalbumin, albumin, protein, and creatinine. We used multiple logistic regressions to evaluate the relationship between paraben exposure and renal function in our participants.

RESULTS: Median levels of urinary MeP, EtP, PrP and BuP in adults were 397, 38.7, 117 and 6.77 ng/mL, respectively, which were significantly higher than those in children/adolescents (all P<0.001). Multivariate regression models adjusted for the same confounding factors confirmed the positive association of BUN and the negative association of eGFR with urinary EtP (β : 0.059; 95% confidence interval [CI] =0.001 to 0.116; β : -0.049; 95% CI = -0.094 to -0.005).

The multiple logistic regression showed that the adjusted odds ratio of the higher EtP and PrP level in adults for lower eGFR were 1.81 and 1.82 times than the lower group, respectively.

All regression showed that there were null association between paraben exposure and renal function index in children/adolescents participants.

CONCLUSIONS:Our findings suggested that daily exposure to EtP were significantly positively associated with an increased risk of higher BUN and lower eGFR in Taiwanese \geq 18 y.

Keywords: Chemical exposures, Endocrine disrupting chemicals, Biomarkers of exposure, Exposure assessment

Application of metabolomics to toxicity assessment of perfluorooctane sulfonic acid

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BACKGROUND AND AIM:Poly- and perfluoroalkyl substances (PFAS) are a group of artificial chemicals with thousands of individual compounds based on their diverse structures that pose severe public health concerns. However, regulation of PFAS is challenging due to the need for more toxic data. Therefore, a sensitive and rapid assessment method, such as metabolomics, is needed to provide information for PFAS management. In this study, we aimed to use metabolomic approaches to examine the dose-response relationship of perfluorooctane sulfonate (PFOS) and correlate with cell toxicity.

METHOD:HepG2 cell line was applied to the in-vitro model and treated with a series of doses of PFOS for 48 hours. After PFOS exposure, cell viability quantification was first conducted by MTS assay, and the 1/10 inhibition concentration (IC)10, IC10, and IC20 values were determined as the low-, median-, and high-dose treatment groups. Then, the control and treatment groups were collected and extracted for nuclear magnetic resonance-based metabolomics analysis, followed by multivariate analysis.

RESULTS: The results of the triplicate in-vitro experiments showed that 1%, 10%, and 20% ICs of PFOS were 12.5, 50, and 150 μ M. Numerous cellular metabolites were detected in the NMR spectra Treatment of PFOS altered the metabolic profiles of HepG2 cells. Critical metabolite responses were identified.

CONCLUSIONS: The experiments of cell viability determined the exposure dose of PFOS for metabolomics analysis. Identifying the representative metabolic responses of PFOS is essential. This approach can also be applied to risk assessment for other chemicals.

Keywords: Toxicology, Metabolomics, PFAS

Decreased perfluoroalkyl substances found in patients undergoing hemodialysis treatment

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BACKGROUND AND AIM:Perfluoroalkyl substances (PFAS) have been reported to be harmful to multiple organs in the human body. We aimed to compare the serum PFAS concentrations of patients undergoing regular hemodialysis (HD) and controls. Additionally, we also investigated the correlation between PFAS and biochemical data, as well as concurrent comorbidities.

METHOD: We recruited 301 participants who had been on maintenance dialysis for more than 90 days and 55 control participants. Eight different PFAS, namely perfluorooctanoic acid (PFOA), total and linear perfluorooctanesulfonic acid (PFOS), perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), and perfluoroundecanoic acid (PFUnDA), were measured using ultra-performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS). Spearman correlation and multivariable linear regression with 5% false discovery rate were used to evaluate the relationships between PFAS and clinical biochemistry in HD patients and controls.

RESULTS:Results

Circulating concentrations of seven PFAS, including total and linear PFOS (T-PFOS and L-PFOS) PFDA, PFNA, PFHxS, PFOA, and PFUnDA, were significantly lower in the HD group compared to the control group. For the interplay between biochemical data and PFAS, all of the studied PFAS were positively correlated with liver function, glucose, blood urea nitrogen, ferritin, and vitamin D in the controls, while in HD patients, the PFAS were all positively correlated with albumin, uric acid, iron, and vitamin D. As for comorbidities, we discovered that individuals with coronary artery disease had lower levels of PFNA and PFHpA, while those with hypertension had higher levels of linearPFOS. CONCLUSIONS:Conclusion

The levels of T-PFOS, L-PFOS, PFDA, PFNA, PFHxS, PFOA and PFUnDA, but not PFHpA, were significantly lower in the patients under HD treatment. HD played an important role in removing PFAS in patients with ESRD. Moreover, PFAS were positively associated with vitamin D, AST, and ALT in both HD patients and control populations.

Keywords: PFAS, Exposures

MP-143[Neurologic and mental health outcomes » Mental health outcomes]

Correlation of heavy metal levels and emotional/behavioral problems among adolescents in North Taiwan: a preliminary report

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BACKGROUND AND AIM: Previous studies showed some correlation between heavy metal and depression. However, the data among adolescents is limited. Thus we plan this study to survey the relationship. We also control related confounding factors of depression and emotional problems. METHOD: We invited youths aged 15 to 19 years in the community to participate in the study. They filled in the questionnaires about socio-demographic data, emotional and behavioral problems (Youth Self Report Form, YSR), experiences of being bullied, childhood trauma experiences, family relationships, alcohol use, smoking, number of physical illnesses, and family psychiatric history. We also collected their urine to examine the heavy metal level, including vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, arsenic, and selenium. We performed the linear regression analysis to see if the heavy metal level is correlated with emotional or behavioral problems. The confounding factors mentioned above were also put into the analysis. RESULTS: Among these 137 students, 95.6% were female. We found that the risk factors for severe internalizing problems are childhood trauma experiences (B=0.400, p<0.001), psychiatric family history (B=5.485, p=0.015), and a higher level of urine vanadium (B=820.215, p=0.041). The risk factors for severe externalizing problems are childhood trauma experiences (B=0.215, p<0.001), being victims of a passive bully (B=0.827, p=0.042), and a higher level of urine vanadium (B=545.669, p=0.030) or tin (B=646.304, p=0.010). The risk factors for total problems of YSR are childhood trauma experiences (B=0.849, p<0.001), family psychiatric history (B=10.012, p=0.048), and a higher level of urine vanadium (B=1915.487, p=0.042) or tin (B=2112.087, p=0.023). CONCLUSIONS: Our results are consistent with previous research that a higher tin level correlates with depressed mood in adults. There is very limited data reporting the relationship between vanadium and emotion and behavior. Adolescents should consider avoiding exposure to these 2 metals. Longitudinal studies are warranted to survey the causal inference.

Keywords: Children's environmental health, Community health, Environmental epidemiology, Heavy metals

Musculoskeletal symptoms and disorders, and related knowledge, attitude and practices among female textile workers in Karachi, Pakistan

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BACKGROUND AND AIM: The aim of this study was to determine the prevalence of Musculoskeletal symptoms and disorders (MSD) and to assess Knowledge, Attitude and Practices regarding Musculoskeletal symptoms and disorders among female textile workers

METHOD:To assess prevalence of MSD, we used the adopted version of Nordic Musculoskeletal Questionnaire (NMQ). For assessing individual and work-related factors, a structured questionnaire was used. Data was captured on EpiData and analyzed using SPSS 19. Percentages, frequencies, Standard deviation, and means were calculated. KAP variables, responses were coded as "positive" or "negative". Those scoring "positive" were considered as having good knowledge, attitude, and practices.

RESULTS:311 female workers participated in this study. 253 (81.4%) workers reported musculoskeletal symptoms. The Lower back was the most frequently affected region (71.7%), followed by shoulders (70.7%) and neck (43.4%). Self-reported average difficulty of pain was moderate, and most individuals (29.6–53.1%) reported duration of pain to be between 3-5 days. 69.5% of workers were very dissatisfied with their working space. Frequency of musculoskeletal complaints were popular among 26-35 years old. MSD prevalence had significant associations with insurance coverage (p = 0.014), working postures (p = 0.012), marital status, (p = 0.025) and lower educational attainment (p = 0.029). Those with MSD complaints were more likely to have better knowledge and safer practices score.

CONCLUSIONS: There is a high prevalence of musculoskeletal symptoms and disorders among female textile workers in economically developing countries. Preventive measures and worksite interventions are needed to reduce work-related musculoskeletal disorders in this population. Health insurance, treatment and reimbursement schemes should be launched.

Keywords: Textile workers, Musculoskeletal symptoms and disorders, Women Health, LMIC, Health Insurance

MP-145[Climate » Temperature]

Quantifying the Burden of Heat-Attributable Occupational Injuries in Australia: A DALY-based analysis

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BACKGROUND AND AIM: Many studies have shown that high temperatures increase the risk of occupational injuries. However, these studies typically use relative risk or odds ratios to summarize the impact of high temperatures, and none has reported the burden of disease summary measures for heat-attributable occupational injuries. This study sought to address this gap by quantifying the burden of occupational injuries attributable to high ambient temperatures in Australia at the national, state and territory, and climate zone level.

METHOD: The population attributable fraction of heat-attributable occupational injuries for the period 2014-2019 was calculated using relative risk functions sourced from a systematic review and metaanalysis. The burden of occupational injuries and the proportion attributable to heat (i.e., above the mean annual temperature) in each Köppen-Geiger climate zone and Australian jurisdictions were estimated using Disability-adjusted life years (DALY), factoring in fatal and non-fatal health loss. RESULTS:Between 1 July 2014 and 30 June 2019 in Australia, a total of 42,884 years of healthy life were lost due to occupational injuries, with an average rate of 0.8 DALY per 1,000 workers per year. Heat-attributable DALYs accounted for an estimated 2.3% of the total DALY of occupational injuries, with the fatal burden representing 92%, and the non-fatal burden representing 8% of the estimated 968 heat-attributable DALYs. Tropical climate zones had the highest proportion of heat attributable occupational injury DALY rates per 1,000 workers.

CONCLUSIONS: This study highlights that over 2% of the burden of occupational injuries in Australia can be attributed to high ambient temperatures. Without adaptive measures and industry-based policies to reduce heat exposure and protect worker health and safety, the heat-attributable burden of occupational injuries is likely to increase as heat exposure increases due to climate change.

Keywords: Heat; DALY; Injury; Occupational

A police officer-specific model for predicting the 10-year risk of major adverse cardiovascular events

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BACKGROUND AND AIM: Police officers are at high risk for cardiovascular diseases. This study aimed to develop a 10-year major adverse cardiovascular events (MACE) risk prediction model in police officers.

METHOD: We obtained medical claims data (2006–2020) from National Health Insurance Service in the Republic of Korea. We constructed a retrospective fixed cohort of police officers (identified in 2009 and 2010) who underwent national health check-up between 2008 and 2010. The cohort was followed for 10 years from health check-up (closest to identification year). The endpoint was defined as first hospitalization for MACE (acute myocardial infarction, ischemic stroke, and hemorrhagic stroke) during the follow-up. Health check-up data were randomly assigned into two sets for model development (70%) and validation (30%). A Cox regression analysis was performed to estimate the risk of MACE given a set of various cardiovascular-related predictors.

RESULTS:A total of 1,351 (2.1%) police officers developed MACE based on the development set (n=64,557). The 10-year MACE risk prediction model included sex (hazard ratio, 1.682; 95% confidence intervals, 1.228–2.305; male vs. female), underweight (1.577; 0.739–3.365; vs. normal), current smoker (1.435; 1.255–1.641; vs. non–smoker), history of hypertension (1.424; 1.239–1.637; vs. no history of hypertension), history of diabetes mellitus (1.301; 1.098–1.542; vs. no history of diabetes mellitus), obese (1.259; 1.082–1.465; vs. normal), overweight (1.168; 0.990–1.378; vs. normal), age (1.062; 1.054–1.069), former smoker (1.029; 0.889–1.192; vs. non–smoker), diastolic blood pressure (1.015; 1.006–1.023), systolic blood pressure (1.005; 0.999–1.011), fasting blood glucose (1.003; 1.002–1.005), total cholesterol level (1.002; 1.001–1.003), low–risk alcohol drinking (0.877; 0.773–0.994; vs. non–drinker), moderate–risk alcohol drinking (0.635; 0.472–0.854; vs. non–drinker), and high–risk alcohol drinking (0.524; 0.372–0.739; vs. non–drinker). The model performance (Harrell's C-index) was estimated at 0.75 based on the validation set.

CONCLUSIONS: We developed a police officer-specific MACE prediction model using nationwide medical claims data in the Republic of Korea.

Keywords: Cardiovascular diseases, Occupational epidemiology

Occupation and the incidence of female breast cancer in Taiwan: A longitudinal and nationwide cohort study

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BACKGROUND AND AIM: Female breast cancer has been the first cause of cancer incidence in Taiwan over decades, but the incidence of female breast cancer at different stages among workers is limited. This study aimed to investigate the associations between the incidence of breast cancer at different stage with various occupations and industries among female workers in Taiwan. METHOD: We incorporated databases from Ministry of Labor and Ministry of Health and Welfare to establish an occupational cohort of 4,742,717 female workers and a non-occupational cohort of 2,124,616 women during 2010-2018. The cox regression models were used to evaluate the differences in the incidence of female breast cancer over occupations and industries. RESULTS: Female workers had a significantly higher risk of breast cancer at full-stage (Hazard ratio [HR]=1.16, 95% confidence interval [CI]: 1.14-1.19), stage 0 (1.43, 1.36-1.50), stage 1 (1.28, 1.23-(1.32), stage 2 ((1.16, 1.12-1.20)), stage 3 ((1.05, 1.00-1.10)), but a significantly lower risk at stage 4 (HR=0.85, 95% CI: 0.79-0.92) compared with the non-occupational women. Female workers in the financial and insurance activities (HR=1.07, 95% CI: 1.00-1.13) and real estate activities (HR=1.10, 95% CI: 1.01-1.20) had significantly higher risks of full-stage breast cancer than those employed in the educational industry. Similar patterns were observed at stage 0 (HR=1.75, 95% CI: 1.52-2.02), stage 1 (HR=1.40, 95% CI: 1.30-1.50), and stage 2 (HR=1.25, 95% CI: 1.17-1.35) in the financial, and at stage 0 (HR=2.15, 95% CI: 1.82-2.54), stage 1 (HR=1.35, 95% CI: 1.18-1.56), and stage 2 (HR=1.28, 95% CI: 1.12-1.47) in the real estate activities.

CONCLUSIONS: We found that the significantly higher risk of breast cancer was identified among female workers and those employed in the specific industries.

Keywords: Breast cancer, incidence, industry, occupation, perspective cohort

The impact of urban heat island on heatattributable excess deaths in the past and future warming climate

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BACKGROUND AND AIM: To assess and project the impact of urban heat island (UHI) on heat-related mortality in the Tokyo Metropolitan Area (TMA), Japan.

METHOD: We collected daily time series data on mean ambient temperature and all-cause mortality from 2010 to 2019 for 242 municipalities in TMA. We quantified the UHI intensity using municipalityspecific UHI anomaly (UHIa) and classified them into decile zones. We examined the heat-related mortality for each UHIa zone and then assessed its association with the UHIa. We estimated the heatattributable excess deaths due to the UHI effect by comparing the observed UHI-related mortality with that under a counterfactual scenario in the past. Next, we projected the heat-attributable excess deaths under two climate change scenarios (RCP 2.6 and 8.5) for each UHIa zone, by allowing for two different assumptions on UHI and adaptation in the future. The difference under each climate change scenario was interpreted as the future impact of UHI on heat-related excess death.

RESULTS:The mean UHIa ranged from -2.80°C to 1.29°C. A 1°C increase in mean UHIa was associated with an increase of 0.018 (95% CI: 0.002, 0.034) in heat-related log-relative risk after the full adjustment of all the other confounders. The heat-related excess death attributable to UHI was 0.42% (95% empirical CI [eCI]: 0.26,0.56) in TMA during 2010-2019. Under RCP 8.5, heat-related attributable fraction in TMA is projected to increase from 0.76% (95% eCI: 0.44,1.24) in the 2010s to 2.04% (95% eCI: 1.19,3.05) in the 2090s, and the corresponding attributable fraction due to UHI would increase from 0.52% (95% eCI: 0.33,0.77) to 1.02% (95% eCI: 0.67,1.40).

CONCLUSIONS:Our findings suggest UHI contributes to heat-related mortality in TMA, and its impact is projected to increase under a warming climate.

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Keywords: environmental epidemiology, temperature, mortality

Temperature related occupational accidents in Spain: socioeconomic drivers of adaptation during the last 3 decades

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BACKGROUND AND AIM: To analyze the association between ambient temperatures and work accidents in 48 provinces of Spain during the period 1988-2020, along with the variations through time in the relative risk of work-accidents under heat and cold temperatures, and to explore the drivers of adaptation and/or maladaptation.

METHOD: We obtained daily timeseries of work-related accidents with at least one day of leave from the Spanish Labor Administration. We used distributed lag non-linear models to estimate the association between daily mean temperatures (E-OBS) and work accidents, and we pooled the results through a meta-regression to compute the country-level estimates of relative risk (RR) at extreme temperatures. We performed separate analyses for heat (months from May to September) and cold (December to March) to study the role of a range of variables as meta-predictors of the temporal changes in risk between the years 1989-1993, 1999-2003, 2009-2013 and 2015-2019 (subperiods 1, 2, 3 and 4, respectively).

RESULTS: We found that the overall RR at temperature percentiles 1 and 99 was 1.05 and 1.08 in 1988-2020, respectively, with the minimum accident temperature at 12 °C. The found non-monotonic trends in the RR, with values of 1.19, 1.11, 1.12, 1.15 in subperiods 1, 2, 3 and 4 at percentile 99th, and of 1.0, 1.09, 1.17 and 1.06 at percentile 1st. We found significant associations of RRs with socioeconomic and demographic non-monotonic temporal changes (specifically unemployment and workforce age).

CONCLUSIONS: This study is one of the first to emphasize the changes in time of the relation of temperature and work-accidents during an extended period (33 years) in a country specifically vulnerable to climate change. Potential factors for the (mal)adaptation of workers to temperatures are discussed, highlighting the potential decision-making actions that can be taken in order to enhance our early adaptation response to climate change.

Keywords: Occupational epidemiology, Temperature, Temperature extremes and variability, Socioeconomic factors, Climate

Risk factors for threats and humiliation at the workplace of envrionmental scientists

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BACKGROUND AND AIM:Threats and humiliation are common at the workplace. Factors (personal-, intra-institutional, extra-institutional factors) which influence threats and humiliation at the workplace are largely unknown. We aim to provide data on those factors which contribute to threats and humiliation at the workplace based on an ecological model (personal-, intra-institutional, extra-institutional factors).

METHOD:Online survey of International Society of Environment (ISEE) embers and persons affiliated with ISEE (January – March 2022) To identify factors contributing to threats and humiliation we estimated logistic regression models. We analyzed at the personal level gender, age, migration position, and research area.

RESULTS: The response rate for the whole sample was 32.9% (n = 627 / 1, 907). For this study we included those who responded to the threats and humiliation items (n = 500; 64.2 female; 35.8 males). Gender and age were not related to threats and humiliation; however, migration increased the risk of being humiliated, and being Full Professor decreased the risk. At the institutional level, social support reduced the risk of for threats and for humiliation (Support be colleagues: OR = -0.818,95CI: -1.354. - 0282), Hum: OR = -1.229, 95 CI: -1.001. -0468)). Considering politics more than research in the institution was related to threats but not to humiliation. Extra-institutional factors related to decreased threats were being able to publish research regardless of the level of controversy. In a multilevel model adjusting for adjusted for gender, age, migration, region, job position, job sector, and research area, freedom of expression regardless of political interest is related to less threats and less humiliation (OR: -1.066, 95% CI: -1.781, -0461).

CONCLUSIONS: Scientific integrity and freedom publish research regardless of the level of controversy reduce the risk of threats and humiliation at the workplace.

Keywords: Threats, humiliation, risk factors, environmental scientists

Coexposure to organophosphate flame retardants and phthalates in patients with chronic kidney disease and the potential nephrotoxicity

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BACKGROUND AND AIM:Organophosphate flame retardants (OPFRs) and phthalates are widely used additives in various consumer products and have potential nephrotoxicity. However, the hazardous effects of coexposure to OPFRs and phthalates have not yet been evaluated in patients with chronic kidney disease (CKD).

METHOD:Adult CKD patients in Taiwan were recruited from the Kaohsiung Chang Gung Memorial Hospital to measure the urinary concentrations of ten OPFR compounds and eight phthalate metabolites. The total urinary concentrations of OPFRs and phthalates were calculated, and the urinary kidney injury molecule-1 (KIM-1) concentration was measured as the biomarker of renal tubular injury in the study population. The urinary concentrations of OPFRs and phthalates were assessed in univariate and multivariate analyses to identify factors independently associated with urinary KIM-1 concentration.

RESULTS:Among the 163 CKD patients enrolled in this study (stage 3: n = 79 (49.47%); stage 4: n = 48 (29.45%); stage 5: n = 36 (22.08%)), the overall urinary detection rates of OPFRs and phthalates were 97.88% and 100.00%, respectively. The median total OPFR and phthalate concentrations were 2.04 µg/g creatinine (Cr) (interquartile range (IQR), 0.84–4.27) and 52.96 µg/g Cr (IQR, 31.12–102.29), respectively. Both urinary OPFR and phthalate concentrations were independent predictors of urinary KIM-1 concentration in the enrolled patients after adjusting for baseline covariates, with a 0.171 log ng/g Cr increase in KIM-1 (95% confidence interval (CI), 0.046–0.296, p = 0.008) by per log µg/g Cr total OPFRs and a 0.364 log ng/g Cr elevation in KIM-1 (95% CI, 0.170–0.557, p < 0.001) by per log µg/g Cr total phthalates.

CONCLUSIONS: Coexposure to OPFRs and phthalates is prevalent and associated with renal tubular injury in CKD patients, which highlights the nephrotoxic potentials of these pollutants in this vulnerable population.

Keywords: chemical exposures, phthalates, multi-pollutant

Boron Carbide nanoparticles caused the toxic effects on Caenorhabditis elegans Models

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BACKGROUND AND AIM:Boron carbide (B4C) is a widely known ceramic material composed of boron and carbon. It is known for its toughness, high melting point, low density, and good mechanical property. Due to its diverse properties, it is widely used in industrial applications such as cutting tools grinding wheels, ballistic armor, and neutron absorbers in nuclear power. Despite the various advantages of B4C, constant exposure to boron carbide nanoparticles (B4C NPs) may induce adverse effects on the human body via inhalation, skin contact, or oral ingestion. METHOD:In this study, B4C NPs were investigated using Caenorhabditis elegans (C. elegans) as in-

vivo model to determine the different toxicological endpoints including reproductive (brood size), growth measurement (body length), locomotion (head thrashing and body bending), lifespan, and oxidative stress (gene expression of sod-1, sod-3, ctl-2, and cyp35a2) and metal detoxification (gene expression of mtl-2). The L1 nematodes were prolongedly exposed to B4C NPs concentrations of 320, 160, 80, 40 mg/L until the nematodes attained the L4 stage.

RESULTS: The reproductive and locomotion assay revealed a significant decrease in brood size and body bending in 80 to 320 mg/L B4C NPs concentrations which indicate B4C NPs can induce reproductive toxicity and disrupt neurological function. The nematodes exposed at high concentration of B4C NP showed decrease in survival rate compared to the control group. With regards to the growth measurement assay, there were no significant changes in the body length of the exposed nematodes. CONCLUSIONS: The genes responsible for regulating the oxidative stress and metal detoxification were found to be downregulated resulting to affected biological system of nematodes. These findings indicate that B4C NPs can cause adverse effects on C. elegans and further observation of other physiological changes in nematodes can done in future studies.

Keywords: Boron carbide (B4C), nanomaterials, Caenorhabditis elegans, reproduction, neurological toxicity

Coal Production Trends and Black Lung Disease Incidence Rate in Indonesia during 2013-2021

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BACKGROUND AND AIM: The use of coal in the world continues to increase, resulting in countries supplying coal products continuing to increase their production. Indonesia as the world's largest coal supplier also seeks to increase coal production every year. The aim of this study is to reveal the occupational health perspective of increasing coal production and its impact on black lung disease in Indonesia.

METHOD: This research is a retrospective longitudinal study conducted on 3 coal mines in Indonesia. The research focused on the annual medical check-up program data from 2013 – 2021. Data is taken from Indonesia's national coal production data and black lung disease data. Rate ratios were examined for differences in rates between men and women workers, and annual percent change was calculated to quantify changes in incidence rates over time.

RESULTS: Trends analysis shows that coal production in Indonesia has continued to increase at least 24.49% in the last decade from 490 million tons in 2013 and gradually increased to 610 million tons in 2021. According to the annual chest X-Ray of coal mine workers in Indonesia, the incidence of black lung disease in coal miners was found 112 cases (13.88%) during these period which larger than worldwide incidence rate (9%). Male workers have a greater ratio of black lung disease in coal mining companies. The age of workers over 40 years have an incidence rate twice (69.64%; 78 cases) that of workers under 40 years.

CONCLUSIONS: Increasing coal production in Indonesia results in increasing new cases of black lung disease among coal mine workers in Indonesia. Proper occupational health intervention and early detection of disease would benefit to workers to avoid serious health consequences due to coal exposure.

Keywords: long-term exposure, respiratory outcomes, occupational epidemiology, occupational exposures

Changes in susceptibility to heat during the summer: the role of air conditioning

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BACKGROUND AND AIM: Heat can increase the risk of morbidity and mortality in early summer, even with relatively milder air temperature. However, the factors underlying the variability of heat risk throughout the summer are not well understood. This study aims to investigate the role of air conditioning in the association between summer temperature and heat-related illness ambulance transport (HIAT) using electricity consumption data.

METHOD: We collected daily HIAT, maximum temperature, relative humidity, and electricity consumption (EC) data for Chiba prefecture in Japan from June to August 2016-2019. Quasi-Poisson regression with distributed lag non-linear model was used to estimate the association between temperature and HIAT in each month. An interaction term between temperature and EC was added to estimate the risk of HIAT, centered at the average level of EC in each month.

RESULTS:There were 9,921 cases of HIAT during the summer months in the four-year period. The average monthly EC were 3457, 3907, and 4070 Watt/floor m2 in June, July, and August, respectively. The estimated exposure-response curve showed an exponential increase in risk during the three months. The same pattern was observed in each month from June to August but at a different momentum, with August showing the steepest risk increase. The inclusion of EC attenuated the increase in risk of HIAT during the summer, particularly in July and August, but not in June. CONCLUSIONS:The findings suggest that air conditioning reduced the risk of heat on HIAT in the summer. However, the reduction was not noticeable in June, indicating insufficient adaption in early summer. The results based on electricity usage data have implications for public health policies, particularly on the timing of preventive measures.

Keywords: Environmental epidemiology, Temperature extremes

MP-155[Built environment » Other (to be specified with keywords in the keywords section)]

Experience of implementing MultiTex RCT intervention package at textile mills in Karachi, Pakistan: A qualitative study

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BACKGROUND AND AIM: The MultiTex RCT aims to determine the effectiveness of a multifaceted intervention package in reducing dust levels in cotton mills, decreasing the frequency of respiratory symptoms among cotton textile workers, and improving their lung function. A total of 38 textile mills were included in the MultiTex RCT. This qualitative study is nested within the larger MultiTex RCT study.

Through this, we have explored the experiences and views of textile mill workers, managers, and stakeholders, involved with the MultiTex RCT using qualitative research methods. It was initiated to have an understanding of the experiences and barriers faced during the implementation of the intervention package.

METHOD:10 managers were selected for in-depth interviews (IDIs), 5 stakeholders for Key Informant Interviews(KIIs) and 8 focus group discussions (FGDs) were conducted among workers using a semistructured questionnaire. Interviews were recorded and then transcribed verbatim. Thematic analysis was used to generate themes and subthemes.

RESULTS:Participants identified audit and compliance requirements as key factors that facilitated compliance with PPE guidelines.

stakeholders identified government and worker unions as key for the proper implementation of the safety package and to ensuring compliance of workers with it. Participants also believed that this intervention package had numerous health and safety benefits however there was still a lack of compliance by the workforce which was attributed to a combination of factors, including education level and cultural attitudes toward PPE. Covid-19 emerged as a strong facilitating factor that led to increase in compliance as factories and the government had strict implementation of PPEs during the spread of this infection.

CONCLUSIONS: The implementation of safety measures in the workplace can be challenging, and several factors can hinder their effectiveness. This highlights the need for proper education and training on the importance of wearing facemasks to prevent the spread of chronic respiratory diseases.

Keywords: Occupational health, Chronic respiratory disease, textile mills, RCT nested qualitative study, Qualitative study

Digitalization of Medical Records: Streamlining Healthcare Operations: Enhancing Efficiency and Reducing Burnout

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BACKGROUND AND AIM: The electronic medical record (EMR) systems remain a significant priority for the improvement of healthcare services. However, their implementation may have resulted in a burden on healthcare workers (HCWs). This study aimed to determine the prevalence of burnout symptoms among HCWs who use EMRs at their workplace, as well as burnout-associated factors. METHOD: This is an analytical cross-sectional study was conducted at six public health clinics equipped with an electronic medical record system. The respondents were from a heterogeneity of job descriptions. Consent was obtained before enrolment into the study. A questionnaire was distributed through an online platform. Ethical approval was secured.

RESULTS: A total of 161 respondents were included in the final analysis, accounting for a 90.0% response rate. The prevalence of burnout symptoms

was 10.7% (n = 17). Three significant predictors were obtained in the final model: experiencing ineffective screen layouts and navigation systems, experiencing physical or verbal abuse by patients, and having a poor relationship with colleagues.

CONCLUSIONS: The prevalence of burnout symptoms among healthcare workers working with electronic medical record systems was low. Despite several

limitations and barriers to implementation, a paradigm shift is needed to equip all health sectors with electronic medical record systems to improve healthcare service delivery. Continuous technical support and financial resources are important to ensure a smooth transition and integration.

Keywords: electronic medical record, healthcare system delivery, burnout, mental health, healthcare information system.

Korean Radiation Workers Study: Baseline Characteristics of an Expanded Cohort

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BACKGROUND AND AIM: The Korean Radiation Workers Study (KRWS) is a large cohort study of radiation workers to assess health effects of occupational radiation exposure. The initial cohort included 20608 workers in active at the time of enrollment from 2016 to 2017, and the cohort was recently expanded to include retired workers. The aim of this study is to present the baseline characteristics of cancer incidence and mortality of the cohort along with the comparison with the general population.

METHOD: The study population of the expanded cohort are 196379 workers registered in the National Dose Registry (1984-2021). In order to identify cancer and death of individual workers, we linked the cohort with the National Cancer Registry (1988-2018) and the National Vital Statistics Registry (1992-2020). For external comparisons of cancer incidence and mortality in the cohort with those in the Korean general population, age and sex standardized incidence ratios (SIRs) and mortality ratios (SMRs) were calculated.

RESULTS:A total of 6113 cancer cases were identified from 1988 to 2018, and thyroid cancer was the most prevalent (20.7%), followed by stomach cancer (18.4%) and liver cancer (8.9%). For mortality, a total of 4709 workers (2.4%) deceased from 1992 to 2020, and cancer (33.1%) was the most prevalent cause of death, followed by external causes (29.6%) and circulatory diseases (14.8%). The SIR for all cancer combined was significantly decreased (SIR = 0.89, 95% CI 0.87–0.92); however, that for thyroid cancer was significantly increased (SIR = 1.24, 1.17–1.32). Overall, SMRs for most causes of death were decreased with statistical significance for all causes of death combined (SMR=0.62, 0.60–0.64). Those low SMRs remained after stratification by sex, birth year, and working periods.

CONCLUSIONS: The baseline findings did not deviate from those of other studies, indicating a healthy worker effects, and a continued follow-up is needed with dose-response analyses.

Keywords: Ionizing radiation, Public health

Transitioning to safer LPG cylinder exchange for household cooking in Ghana: lessons from mixed methods pilot study of user experiences

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BACKGROUND AND AIM:Ghana is transitioning from a customer-controlled cylinder model (CCCM) of liquefied petroleum gas (LPG) distribution to a branded cylinder recirculation model (BCRM) to increase population-level LPG access for cooking to 50% of Ghanaians by 2030. As the BCRM aims to improve consumer safety, distribution and accessibility, we explored users' perceived advantages and limitations of obtaining LPG under the BCRM during a pilot phase implemented by the Ghanaian Government in Obuasi, Ghana

METHOD: We adopted a mixed methods approach comprising a survey (n=50) and in-depth qualitative interviews (n=7) conducted among LPG customers selected from retail points in Obuasi to explore fuel/stove use and opinions/experience of the BCRM. We applied a framework analytic method and thematic analysis to describe and identify emerging patterns and themes in the qualitative data. RESULTS: The survey participants were mostly young people (mean age 28.3+/-8.9) and the majority of them were females (74%). LPG was the primary cooking fuel for all of them. Only half (n=26; 52%) of participants had successfully exchanged their old cylinders for the branded cylinders under the BCRM; the old model of LPG procurement (i.e partial filling of customer-owned cylinders at filling-stations) continued in parallel. The interviews revealed that study participants did not perceive the novelty and intended advantages of the BCRM. Branded cylinder holders could only access their LPG refills at designated refilling stations, with fewer access options than those offered by the CCCM at the time of the pilot. Interviews revealed insufficient branded cylinders in circulation coupled with cylinder cross-filling and poor monitoring of cylinder quality.

CONCLUSIONS: The BCRM pilot in Obuasi did not achieve its intended benefits, pointing out the need for a much larger number of fully audited/high-quality branded cylinders to avoid the coexistence of the two distribution models and an increased number of retail points to maximize customer access.

Keywords: Transition, Liquefied Petroleum Gas, clean cooking, cylinders recirculation, Ghana

"Cumulative preventable number" for heathealth alert system

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BACKGROUND AND AIM:Last year, we proposed the new index, preventable number, for heat-health alert system to set the alert criterion of daily maximum wet-bulb globe temperature (=WBGTmax). In brief, the idea is as follows: If a counterfactual "perfect action" is implemented at a certain WBGTmax criterion, all the emergency ambulance car visits (=EVs) estimated to occur on the day with the WBGTmax equal to or higher than the criterion should be prevented. This number can be regarded as "preventable number" (= PN).

METHOD:Data we used were the daily maximum WBGT estimated with weather factors and daily number of EVs, both obtained from the governmental agencies of Japan. The study period was 2015 to 2019, during warmer season (May to September). Using these data, we first modelled the relation between WBGTmax and EVs, assuming quasi-Poisson distribution with log link in generalized linear model. From the highest integer WBGTmax to the lowest, we can accumulate the PN using the model mentioned above. This can be regarded as cumulative preventable number (= CPN). In this study, we observed the difference in the pattern of the month-specific CPN for 47 prefectures in Japan. RESULTS:In most of the prefectures, the CPN was highest in July, followed by August. Although the risk at a certain WBGTmax, say 30 degC, is higher for May or June, the CPN was much lower for these months, as well as September, when the acclimatization made the risk lower and the number of hot days became much smaller than July or August. However, some prefectures, including Tokyo, the highest CPN was August. Another finding was that May, June and September needs lower criterion WBGTmax than July and August to substantially prevent the EV occurrence.

CONCLUSIONS: The variation of the CPN pattern clearly shows that the heat-health alert criterion should be area- and month-dependent.

Keywords: Web Bulb Globe Temperature, Ambulance car visits, Heatstroke, Heat-health alert, preventable number

MP-160[Exposures » Other (to be specified with keywords in the keywords section)]

Nanomaterial Titanium dioxide caused the toxicity on Caenorhabditis elegans

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BACKGROUND AND AIM: This study investigated the toxicity of nano Titanium dioxide (nTiO2) using Caenorhabditis elegans as the model organism. The lethality, lifespan, growth, reproduction, locomotion, and oxidative stress induced by varying concentrations of nTiO2 on C. elegans were investigated. In this study, commercially available (Degussa P25) and synthetically prepared nTiO2 solutions were prepared.

METHOD: The nematodes were acutely exposed (from L3 to young adult stage) to 4 concentrations of each nTiO2 solutions (10, 1.0, 0.1, and 0.01 mg/L).

RESULTS: The results showed that there are no significant effects to the survival rate, growth, and life span of the nematodes for all concentrations of both solutions compared to the control group. However, there is an observed decrease in the brood sizes (reproductive effects) of the nematodes as the concentrations of nTiO2 increased. The same is observed in the locomotion of the nematodes, where the head thrashing and body bending decreased as the concentration increased. Oxidative stress expression of sod-1, sod-3, ctl-1, ctl-2, cyp35A2, mlt-1, and mlt-2 was also observed. For commercially available nTiO2, there is an overexpression of all genes at 1 mg/L exposure and for synthetic nTiO2, there is a significant overexpression of all genes at 10 mg/L exposure. CONCLUSIONS:In conclusion, acute exposure of C. elegans to high concentrations of nTiO2 reduced the brood size produced and have affected the locomotion of the nematodes.

Keywords: nano Titanium dioxide, Caenorhabditis elegans, Reproductive toxicity, Neurobehavioral toxicity, Oxidative stress

MP-161[Exposures » Other (to be specified with keywords in the keywords section)]

PM2.5 emission from air fryers to cause the harmful effects on Caenorhabditis elegans models

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BACKGROUND AND AIM: The purpose of this study was to examine the emission characteristics of indoor air pollution generated by air fryers and their potential effects on human health, specifically the impact of PM_{2.5}.

METHOD:To achieve this, we utilized Caenorhabditis elegans (C. elegans) as an animal model due to the nematodes' genetic similarity to humans. We established an in-vivo model and conducted toxic tests to evaluate lethality, reproductive toxicity, locomotor behavior, body length, and lifespan. RESULTS:A statistical analysis revealed that the concentration of PM2.5 did not prove to be fatal for C. elegans. However, there was a locomotor behaviour effect that was noticed at a dosage of 7.5 x 10-3 μ g/L and was significantly different from the control group. At higher concentrations of 7.5 x 10-2 μ g/L and 7.5 x 10-1 μ g/L, the negative impact on the body length, locomotor behavior, and reproductive toxicity of C. elegans was noticeable. In particular, the locomotor system of C. elegans was affected, causing a significant reduction in locomotor behavior, body length, and reproductive capacity when compared to the control group.

CONCLUSIONS: The air fryer generated PM2.5 at toxic concentrations can impede the development of C. elegans and studying the organism's other physiological characteristics can provide valuable insights for diverse research applications.

Keywords: Air fryer, Indoor air pollutants, PM2.5, C. elegans, neurological toxicity

Older Queenslanders' behaviours during hot weather: factors impacting their heat response actions

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BACKGROUND AND AIM:Understanding the determinants of individual heat response behaviours is important for promoting these behaviours, especially among at-risk populations. Therefore, this study was conducted to understand the status and determinants of heat response behaviours in the older population of Queensland, Australia

METHOD:Online- and paper-based surveys were administered from 15 September 2022 to 29 November 2022 to recruit and survey a representative sample of older Queenslanders (n = 547). The survey questionnaire included five sections: (1) sociodemographic factors (age, gender, education level, and financial status); (2) pre-existing heat-sensitive diseases; (3) heat-health risk knowledge (multiple questions); (4) heat-health risk perception; and (5) heat response behaviours. Chi-square tests were conducted to identify each factor associated with heat response behaviours, followed by ordinal modelling analyses of significant factors (identified from the Chi-square tests) to identify the key factors associated with heat response behaviours.

RESULTS: The top heat response behaviours which older Queenslanders use most frequently are: adjusting their clothing (55.7%), increasing fluid intake (52.2%), using fans (38.3%), and using air conditioning (21.3%). Chi-square tests reveal that heat-health risk knowledge and heat-health risk perception are associated with all these heat response behaviours. Age, education level, self-reported financial status, or self-reported pre-existing heat-sensitive diseases, were not significantly associated with any of these response behaviours. The ordinal regression results suggest that older

Queenslanders with higher heat-health risk perception were more likely to adjust their clothing (odds ratio [OR]: 3.00, 95% confidence interval [CI]: 1.13-7.99), increase fluid intake (OR: 4.51, 95% CI: 1.78-11.45), and use fans (OR: 4.52, 95% CI: 1.79 - 11.45).

CONCLUSIONS: This study shows that raising awareness around heat-health risk perception in older Queenslanders irrespective of the sociodemographic factors could be useful for increasing their heat response behaviours.

Keywords: climate, temperature extremes, environmental epidemiology

ORAL ABSTRACTS

OP-001[Exposome » External exposome]

The potential of biodiversity interventions to modulate immune response - experiences from the first generation of randomized trials

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BACKGROUND AND AIM: Urban populations are suffering from increasing levels of immune-mediated diseases. The costs of these diseases are hundreds of billions of dollars in developed countries. The biodiversity hypothesis states that one of the core reasons for the epidemic is unsufficient daily contact with rich and diverse environment microbiota that flourishes in organic soil and vegetation. To test the hypothesis, my research group - jointly with collaborators - has performed intervention trials for several years in urban environment.

METHOD: Microbial diversity was added to urban outdoor and indoor environment. The target groups covered daycare children and adult volunteers. Yard rewilding was done using horticultural soil and diverse vegetation. Green walls were tested indoors. Four randomized trials were performed. The trials lasted from two weeks to two years. One of the trials was double-blinded. Volunteers were exposed to biodiversity on five days per week. Shifts in environmental and commensal microbiota as well as several cytokines and regulatory T cells were measured using standard methodology.

RESULTS: In yard rewilding experiments, commensal microbiota was enriched and immune modulation was enhanced in all trials. In the green wall experiment, the results were similar. In general, the level of interleucin-10 in the intervention arms increased compared to the control arm. Skin microbiota was associated with immune modulation, e.g. the level of regulatory T cells, more often than stool microbiota.

CONCLUSIONS: Based on these biodiversity interventions, adding microbial diversity to everyday urban living environment causes shifts in commensal microbiota and immune modulation. In previous studies, similar shifts have been connected to low risk of several immune-mediated diseases. Similar but large-scale trials should be run for longer periods to find out whether disease incidence is less among those exposed to rich natural microbiota on a daily basis.

Keywords: External exposome, health co-benefits, other (biodiversity intervention), other (immune modulation), other (environmental microbiota)

The WEF HEALTH NEXUS: Assessment of Strategies & Co-Benefits in the Eastern Mediterranean Region

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BACKGROUND AND AIM: The water-energy-food (WEF) and Health (H) sectors are typically dealt with from different perspectives and through different interventions, which makes assessing their interactions complex. However, a conceptual system analysis that incorporates data from all these sectors can enable policy and decision-makers to gain a comprehensive understanding of the WEF-H Nexus, seek large benefits, and aggregate the sectors' key political objectives. The goal of this study is to change the projection on Health in the WEF analysis from a healthcare and burden perspective to a resource and enabler perspective, which can help us connect the Energy, Water, and Food indicators with the Health and well-being indicators.

METHOD: The study uses the WEF-H Nexus Software, a scenario-based platform designed to help identify sustainable resource management strategies informed by the WEF-H Nexus. The scenario-based tool quantifies the interconnections between the WEF and Health resources and captures the impacts of challenges and other stresses.

RESULTS: The review of databases for this study found that the explicit interaction between Health and the WEF Nexus is not well-studied. Although Health is often addressed within the WEF Nexus, it is still viewed mainly as a burden rather than as an asset for well-being. Therefore, this study proposes a conceptual system modeling approach to address this research gap, particularly in the Eastern Mediterranean Region.

CONCLUSIONS: The WEF Nexus concept is relatively recent, but it shows great potential as a business model that incorporates resource efficiency. However, there is a need for more research to integrate Health as a resource for sustainability. By changing the projection on Health in the WEF analysis from a burden to a resource and enabler, we can promote a holistic approach to sustainability that considers the interconnections between the WEF and Health sectors.

Keywords: WEF, Nexus, Modeling, Health co-benefits.

Biodiversity interventions for well-being of humans and planet

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BACKGROUND AND AIM: Biodiversity is essential for well functioning urban ecosystems and human well-being. Biodiversity loss limits exposure to rich microbial communities, which is associated with commensal microbiota and poor immunological resilience. In addition, urban pollutants, such as polycyclic aromatic hydrocarbons (PAHs), may alter microbial communities and interfere with immune regulation. Our aim was to estimate the connections between biodiversity, PAH pollution, environmental and commensal microbiota and immune regulation.

METHOD: In the first experiments, we estimated PAH induced bacterial shifts in several urban landscaping materials, and whether environmental exposure to PAHs affects commensal bacterial communities on the skin and in the gut among urban and rural populations. Results from the pollution studies were combined with publicly available land cover data. Thereafter, we set up a placebocontrolled human intervention trial in which novel landscaping material with high microbial diversity was used to examine its effects on commensal microbiota and immune regulation in daycare children. RESULTS: In the PAH experiment, the magnitude of shifts in bacterial communities, including shifts in Gammaproteobacteria, depended on landscaping material. High playground soil PAH contamination was associated with Proteobacterial communities on the children's skin, whereas high coverage of forests was associated with decreased PAH levels in ambient air. In the placebo-controlled biodiversity intervention trial among daycare children, skin Gammaproteobacterial community shifted only among the intervention children, which was associated with enhanced immunoregulation. CONCLUSIONS: The PAH pollution studies indicate that PAHs may induce shifts in environmental and commensal bacterial communities that are associated with human health, and that it is possible to design landscaping materials that are more resilient to bacterial shifts induced by pollution. Urban biodiversity might be an important determining factor in the context of pollution-induced disturbances within commensal microbiota. Our placebo-controlled biodiversity intervention indicates that playground microbial diversity can be modulated in order to enhance children's immunological resilience.

Keywords: Biodiversity, Microbiome, Children's environmental health

Environmental changes and general health condition

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BACKGROUND AND AIM: The environment directly affects health status and plays a major role in quality of life, years of healthy life lived, and health disparities. Humans impact the physical environment in many ways, like overpopulation, pollution, burning fossil fuels, and deforestation.

To assess environmental changes and the general health condition.

METHOD: It were a cross-sectional study. To assess environmental changes and general health condition of dental second-year students and data were collected by checklist.

RESULTS:Distribution of the respondents according to sex, 64.5% were female and 35.5% male. Majority of the student (51.6%) come from outside of Dhaka. 45.2% of respondents were lived in Dhaka by born. 80.6% respondents lived with their family. It was alarming that 83.9% of respondents never did physical exercise and only 16.1% did sometimes physical exercise. 61.3% of respondent admired that they have hair loss, 16.1% has no problems in skin but others have problems. 51.6% has dust, 12.9% has food allergy. 6.5% has frequents exposure of diarrheal diseases. Often 67.7% has been suffered from headaches. Reason of seasonal changes 29% respondents suffered by itching. 77.4% and 83.9% of respondents were affected by anxiety and depression. 77.4% respondent has knowledge about weather change in our country as well as the whole world.

CONCLUSIONS: General health condition may change multiple causes. The environment is one of the strong factors. The relationship between environmental temperature and health has been known for a very long time.

Keywords: Health, environmental change, knowledge, weather, relationship.

Clean Energy for Healthy Environments and Lives: Rural and Remote Community Leadership in Clean Energy Solutions for Australia and India

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BACKGROUND AND AIM: The Clean Energy for Healthy Environments and Lives (CE4HEAL) project aimed to engage with Central Australian and South Indian communities in rural and remote areas to identify barriers and enablers to adopting solar energy for improved health outcomes. The project aimed to collect, synthesise and communicate examples of good practice in solar energy projects in rural and remote communities with high levels of poverty and climate change vulnerability. METHOD: We involved Indigenous and non-Indigenous collaborators and communities from Central Australia and South India. Qualitative methods were used for data collection and thematic analysis, including a scoping review, stakeholder interviews and focus group discussions. Local schools and art centres were involved in artwork development aiming to enhance awareness of the health benefits of clean energy and design solar energy advocacy materials.

RESULTS: The lack of clean, reliable and affordable energy is a key contributor to poor health outcomes and social injustice in rural and remote communities. Indigenous communities in particular have often been excluded from electrification programmes and impacted by large scale renewable energy developments on traditional lands. Low home ownership, inadequate housing construction and maintenance, and inter-linked institutional, financial, technical, cultural and linguistic barriers pose challenges to clean energy transition in rural and remote communities. Without close and ongoing consultation with community stakeholders, clean energy projects may fail to gain acceptance, making their sustainable implementation difficult.

CONCLUSIONS: Successful implementation of solar energy projects in rural and remote Central Australia and South India requires community led participatory processes, integrating clean energy and housing adaptation approaches, suitable finance models, and appropriate microgrid technology. Indigenous environmental knowledge and culture are critical to enhancing awareness and understanding the challenges to implementing clean energy solutions. This can help to decrease energy vulnerability, achieve better environmental, health and socio-economic outcomes for rural and remote communities.

OP-006[Cancer and cancer-precursors » Incidence]

Thyroid nodules, Fine Needle Aspiration Cytology, and Thyroid cancer in Fukushima

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BACKGROUND AND AIM: After the Fukushima-Daiichi nuclear power plant disaster, thyroid ultrasound examination (TUE) was performed on subjects who were aged ≤ 18 years. In the first round of TUE (October 2011 to March 2014), 115 malignancies were detected. In the second and later rounds of TUE, while much less malignancy was expected, additional 71, 31, and 38 malignancies were detected. Most studies focused on thyroid cancers and thus failed to understand the protocol of TUE; cancer detection depends on whether fine needle aspiration cytology (FNAC) is applied to participants with nodules larger than 5mm. With regarding this protocol, this study analyzes the relationships between thyroid dose and thyroid nodule, FNAC, and thyroid cancer detected in Fukushima. METHOD: The relationship between thyroid dose and the number of participants with a thyroid nodule, with whom fine needle aspiration test (FNA) was conducted, and with malignancy were analyzed using publicly available municipality-level data without regional grouping (N=59). A Poisson regression model with log(Thyroid dose for ten years old) and age on TUE was introduced as regressors. RESULTS: UNSCEAR(2022) re-estimated thyroid dose incorporating the latest information on the ingestion of contaminated food, the flow of radiation plumes, and other factors. The estimates were reduced by 1/8 lower than the previous estimates (UNSCEAR 2013). Although magnitudes were reduced, previous and re-estimated thyroid doses have a positive and significant correlation of 0.44. The coefficient of log (Thyroid dose for ten years old) was positive and significant for small nodules $(\beta = 0.112, p=0.008)$, FNA $(\beta = 0.514, p=0.000)$, and malignancy $(\beta = 0.36, p=0.077)$ CONCLUSIONS: Although this was an ecological study, health follow-up for children in Fukushima is urgent. Since the third screening, municipality-level data has been undisclosed because of privacy concerns. Data disclosure is necessary to understand the effect of the Fukushima disaster.

Keywords: Thyroid cancer, radiation epidemiology, Fukushima nuclear disaster

Land use regression model developments for air pollutants and particle-bound heavy metals in Taichung City, Taiwan

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BACKGROUND AND AIM: In order to understand the intra-city variations of air pollutants and particlebound heavy metals in Taichung City located at the central Taiwan. At the same time, the land use regression (LUR) model developments for above mentioned pollutants would be supported the further exposure assessments link with the epidemiological studies.

METHOD:Thirty-three micro-environmental sites included 26 schools (in each district) and 3 buildings (total 7 sites) scattered on Taichung City were chosen. For obtaining the spatial variations, one continuous site (Situn EPA Air Quality Monitoring Network Station) was selected as time-adjusted reference. Harvard impactor and Ogawa passive samplers were used to measure the concentrations of PM2.5 and SO2/NOx, respectively. Particle- bound heavy metals were analyzed by Inductively Coupled Plasma – Mass Spectrum (Model 7500c, Agilent). We also measured the absorption coefficients of sampled filters to be considered as soot or elemental carbon measurement. Land use, demographic, and road network numerical data were selected to develop the LUR models. The major buffer radiuses of each selected variable were set 25, 50, 100, 300, 500, 1000 and 5000 meters, respectively. All the LUR models were diagnosed following the standard protocols from the European Study of Cohorts for Air Pollution Effects (ESCAPE) project.

RESULTS:Modeled R2 (Coefficient of Determination) for PM2.5 and PM2.5 absorbance were 0.61 and 0.72, respectively. For SO2 and NOx, the modeled R2 were 0.51 and 0.68, respectively. The modeled R2 ranged from 0.36 and 0.65 for five particle-bound heavy metals (As, Cd, Cr, Ni, and V). The background/site-specific variables, point-, line-, and area-land use variables had taken into accounted in the developed LUR models.

CONCLUSIONS:PM2.5, PM2.5 absorbance, SO2, NOx, and particle-bound heavy metals based LUR models could be developed with well performances. Finally, these model-based exposure assessments could be effectively used for environmental epidemiological study.

Keywords: Air pollution, Particulate matter, Heavy metals, Exposure assessment
Atmospheric fine particulate matter (PM2.5) in Bloemfontein, South Africa

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BACKGROUND AND AIM:Indoor and outdoor pollution is a global issue that has adverse effects on both the environment and human health. While research-based studies have been conducted to assess air pollution in larger South African cities such as Cape Town and Pretoria, there has been minimal research conducted in the Free State province. The aim of the current study was to report on PM2.5 levels and its chemical components in Bloemfontein, the capital of the Free State Province. METHOD:The 24-hour PM2.5 samples were manually collected on PFTE filters every third day during 26 June 2020 to 18 August 2021. Smoke stain reflectometry and X-ray fluorescence were used for the chemical analyses.

RESULTS:The average concentration of PM2.5 during the study period was 11 μ g/m3, which exceeded the World Health Organization's (WHO) annual guideline limit of 5 μ g/m3, but not the annual South African National Ambient Air Quality Standard of 20 μ g/m3. The daily WHO guideline of 15 μ g/m3 was exceeded on 28 of the 180 days sampled, but not the daily South African standard of 40 μ g/m3. The average soot concentration was 1.2 μ g/m3. On average, winter had the highest PM2.5 and soot concentrations, followed by autumn, summer and spring. The five most abundant trace elements detected in the PM2.5 filter samples were S (540 ng/m3), Si (440 ng/m3), K (160 ng/m3), Fe (130 ng/m3) and Ca (100 ng/m3).

CONCLUSIONS: PM2.5 and its trace element concentrations pose a risk to human health in Bloemfontein.

Keywords: PM2.5, soot, trace elements, South Africa, health risk

OP-010[Exposure assessment methods » Exposure assessment-air pollution]

Biases in estimated ambient PM2.5 exposure and associated health burden in India due to satellite aerosol optical depth sampling gaps

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BACKGROUND AND AIM:Satellite-derived ambient PM2.5 became the main source for exposure assessment and attributable health burden estimation in countries that do not have adequate ground monitors. PM2.5 is derived from satellite aerosol optical depth (AOD), which has sampling gaps due to clouds and other challenges. The bias in exposure and health burden estimates due to the AOD sampling gaps is not known. Here we estimate this bias for India and discuss the implications for air quality management and epidemiology studies.

METHOD: We develop a machine learning algorithm to fill the sampling gap in MODIS AOD data available at 1 km spatial scale. We further build a machine learning model to convert AOD to surface PM2.5 using predictor variables. We then estimate the mortality burden attributable to PM25 exposure for the years 2017 to 2022 for India. The difference in exposure and burden with and without filling the AOD sampling gaps provide the biases.

RESULTS:Our 5-fold cross validation of satellite-PM2.5 (derived from gap-filled AOD) with the ground data from the Central Pollution Control Board shows a very high level of accuracy. We show that population-weighted exposure in India during the period was 18.1% lower than that estimated using unfilled AOD, more so in the states having high rainfall during the monsoon. We find that the rising trend in PM2.5 exposure has either stabilised or PM2.5 exposure has declined in recent years in India. This cannot be explained by the changes in meteorology. Without accounting for the sampling gap, mortality burden in India would have been over-estimated by 0.1 million (95% confidence interval: 0.07-0.13), with a higher bias in the middle socio-demographic indicator states.

CONCLUSIONS:Our results suggest that exposure modelling using satellite data should adjust the sampling gaps on a daily scale before any further applications in air quality and epidemiology studies.

Keywords: Ambient PM2.5 exposure, health burden, AOD sampling gap, bias, India

Global estimates of daily ambient fine particulate matter concentrations and unequal spatiotemporal distribution of population exposure

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BACKGROUND AND AIM:Short-term exposure to ambient particles with a diameter of $2.5 \ \mu m$ or less (PM2.5) is a leading contributor to the global burden of diseases and mortality. However, few studies provide the global spatiotemporal variations of daily PM2.5 concentrations over two decades. METHOD:We implemented a deep ensemble machine learning (DEML) model based on ground-based measurements from 5,446 monitoring stations in 65 countries worldwide, combined with GEOS-Chem chemical transport model (CTM) simulations, satellite-based data, and meteorological and land cover information to estimate global daily ambient PM2.5 concentration at $0.1^{\circ} \times 0.1^{\circ}$ spatial resolution in 2000-2019. We investigated the population-weighted (PWD) PM2.5 and annual population-weighted exposed days (PED) above daily WHO Air Quality Guidelines levels (15 µg/m3) to measure the spatiotemporal unequal exposure from 2000 to 2019.

RESULTS:Our global DEML model achieved state-of-the-art performance with a cross-validation coefficient of determination (R2) of 0.91 and root mean square error (RMSE) of 7.86 μ g/m3. Globally, there was a slight upward trend in the annual average PWD PM2.5 in 2000-2019, from 31.6 μ g/m3 ± 10.5 μ g/m3 in 2000 to 32.3 μ g/m3 ± 10.1 μ g/m3 in 2019. Despite a dramatic decline in Europe and North America, some regions in Asia, Oceania and Northern Africa have witnessed substantial increases in PWD PM2.5 over two decades. Only 0.18% of the global land area and 0.001% of the global population were exposed to PM2.5 below the WHO AQG annual guideline value in 2019, with more than 70% of days experiencing the daily PM2.5 concentrations above AQGs. Distinct seasonal patterns were found in many regions of the world.

CONCLUSIONS:Our global high-resolution estimates of daily PM2·5 provide the first global view of the unequal spatiotemporal distribution in PM2·5 exposure over decades, which is of significance for assessing short- and long-term health impacts of PM2·5, especially for areas where monitoring station data are not available.

Keywords: Exposure assessment, Particulate matter, Big data

A global One Health tool to prioritize climatesensitive zoonotic diseases

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BACKGROUND AND AIM: Zoonotic diseases pose a significant threat to humanity and animals and this threat is further aggravated by amplifying drivers of transmission including climate change. Given the complex interplay between zoonoses and climate change, and the limited resources available to tackle this combined threat, a structured decision-making process is critical to effectively identify priority climate-sensitive zoonotic pathogens (CSZs) to target prevention and surveillance efforts. In this study, we developed a novel structured and scalable process that enables the prioritization of CSZs to inform decisions across human and animal health.

METHOD:As a first step we performed a literature review to unravel the epidemiological links between climate hazards stemming from climate change, the mechanisms by which these impact on zoonotic disease transmission and the resulting impacts on animal and human health. Based on this, we developed a 4-step framework which included: a) development of 3-dimentional set of criteria considering climate hazard, mechanisms of transmission and health impact, b) utilization of fuzzy analytical hierarchy process (AHP) methodology to compare relative importance of each strata within criteria, c) define a comprehensive list of questions to rank CSZs and d) ranking of CSZs using fuzzy AHP during rounds of expert elicitation.

RESULTS: This prioritization process provides a ranked list of zoonotic diseases that are considered sensitive to climate hazards. With the fuzzy AHP methodology, this approach also enables the assessment of uncertainty in disease prioritization.

CONCLUSIONS: The CSZ prioritization tool developed in this research is a scalable evidence-based and transparent approach that enables human, animal, and environmental experts to engage and communicate the impacts of climate hazards on zoonotic disease transmission. The resulting ranked list of CSZs corresponds to priority diseases for which One Health investment priorities need to be targeted to enhance surveillance and prevention efforts. This work was funded by the World Bank Group.

Keywords: Climate change, zoonoses, disease prioritization, One Health, stuctured decision-making

OP-014[Neurologic and mental health outcomes » Mental health outcomes]

A longitudinal analysis of residential greenspace and anxiety symptoms among a cohort Australian women living in cities

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BACKGROUND AND AIM: Relatively few longitudinal studies have reported on the mental health benefits of residential

greenspace. We assessed longitudinal associations between two greenspace exposures and anxiety symptoms in Australian women living in cities.

METHOD:Our study comprised 3,938 women, born between 1973-78. Anxiety symptoms in the previous month were assessed at follow-up (every three years in 2003-2018), using the Goldberg Anxiety and Depression Scale. Seasonal average normalized difference vegetation index (NDVI) was estimated from 30 m Landsat satellite images in a 500 m buffer (NDVI500m) around participants' address per survey. Annual percentage cover of non-photosynthesising vegetation (fNPV500m, e.g. dead leaf litter, dry grass) was estimated. A generalised estimating equation tested for associations between greenspace and anxiety symptoms (as odds ratios [ORs]), adjusting for individual-level covariates. Sensitivity analyses addressed women experiencing substantial (>1 SD) between-survey changes due to moving, and adjusting for NO2 and PM2.5.

RESULTS:A 0.12 (1 SD) unit increase in NDVI500m was significantly associated with lower odds of anxiety symptoms (OR: 0.96, 95% CI: 0.93-0.99) in the adjusted model. A 5.2% (1 SD) increase in annual fNPV500m was not significantly associated with anxiety symptoms in the adjusted model (OR: 1.03, 95% CI: 0.99-1.07). NDVI500m was modestly attenuated when air pollutants were adjusted for, though fNPV500m only became significant when PM2.5 was adjusted for. Between-survey contrasts had no clear effect for NDVI500m, while a marked increase in fNPV500m between surveys was consistently associated with anxiety, compared with those experiencing similar exposure (OR: 1.15, 95% CI: 1.02-1.31).

CONCLUSIONS:NDVI500m was generally associated with lower odds of anxiety symptoms, while fNPV500m was generally associated with higher odds of anxiety. The adverse effects of fNPV may reflect a sub-optimal restorative capacity and/or lower aesthetic value and ability to hold attention compared with greener spaces, among other potential explanations.

Keywords: greenspace, cohort study, mental health, anxiety, women

Geospatial co-distribution of human and canine urothelial cell carcinoma and associated environmental risk factors in Queensland, Australia

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BACKGROUND AND AIM: Available evidence indicates that tumours in dogs and humans show a wide variety of biological and clinical similarities. Recent evidence suggests that environmental pollutants may contribute to increased risk of cancers of the urinary tract such as urothelial cell carcinoma (UCC) in humans and dogs. We hypothesised if such a relationship exists then urinary cancer incidence in humans could be spatially and temporally collocated with that of canine companion animals. METHOD: We used human UCC patient records for 4937 individuals and 170 dogs in Queensland, Australia from 2008 to 2018, retrieved from Cancer Data Queensland and from the VetCompass Australia and the University of Queensland's pathology laboratory databases, respectively. Both human and canine data were aggregated to the postcode-level, using postcode of residence for humans and postcode of veterinary clinic for dogs. Climate and environmental exposures including precipitation, land surface temperature, model predictions of outdoor annual fine particulate matter \leq 2.5µm (PM2.5) and nitrogen dioxide (NO₂) concentrations, and distances to cropland and industrial areas were linked to the postcodes. Cluster analysis of canine UCC incidence was performed using Anselin Local Moran's I and a statistical model of human UCC incidence was developed, taking into account environmental and climate factors, including PM2.5, NO2, precipitation, land surface temperature, and land use.

RESULTS:Our results suggest that human UCC incidence is higher in postcodes surrounding clusters of high canine UCC incidence. The significance of this result is partly explained by environmental pollution factors. The findings of this study highlight significant spatial variation in both human and canine UCC incidence are associated with common environmental and climatic factors in Queensland. CONCLUSIONS:These results suggest the potential for canine UCC incidence to be used as sentinel data in high-risk postcodes for human UCC.

Keywords: Air pollution, Epidemiology, Long-term exposure, Spatial statistics, Temperature

Multidrug-Resistant and Extended-Spectrum β-Lactamase Escherichia coli in Dairy Farms: One Health Perspective

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BACKGROUND AND AIM:As Escherichia coli is a key species linked to antimicrobial resistance (AMR) and often used as an indicator for AMR surveillance across humans, animals, and environments, we aimed to investigate the dispersion of multidrug-resistant (MDR) and extended-spectrum β -lactamase (ESBL) E. coli in various domains within dairy farms.

METHOD:Soil, effluent, cow dung, milk, and human samples were collected from eight dairy farms in Selangor, Malaysia. A total of 145 pure strains were isolated and stored. Identification and antibiotic susceptibility testing were conducted using VITEX® 2 system. VITEK® 2 AST card N314 was used to test 16 types of antimicrobials representing 8 antimicrobial categories, including the presence of ESBL. RESULTS:The highest resistance of E. coli strains was recorded by penicillin (18.6%), followed by trimethoprim/sulfamethoxazole (9.0%). A total of 10 strains (6.9%) were MDR E. coli with a maximum of four antimicrobial categories. MDR-producing ESBL was observed among cow dung (n=3), milk (n=2), and soil (n=2). Both strains from milk exhibited CTX-M β -lactamases. CONCLUSIONS:The presence of MDR and ESBL E. coli in dairy farms implies antimicrobial usage. It is worrying as there might be a possible route transfer of MDR bacteria and AMR genes from food and environment to animals and humans. Therefore, quantification of antibiotic residues and resistance genes could further add value to identify the high-risk source of contaminants.

Keywords: microbes, infectious disease, exposures

One Health approach to fight Rabies in **Casablanca Region-Morocco**

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BACKGROUND AND AIM: Rabies is a neglected zoonosis, especially in Africa and Asia. In Morocco, cases occur mainly in rural areas in Casablanca Region. Preventing rabies is considered a high priority national program for both human and animal health sectors. Since 2018, Morocco is moving towards a one-health approach to counter this endemic disease.

Our Objective is to share our promising experience of dealing with rabies in Casablanca Region since the implementation of the Intersectoral One Health convention in 2022.

METHOD: A retrospective study examined human rabies data routinely collected by Regional Public Health Department (RPHD) from 2000 to 2023.

We also described the multidisciplinary One Health National Rabies control strategy initiated regionally since January 2022.

RESULTS: During the period from January 01, 2000, to March 01, 2023, 91 human rabies cases have been reported (0,05 per 100000 population). Age distribution of cases ranged from 1 year to 30 years, with a median age of 11 years, 66% of cases occurred in rural areas, all 16 Casablanca provinces have reported cases.

Since January 2022, to improve access and quality health care for the exposed population, Casablanca Region ensured the implementation of 59 Post Exposure Prophylaxis PEP centers. RPHD organized training sessions for PEP centers (120 medical and paramedical staff).6629 exposed patients received PEP (incidence rate 92,5 per 100000 population), 36,1% of exposed patients are aged under 15 years, 68,8% are male. 60,7% of cases are from rural areas, 79,7% of cases are caused by dog bites. 45% of exposed patients visiting PEP centers reported Exposure Category II.

CONCLUSIONS: The first steps of one health response implementation in Casablanca Region have helped to raise public awareness to prevent exposures, to seek proper treatment and reduce unnecessarv PEP.

Keywords: Outcomes, Infectious diseases, Mortality, Policy and practice.

OP-018[Air pollution » Particulate matter]

Estimating the Health Benefits of Achieving the Air Quality Guidelines for PM2.5 in Korea

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BACKGROUND AND AIM:One component of air pollution, in particular, fine particulate matter (PM2.5) has been known to enter deep into the lungs of humans, causing negative health effects and premature death of cardiovascular and respiratory-related disease. In 2021, the World Health Organization published the new Air Quality Guidelines (AQG) and strengthen the annual standard of fine particulate matter (PM2.5) from 10 to 5 μ g/m³.

This study estimates the health benefits in Korea if it achieved new Air Quality Guidelines of PM2.5. METHOD: The Environmental Benefits Mapping and Analysis Program (BenMAP) of Environmental Protection Agency and AirQ+ of World Health Organization were used to estimate the health benefits of improved air quality, and the two results were compared. Additionally, Statistics Korea's population and baseline mortality data were used, and the Krewski function were used to calculate the concentration-response function of PM2.5 and its health benefits.

RESULTS:The study was conducted with 2020 as the reference year, when the annual concentration of PM2.5 in Korea was 18.6 μ g/m³ and the regional concentration ranged between 11.9 and 29.5 μ g/m³. To achieve the AQG of PM2.5, the annual concentration of PM2.5 would have to be improved to 6.36~19.07 μ g/m³.

The results of the BenMAP and AirQ+ showed that if Korea had achieved an AQG of PM2.5, premature mortality would have decreased by 20,111(95% CI: 13,794~26,300) and 21,175(95% CI: 14,005~27,698), respectively. The difference between the two results was not significant, and the contribution of PM2.5 to the total mortality was 7.96%.

CONCLUSIONS: In conclusion, this study showed that it is crucial to devise appropriate mitigation strategies for PM2.5 to improve air quality owing to its critical role in improving health benefits.

Keywords: PM2.5, BenMAP, AirQ+, Health benefits

OP-019[Air pollution » Particulate matter]

Effects of long-term exposure to air pollution on all-cause and cause-specific mortality in South Korea

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BACKGROUND AND AIM: It has been widely reported that long-term exposure to particulate matter (PM) is associated with mortality. Due to limitations in PM2.5 exposure data and health data, research on PM2.5 risk assessment with a national cohort was limited. Using machine learning-based PM2.5 prediction model that covers the entire continental areas of South Korea from 2002 to 2019, this study aims to investigate the associations between PM2.5 and all-cause and cause-specific mortality in South Korea.

METHOD:Participants above 50 years in enrollment were included from the National Health Insurance Service-National Sample Cohort (NHIS-NSC) between 2002 and 2019. The NHIS-NSC data include all medical claims of approximately 1 million individuals, accounting for 2% of the national population by random sampling. To secure representation of the Korean population, stratified sampling was conducted based on gender, age, income level and region. PM2.5 exposures using a 1-km^2 grid network across South Korea was assessed with ensemble-based prediction model. Monitoring data for PM2.5 were obtained in our study area from 2000 to 2020. Cox regression model with time-varying covariates was used to estimate the associations of PM2.5 with mortality. Furthermore, generalized propensity score weighting and sub-population analyses were performed for those between 50 and 65 years and those aged 65 and older.

RESULTS: With the weighted pseudo-population, a 1µg/m3 increase in PM2.5 was associated with allcause mortality hazard ratio (HR) 1.002 [95% confidence interval (CI): 0.998-1.007]. Specifically, the circulatory (HR 1.012; 95% CI 1.003-1.021) and digestive mortality (HR 1.026; 95% CI 1.005, 1.048) were significantly associated with PM2.5. Moreover, circulatory mortality in individuals below 65 (HR 1.017; 95% CI 1.000-1.033) and digestive mortality in elder population (HR 1.043, 95% CI 1.016-1.070] were significantly associated with air pollutant.

CONCLUSIONS:Long-term exposure to one-year average PM2.5 was associated with elevated risks of all-cause mortality and deaths from circulatory and digestive diseases.

Keywords: Air pollution, Particulate matter, Long-term exposure, Environmental epidemiology, Mortality

Short-term exposure to air pollution and acute kidney injury-related mortality: a global time-series study in 136 cities in 6 countries

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BACKGROUND AND AIM:Recent studies have shown the association between air pollution and chronic kidney disease. However, less is known about effects of exposure to air pollution on acute kidney injury (AKI) and resultant disease burden. Therefore, this study aimed to estimate the short-term association between three air pollutants (PM2.5, O3, and NO2) and AKI-related death using a multi-city multi-country database.

METHOD: We obtained data on daily time-series of AKI-related death count and concentration of air pollutants for 136 cities across the six countries during the period 1987–2018 from the Multi-City Multi-Country (MCC) Collaborative Research Network. We conducted a novel case time-series design with quasi-Poisson distribution to estimate the association between each air pollutant and AKI-related death and calculated the excess deaths due to noncompliance with the new WHO air quality guidelines. Air pollutant was included in a model using a distributed lag model (DLM) with 35 lag days. RESULTS:Total of 41,379 AKI-related deaths were included in this study. AKI-related deaths were positively associated with air pollutants, with RRs of 1.06 (95% CI: 0.99, 1.12) for PM2.5, 1.03 (95% CI: 0.99, 1.08) for warm season (April to September) O3, and 1.03 (95% CI: 0.98, 1.08) for NO2, per 5, 10, and 10 µg/m3 increase in each air pollutant. In lag-distributed associations, the risks of AKI death tended to decrease during the early lag periods and started to increase after 15 lag days for PM2.5 and warm season O3. Proportions of excess AKI deaths attributable to air pollutant levels above the new WHO guidelines were 2.6%, 5.1%, and 4.7% for PM2.5, warm season O3, and NO2, respectively.

CONCLUSIONS: Our findings provide evidence that short-term exposure to air pollution is associated

with an increased risk of AKI-related death and implications on disease burden of AKI attributable to air pollution.

Keywords: Mortality, Particulate matter, Ozone, Oxides of nitrogen

OP-021[Air pollution » Particulate matter]

Reducing PM 2.5 seasonal concentration in urban areas could reduce the number of hospital admissions in Cote d'Ivoire

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BACKGROUND AND AIM:Rapid urban expansion has severely increased ambient levels of air pollution, including both particulate matter consisting of a diverse set of suspended solid and liquid particles of varying size and chemical composition, as well as gases dioxide.

Epidemiological studies have contributed much to the understanding of both the short and long term effects by documenting adverse effects of air pollution on various organ systems, such as the respiratory, cardiovascular, metabolic and central nervous systems

Health impacts due to pollution are being studied worldwide in response to high levels of PM 2.5 pollution and a growing understanding of the damages air pollutants have on respiratory, cardiovascular, and neurological systems.

The objective of this study was therefore to assess the impact of air pollution on health in Abidjan and Korhogo, with special attention to cardiorespiratory and skin diseases, by measuring both exposure to PM 2.5 and health objectively.

METHOD: The study was conducted from December 2018 to September 2019. PM2.5 concentrations were measured in Abidjan as well as in Korhogo. In addition, the medical admission outcomes were recorded and the health impact analysis were done via health risks.

Also, we use a multinomial regression to assess the health problem that can be induced by exposure to the PM2.5 pollutant and the number of deaths to avoid

RESULTS: The results showed that the average daily concentrations of PM 2.5 levels were 77 μ g/m3 and 155 μ g/m3 for Korhogo and Abidjan respectively. 682 patients in Korhogo and 1396 patients in Abidjan were recorded during both dry and rainy season.

Using health impact assessment, in Abidjan 704 respiratory admissions and 227 could have been avoided where 338 where observed and 26 avoided in Korhogo if PM 2.5 was under 12 μ g/m3 annually

CONCLUSIONS: Reduicing PM 2.5 as required by WHO could avoid hospital admission in Abidjan

Keywords: PM 2.5, respiratory, admission avoided

Association between ambient air pollution and mortality in Brazil: a nationwide time-series study

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BACKGROUND AND AIM: This is the first study to explore the association between ambient air pollution (PM2.5, O3, and NO2) and cardiorespiratory mortality across different population groups by sex and age in Brazil using a nationwide death record from 2003 to 2017.

METHOD: We used a time-series analysis with a distributed lag model to assess this association. Our study population includes 2,872,084 death records in Brazil.

RESULTS:Our results suggest association between air pollution and mortality in Brazil. The associations vary significantly by region, type of air pollutant, and population group. We found that the older population (> 65 years) was most affected, with men having a higher proportion of deaths. The national meta-analysis for the whole population showed that for every 10µg/m3 increase in PM2.5 concentration, there was a 2.93% (95%CI: 1.42; 4.43) increase in the risk of death from respiratory diseases. For every 10ppb increase in O3, there is a 2.21% (95%CI: 0.59; 3.83) increase in the risk of all-cause mortality for the age group of 46-65 years old, and a 3.53% (95%CI: 0.34; 6.72) increase in the risk of circulatory mortality for women of all ages. For every 10ppb increase in NO2, the risk of respiratory mortality increases by 17.56% (95%CI: 4.44; 30.64) and the risk of all-cause mortality by 5.63% (95%CI: 1.83; 9.44).

CONCLUSIONS: These results provide epidemiological evidence that air pollution poses a higher risk of cardiorespiratory mortality in Brazil. This study's findings are critical for policymakers as there is a lack of nationwide studies on air pollution in Brazil.

Keywords: Air pollution, Cardiovascular diseases, Respiratory outcomes, Mortality

Climate Change Adaptation: Exploring the Risk of Acute Myocardial Infarction in Hot Climate Naïve Population Immigrating to Hot Climate Country

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BACKGROUND AND AIM:During the last three decades Israel, a hot climate country, absorbed a wave of immigration from global North (mainly USSR) comprising 10% of the country population. This study aimed to investigate the adaptation to the increased temperature exposure and the risk of acute myocardial infarction (MI), focusing on this hot climate naïve population.

METHOD: We identified all MI cases that were hospitalized between 2000 and 2018 at a 1300-beds tertiary hospital serving a population of 800,000. Temperature exposure was determined using data from monitoring stations. We analyzed events occurring during the summer, when increased temperature is expected to have an adverse effect on health. Study population was divided into groups: immigrants, and Israel-born populations of Jewish and Bedouin-Arab ethnicities. The analysis was conducted in a case-crossover design. Exposure was measured as interquartile range increase in ambient temperature. Risk estimates were retrieved using conditional logistic regression. RESULTS:A total of 1,285 MI events were included in the analysis. Increased risk of MI was positively associated with exposure to elevated temperatures on the day of the event in all populations: immigrants (OR 1.03 [95% CI 0.9-1.16]), Jewish Israeli-born (OR 1.11 [95% CI 1.03-1.19]), and Bedouin-Arab Israeli-born (OR 1.08 [95% CI 0.90-1.30]). Recent (\leq 5 years) immigration was associated with higher effect compared to an earlier one: OR 1.13 [95% CI 0.55-2.30] and 1.03 [95% CI 0.91-1.16], respectively.

CONCLUSIONS: Exposure to higher temperatures during the summer is associated with an increased risk of MI. Furthermore, our results provide support for the adaptation theory by showing an increased sensitivity to elevated temperatures in hot climate naïve population.

Keywords: environmental epidemiology, short-term exposure, cardiovascular diseases, outcomes

Non-optimum temperatures and productivityadjusted life years lost in Brazil: a nationwide time-series study

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BACKGROUND AND AIM:Non-optimal temperatures are associated with premature deaths globally. However, the evidence is limited in low- and middle-income countries, and the productivity losses due to non-optimal temperatures have not been quantified. In this study, we aimed to estimate the workrelated impacts and economic losses attributable to non-optimal temperatures in Brazil. METHOD:We collected daily mortality data from 510 immediate regions in Brazil during 2000 and

2019. A two-stage time-series analysis was applied to evaluate the association between non-optimum temperatures and the Productivity-Adjusted Life-Years (PALYs) lost. The temperature-PALYs association was fitted for each location in the first stage and then we applied meta-analyses to obtain the national estimations. The attributable fraction (AF) of PALY lost due to ambient temperatures and the corresponding economic costs were calculated for different subgroups of the working-age population.

RESULTS:A total of 3,629,661 of PALYs lost were attributed to non-optimal temperatures during 2000–2019 in Brazil, corresponding to 2.90% (95% CI: 1.82%, 3.95%) of the total PALYs lost. Non-optimal temperatures have led to US\$104.86 (95% CI: 65.95, 142.70) billion of economic costs related to PALYs lost and the economic burden was more substantial in males and the population aged 15–44 years. Higher risks of extreme cold temperatures were observed in the South region in Brazil while extreme hot temperatures were observed in the Central West and Northeast regions. CONCLUSIONS:Non-optimal temperatures are associated with considerable labour losses as well as economic costs in Brazil. Tailored policies and adaptation strategies should be proposed to mitigate the impacts of non-optimal temperatures on the labour supply in a changing climate.

Keywords: temperature, mortality, climate, short-term exposure

Comparing the effect of different temperature indicators on mortality and hospital admissions in the Asian subtropical city of Hong Kong

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BACKGROUND AND AIM:Different temperature indicators may demonstrate different patterns of association with adverse health outcomes. It is important to identify suitable indicators for evidencebuilding and potential use in heat-health warning systems. The purpose of this study was to compare the associations of maximum, mean, and minimum temperatures on mortality and hospital admissions in the Asian subtropical city of Hong Kong.

METHOD: Meteorological, mortality, and hospital admissions data was obtained for Hong Kong, 2010-2019 hot seasons. Maximum, mean, and minimum temperatures were examined for their associations with mortality and hospital admissions using a combination of Generalized Additive Models (GAM) and Distributed Lag Non-linear Models (DLNM).

RESULTS: While maximum temperatures were not found significantly associated, mean and minimum temperatures were significantly associated with non-cancer mortality and hospital admission outcomes in Hong Kong. Particularly, minimum temperatures were more sensitive to the acute effects of hospital admissions. The associations were statistically significant mainly among older adults aged 65 and above, with only a slight variation when using higher age cut-offs.

CONCLUSIONS:Our study identified that mean and minimum temperatures were strong indicators in the highly dense subtropical city of Hong Kong. The study findings also suggest the potential protective effect of currently implemented hot weather warnings on maximum temperatures. This study was novel to comprehensively examine the effect of different temperature indicators on both mortality and hospital admissions in an Asian city, and simultaneously assess multiple age cut-offs and outcomes. With increased temperature variability due to climate change, the study findings can be used to support continued development of heat-health warning systems and other climate adaptation efforts.

Keywords: Temperature extremes and variability, Mortality, Epidemiology, Public health, Modeling

Association between heatstroke incidence and wet bulb globe temperature in Japan according to regionality and location of occurrence

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BACKGROUND AND AIM: Heatstroke has become a serious issue in Japan. It is important to understand regionality in the location of heatstroke occurrence in order to plan effective adaptation measures. This study analyzed the association between heatstroke incidence and daily maximum wet bulb globe temperature (WBGT) for the 47 prefectures in Japan according to location of occurrence. METHOD: The data on the number of heatstroke patients transported by ambulance was provided by the Fire and Disaster Management Agency, and the daily maximum WBGT data was provided by the Ministry of the Environment. The locations of occurrence considered were residences, workplaces 1 (such as factories), workplaces 2 (such as farms), educational institutions, public areas 1 (indoors), public areas 2 (outdoors), and roads. The study period was from May to September, 2015 to 2019. A distributed lag non-linear model was adopted to analyze the association between the number of patients and daily maximum WBGT, controlling for the day of the week, holidays, long-term trend, and considering lags. Next, the relative risk (RR30) at a daily maximum WBGT of 30 °C relative to WBGT threshold (at which patients began to increase) were evaluated. Finally, the correlation between the regional climate (average daily maximum WBGT during study period) and RR30 were analyzed. RESULTS: Except for workplaces 1, the correlation (regression line) between the regional climate and RR30 showed a negative trend (the higher the regional climate, the lower the RR30). The slope of the regression line and R^2 value varied from location to location. It is considered that the larger the regional difference (the larger the slope of the regression line), the greater the difference in the amount of adaption measures required to reduce the number of patients. CONCLUSIONS: Regional differences were observed in the location of heatstroke incidence. The implementation of adaptation measures that considers these differences is required.

Keywords: Climate, Temperature, Risk assessment, Environmental epidemiology

A mixed-methods systematic review: extreme events and gender-based violence

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BACKGROUND AND AIM:Due to antroprogenic climate change, the intensity and frequency of extreme weather and climate events are expected to increase. Left unabated this results in profound negative human and ecosystem impacts. This systematic review explores extreme events and one of the more overshadowed consequences: gender-based violence (GBV) experienced by women, girls, and sexual and gender minorities.

METHOD:Ten databases were searched from inception up to February, 2022 without language restriction. Grey literature was searched using the websites of key organisations working on GBV and Google. Quantitative studies were described narratively, whereas qualitative studies underwent thematic analysis.

RESULTS:26,381 records were identified. After de-duplication,16,257 records were screened by title and abstract and 192 in full-text. 41 studies were included exploring several types of extreme events (storms, floods, droughts, heatwaves, and wildfires) and GBV (sexual violence and harassment, physical violence, witch killing, early or forced marriage, and emotional violence). Only one study included sexual and gender minorities. Most studies showed an increase in one or several GBV forms during or after extreme events, often related to economic instability, food insecurity, mental stress, disrupted infrastructure, increased exposure to men, tradition, and exacerbated gender inequality. Importantly, the experience of GBV during and after extreme events seems to be a shared experience in most contexts studied, suggesting that amplification of GBV is not constrained geographically. CONCLUSIONS:Overall, whilst considering the limitations of available data, the results suggest that extreme events may be associated with GBV. These findings could have important implications for sexual-transformative and gender-transformative interventions, policies, and implementation. Given the anticipated acceleration of weather and climate shocks, further high-quality quantitative and qualitative research with ethnographically diverse, longitudinal cohorts comparing changes in GBV levels before, during, and after an event is imperative. **Keywords:** climate change, extreme events, gender-based violence, systematic review

Heat stress and associated mortality risk in varied climate zones of India

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BACKGROUND AND AIM: Heat stress is associated with mortality, morbidity, and economic losses. India is at high risk, given the tropical climate, expanding population and limited adaptive capacity. Yet, studies on the health impacts of heat stress across varied climate zones of India are missing. In this study, we examine heat stress related health impacts in India using long range meteorological data from ERA5 (1979-2020) and developing climate-zone specific percentile-based human comfort class thresholds.

METHOD: We examine the association of heat stress, captured as India specific Heat Index (IHI), with daily all-cause mortality in three cities: Delhi (semi-arid), Varanasi (humid subtropical), and Chennai (tropical wet and dry), using a semi-parametric quasi-Poisson regression model, adjusted for nonlinear confounders, time and PM2.5.

RESULTS:We find that heat stress is highest during heatwave days. The non heat wave days are not completely free from heat stress related health impact. The all-cause mortality risk on sweltering days (high heat stress days) as compared to comfortable days is 8.1% (95% confidence interval, CI: 6.0-10.3), 5.9% (4.6-7.2), and 8.0% (1.7-14.2) 34 during 'sweltering' days in Varanasi, Delhi, and Chennai, respectively. Females are at higher risk of mortality due to heat stress than males in Chennai, while the gender difference is not found in the other two cities. The impact is more severe in Varanasi (ranging from a 3.2-7.5% increase in mortality risk per unit rise in heat stress) than in Delhi (2.6-4.2% higher risk) and Chennai (0.9-5.7% higher risk).

CONCLUSIONS: The study highlights heat stress induced health risks in India vary by climate zones. Our findings underline the need for regional thermal stress alerts and early warning systems.

Keywords: Heatwave, Heat stress, Mortality, India Heat Index, Human Comfort

The impact of high ambient temperature on child health outcomes: a systematic review and metaanalysis

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BACKGROUND AND AIM:Increased ambient temperatures and extreme heat events are wellestablished risk factors for increased human mortality and morbidity rates. Most studies to date have focused on adult age groups. However, the paediatric population has an established vulnerability to illness or mortality in increased temperatures. This is likely due to a combination of physiological and social vulnerabilities characteristic of children. This presentation will summarise the literature and present the findings of a systematic review and meta-analysis on increased heat and childhood health globally

METHOD:A literature search was carried out of three scientific databases: Pubmed, Embase, and Web of Science. Articles were identified which used an increased heat metric (either incremental temperature increase or heatwave) as an exposure, and included a paediatric population. This included studies limited to children, or studies reporting data from all ages with effects reported by age groups, one of which included children. The data was pooled and summarised in statistical meta-analysis, and presented as relative risk (RR) scores.

RESULTS:There is evidence that increased heat increases all-cause mortality in the paediatric population. Increased heat is a risk factor for morbidity throughout the childhood years, from increased rates of preterm birth, to increased adolescent mental health presentations. There is evidence that heat increases the risk of respiratory, nutritional, heat illness, renal disease, mental health, and infectious diseases in children. The majority of studies which quantified the relationship between increased heat and illness did not separate children from adults in statistical analyses. CONCLUSIONS:There is a substantial body of evidence demonstrating that children have higher rates of morbidity and mortality as a result of higher than usual; temperatures. It will be argued that further research is required into the effects of global warming on child health, and that researchers should consider subgroup analyses of children in wider population studies.

Keywords: Children's environmental health, Temperature extremes and variability

School building energy efficiency and health: Modelling childhood asthma and hospital admissions in England and Wales

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BACKGROUND AND AIM:Recent evidence has emphasized the importance of the school indoor environment for childhood asthma. We assessed how different strategies for improving the energy efficiency of school buildings in England and Wales may affect asthma incidence and healthcare utilization costs in the future.

METHOD:Changes in internal nitrogen dioxide (NO2) were modelled inside school buildings covering 13 climate regions in England and Wales under four energy efficiency interventions consisting of combinations of retrofit and operational indoor environmental quality strategies. We developed a health impact assessment model to quantify the resulting burden of childhood asthma incidence in each region using regional asthma incidence and county based-population data with exposureresponse functions from a recent high quality systematic review/meta-analysis. We compared the effects of each energy efficiency on asthma incidence and associated hospitalisation costs. RESULTS:The Thames Valley region (including London) had the highest NO2 levels and childhood asthma incidence, particularly in older school buildings, whereas the newest schools in Wales had the lowest concentrations and health burdens. Asthma incidence decreases with age, with primary school children nearly twice as likely to develop asthma as secondary school children. Two interventions including only operational improvement or a combination of both operational and retrofit strategies resulted in reductions in childhood asthma incidence (547 and 676 per annum average of 13 regions, respectively) and hospital utilization costs (£52,050 and £64,310 per annum average of 13 regions, respectively).

CONCLUSIONS:Our results demonstrate that increasing the energy efficiency of school buildings can reduce NO2 exposure, childhood asthma incidence and healthcare costs providing it is accompanied by measures to improve indoor environmental quality. The findings from this study make several contributions to fill the knowledge gap about the impact of retrofitting schools on exposure to air pollutants and their effects on children's health.

Keywords: Air pollution, asthma, built environment, children's environmental health, modelling

Attributable risk of household solid fuel use and second-hand smoke associated with under-5 mortality in 46 low- and lower-middle-income countries

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BACKGROUND AND AIM: Household solid fuel use (including indoor and outdoor) and second-hand smoke (SHS) are considered to be major contributors of under-5 mortality (U5M) in low- and lower-middle-income countries (LMICs). This study provides a comprehensive assessment of their odds ratios and attributable mortality in LMICs.

METHOD: We used the Demographic Health Surveys data for under-5 children in 46 LMICs (n = 778,532) from 2010 to 2020. Mixed effect multilevel logistic regressions were conducted to estimate the pooled adjusted odds ratio (aOR) for U5M due to solid fuel use, SHS and their combination compared to no exposure to them in 46 LMICs. The attributable mortality of solid fuel use, SHS, and their combination were assessed for each LMIC.

RESULTS:The pooled aOR of solid fuel use and SHS for U5M was estimated to be 1.27 (95% Confidence Interval (CI): 1.19–1.36) and 1.13 (95%CI: 1.06–1.25),respectively, whereas those of their combination was 1.40 (95%CI: 1.31–1.50). U5M attributable to indoor and outdoor solid fuel use was the highest in Myanmar(18.0%) and the Gambia (16.5%), respectively, while those attributable to SHS was the highest in Indonesia (9.8%). U5M attributable to the combination of solid fuel use and SHS was the highest in Timor-Leste (22.7%).

CONCLUSIONS: The combined effect of exposure to solid fuel and SHS had a higher risk of U5M than the individual risk. The use of clean fuel and tobacco control measures should be integrated with other child health promotion policies.

Keywords: household air pollution, solid fuel use, second-hand smoke, under-5 mortality, low- and lower-middle-income countries

The effect of geography, ambient air pollution and seasonality on placental-related adverse outcomes in regions of Mozambique, India, and Pakistan

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BACKGROUND AND AIM: Ambient air pollution, precipitation, and temperature influence maternal health outcomes. However, there is limited knowledge regarding the specificity of effect of these exposures on placental-related outcomes. The study sought to understand the role of seasonal variation in the effects of ambient air pollution, precipitation, and temperature on birth outcome responses in the Community Level Interventions for Preeclampsia (CLIP) trials (Mozambique, India, and Pakistan).

METHOD: This analysis used cross-linked CLIP health outcome data retrofitted to either openly sourced or modelled average monthly exposure estimates. We employed spatio-temporal statistical analysis on 14,931, 25,786 and 28,685 de-identified pregnant women (2013 – 2018), with mappable residences in Mozambique, India, and Pakistan respectively. Additional sensitivity analyses were performed accounting for pre-pregnancy exposure effects.

RESULTS: Geographically consistent weak, but significant, seasonal environmental exposure effects on placenta-related adverse maternal health were observed. Exposure-response relationships differed

mostly in peak exposure effect timings. Cycles of exposure effects on health endpoints did not perfectly follow defined meteorological seasons. Seasonal responses pre-pregnancy exhibited higher effect responses compared with corresponding exposures during pregnancy. CONCLUSIONS:Non-conformity of seasonality responses to defined meteorological patterns emphasizes underestimated geographical influences on in-built physiologies. We challenge seasonality definitions presented to date, as a static and time-bound response to wet and dry conditions. Seasonality ought to be viewed through dynamic and spatially inclined lenses. Weak seasonal responses reported potentially reflect data quality and/or spatial resolutions in openly sourced allpurpose repositories. Improving locational exposure characterization through personal monitoring will further the understanding of why locational differences exist in exposome geographies.

Keywords: seasonality of outcomes, spatial effect, environment, placenta-related maternity outcomes.

Reference Intervals for Clinical Biochemical Tests and Hormones in Cord Blood from Taiwanese Newborn - TMICS Cohort

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BACKGROUND AND AIM: Very few studies have established the reference intervals in cord blood. This study aimed to create biochemical analyte reference levels for cord blood from newborns of Taiwan Maternal and Infant Cohort Study participants (TMICS).

METHOD:2,136 pregnant women receiving regular routine prenatal health assessments in their third trimester (weeks 29-40) were recruited from nine hospitals in Taiwan between October 2012 and May 2015. After exclusion, we were left with 580 cord blood samples to include in this study.

RESULTS:Cord blood thyroid-stimulating hormone was higher in males than females (p<0.05). Males also had significantly higher sex hormone levels (estradiol, follicle-stimulating hormone, and sex hormone-binding globulin), while females had higher levels of luteinizing hormone. Male newborns had higher cord blood immunoglobulin E (IgE), while females had higher insulin-like growth factor-1 (IGF-1) levels. We found a slight positive link between maternal blood and cord blood in thyroid hormones and sex hormones.

CONCLUSIONS: This study found gender differences in cord blood thyroid hormone, sex hormone, IGF-1, and IgE levels and a link between maternal blood levels of thyroid and sex hormones and those in the cord blood of their infants. The establishment of reference values can be used as important points of reference for studies investigating the relationships between the concentrations of the analytes and human development in the clinic.

Keywords: Reference intervals, cord blood, hormones, sex differences, Taiwan Maternal and Infant Cohort Study

Postnatal Metal Exposure and Decreased Kidney Function in Children – a 17 Years Followed Birth Cohort Study

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BACKGROUND AND AIM: The global burden of chronic kidney disease increased in past decades, and the environmental factors may contribute significantly to the pathogenesis of chronic kidney disease. The nephrotoxicity from exposure to metals had been reported in occupational population or general adults, but the evidence for the long term and cumulative effects on young population remains lack. Our purpose is to investigate the association between metal exposure and kidney function from childhood to adolescence.

METHOD: We studied 159 children from a mother-infant paired birth cohort by 6 follow-up interviews and examinations at ages of approximately 2, 5, 8, 11, 14, and 17 years. The structural questionnaires, blood and urinary specimens were collected from participants during follow-up periods. We quantified the concentration of urinary chromium, nickel, arsenic, cadmium, thallium, and lead by inductively coupled plasma dynamic reaction cell mass spectrophotometry. The glomerular filtration rate in children was estimated through the CKD-EPI40 equation with age-adjusted creatinine values, and we also used age- and sex-dependent Schwartz Equations to validate our observation. RESULTS:After adjustment for sex, household income, blood pressure and environmental tobacco smoke at childhood in the model, increased urinary chromium significantly associated with declined kidney function in children ($\beta = -1.59$, p < 0.01). Similarly, urinary arsenic, cadmium, thallium and lead had negative association with kidney function (β from -1.71 to -3.02). By using Schwartz Equations for estimated kidney function, we observed similar results in exposure to chromium, arsenic, cadmium, thallium and lead (β from -0.94 to -2.91).

CONCLUSIONS: From this birth cohort study, we observed childhood and adolescence exposure to metals may associate with declined kidney function, and this scenario may have sex difference. Future work is needed to consider the co-exposure of potentially nephrotoxicity chemicals.

Keywords: Children's environmental health, Environmental epidemiology, Heavy metals, Long-term exposure

Interdiary Temperature Variation and Children Asthma Cases in Lima, Peru, 2010-2016

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BACKGROUND AND AIM:Asthma is the most prevalent respiratory disease in children under 5-yearsold. Although its etiology is not known, ambient temperature has been associated with the appearance of cases, specially low temperatures. Nonetheless, short term variations, such as inter-day temperature variation may trigger asthma episodes due to alterations in the airway tissue. For this reason, the aim of the study was to evaluate the association between inter-day temperature variation or nocturnal temperature range in children daily asthma cases in Lima from 2010-2016. METHOD:Ecological panel time series study in which daily asthma cases for children <5-years-old for the different districts of Lima were obtained from Peru's CDC. Daily mean (Tprom), maximum (Tmax) and minimum (Tmin) temperature, and relative humidity were downloaded from NASA POWER platform (grid resolution 0.5° x 0.625°). Inter-day variation or Nocturnal Temperature Range (NTR) was calculated as the difference between present-day Tmin and previous-day Tmax (Tminn-Tmaxn-1). Seasonal ARIMA models were evaluated for the ambient variables. General Linear Mixed Models of negative binomial family were employed to evaluate the association between asthma daily cases and NTR at lag 0-7 days. Additionally, Tprom was evaluated as an interaction factor to assess if the effect of NTR is modified.

RESULTS:Nocturnal Temperature Range increased the risk of daily asthma cases in 3% for every increase of 1°C (aRR 1.03, 95%CI 1.02 – 1.04, p<0.001) at lag 0. This association was also found for lags 1 – 7, being higher for lags 2 and 6 with an aRR=1.05 (95% CI 1.04 – 1.06 and 1.05 – 1.06, respectively). Mean daily temperature was not found to be an effect modifier in the association. CONCLUSIONS:A higher drop of temperature during the night increases the number of asthma cases in children under 5-years-old. The mechanism of this, such as inflammation of respiratory tissue should be further explored.

Keywords: Asthma, Temperature variability, Children's environmental health

Asthma hospitalisations and heat exposure in England: A case-crossover study during 2002-2019

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BACKGROUND AND AIM:Previous studies have reported evidence of an association between heat exposure and asthma hospitalisation. The focus has been on sex- and age-related vulnerabilities, nevertheless little is known about how this effect has changed over time and how it varies in space. In this nationwide study in England, we aim to estimate the effect of temperature on asthma hospital admissions and investigate vulnerabilities by age, sex, time, and space.

METHOD:Individual-level data on summer asthma hospitalisation at high temporal (daily) and spatial (postcodes) resolution during 2002-2019 in England was available from NHS Digital. The main exposure was defined as mean temperature over the 0-3 days lag and was retrieved at 1km x 1km resolution from the UK Met Office. We fitted Bayesian hierarchal Poisson models within a case-cross over study design and accounted for possible confounders including rainfall, relative humidity, wind speed and national holidays.

RESULTS:We report an increase of 1.13 (95% Credible Interval: 0.92% to 1.34%) and 1.11% (0.88% to 1.34%) in the asthma hospitalisation risk for every 1oC increase in the ambient summer temperature in the unadjusted and fully adjusted models respectively. The effect was highest for males aged 16-64 (2.10%, 1.59% to 2.61%). We found evidence of a decreasing linear trend of the effect over time. Populations in Yorkshire and the Humber and East and West Midlands were the most vulnerable.

CONCLUSIONS: This study provides evidence of an association between warm temperature and hospital admission for asthma. The effect has decreased over time with potential explanations including temporal differences in patterns of heat exposure, adaptive mechanisms, asthma management, lifestyle, comorbidities, and occupation.

Keywords: temperature, asthma, hospital admissions, extreme heat

Health risks of temperature variability on hospital admissions in Cape Town, 2011-2016

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BACKGROUND AND AIM: In developed countries, epidemiological studies provided evidence of associations between temperature variability (TV) and health outcomes. However, such studies are lacking in developing countries. This study aimed to investigate the association between TV and hospital admissions for cardiovascular diseases (CVD) and respiratory diseases (RD) in Cape Town, South Africa.

METHOD:Daily counts of CVD and RD hospitalisation data (1 January 2011 to 31 October 2016) were obtained from seven hospitals. Hourly temperature, relative humidity and air pollution data were sourced from the South African Weather Service. A time-series epidemiological study design was applied along with quasi-Poisson regression models, which adjusted for seasonal trends, daily mean temperature, relative humidity and air pollution. TV is calculated as a composite of intraday and interday variability using the minimum and maximum temperatures. Lag0-1 to lag0-7 of TV were investigated as well as vulnerability by age (all ages combined, 0-14 years, 15-64 years, and ≥ 65 years) and sex.

RESULTS: For the entire study group, the highest increase in CVD hospitalisations (2.84% 95% CI: 1.44% to 4.27%) was observed at 0-5 exposure days and at 0-1 days for RD hospitalisations (2.79% 95% CI: 1.44% to 4.17%). The elderly and the 15-64 year old group were more at risk for RD and CVD hospitalisation, respectively. Men were more at risk for RD and CVD disease hospitalisation than females.

CONCLUSIONS: The results indicate that more attention should be paid to the effects of TV and change on human health in Cape Town. Furthermore, different weather and climate metrics, such as TV, should be considered in understanding the climate component of the epidemiology of these (and other diseases), especially in the light of climate change, where a wider range and extreme climate events are expected to occur in future.

Keywords: Health risks, temperature variability, hospital admissions, South Africa

Ambient Temperature and Heat Index Exposures in Relation to Epigenetic Aging among Participants in Taiwan Biobank

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BACKGROUND AND AIM:Due to climate change, many people, including people in Taiwan, have been exposed to increasing ambient temperature and decreasing temperature variations. Increasing ambient temperature has been reported to link with biological aging in a prenatal study. However, little is known about how biological age in the general adult population was affected by high ambient temperature. DNA methylation age was developed to evaluate biological aging. We aimed to investigate the effects of ambient temperature, heat index (HI), and diurnal temperature range (DTR) in relation to DNA methylation age acceleration in Taiwan Biobank, a general adult population in Taiwan.

METHOD: This study included 2,084 participants recruited in Taiwan from 2008 to 2016. Meteorological data were obtained from Taiwan's Central Weather Bureau. Ordinary kriging was used to estimate individual exposures. Moving averages were calculated from 1 to 365 days before enrollments. The Horvath, Hannum, Weidner, *ELOVL2*, *FHL2*, and phenotypic DNA methylation age were computed from blood genome-wide DNA methylation profiles measured by Infinium MethylationEPIC BeadChip. Age acceleration was the difference between DNA methylation age and chronological age. We used multivariable linear regression model to study age acceleration in relation to ambient temperature, HI, and DTR exposures in multiple exposure windows.

RESULTS: Exposure to high ambient temperature and high HI in the 90- and 180-day exposure windows were associated with a 21 to 38 days increase in age acceleration, whereas low DTR was associated with a 92 to 230 days increase in age acceleration. Increasing days of extreme temperature were also associated with increased age accelerations.

CONCLUSIONS: Climate change could accelerate biological aging. Accompanying the effects of globalwise population aging trends and urban warming, the threats of climate change to human health may exacerbate in the future.

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Keywords: Environmental epidemiology, Climate, Temperature
Air pollution, temperature, and social stressors in pediatric seizures and epilepsy: A Structural Equation Modeling approach

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BACKGROUND AND AIM: Air pollution, temperature, and social stressors are linked to multiple neurological disorders, but research on seizures and epilepsy is scarce. Using covariance-based structural equation modeling (CBSEM), we examined the effects of multiple pollutants, temperature, and social stressors on seizures and epilepsy among children (0-4 years) in New York City. METHOD: Data on seizure and epilepsy cases (n = 28,385), presented at NYC emergency departments (EDs) from 2005 to 2011 were obtained from New York Statewide Planning and Research Cooperative System. Age-standardized annual ED visit rates were assigned to each census tract. Tract-level annual average concentrations of PM2.5, NO2, SO2, O3, and minimum temperature (Tmin) were assigned using NYC Community Air Survey spatial data and U.S. EPA and NOAA temporal data. Point-level NYPD crime data were aggregated to create tract-level annual average rates. Tract-level American Community Survey (ACS) 2007-11 estimates of percent poverty, percent not graduated from high school, percent unemployed, median household income, and percent population Hispanic and non-Hispanic Black were assigned. 'Chronic stress' reflected by crime and ACS indicators was modeled as a latent construct in exploratory and confirmatory factor analyses. Pollutants, temperature, and 'chronic stress' were then fitted in a CBSEM as potential predictors of ED visit rates under maximum likelihood estimation.

RESULTS: While PM2.5 was positively associated with ED visit rates [path coefficient = 0.128 (95% CI: 0.069, 0.186)], NO2 was negatively associated [-0.342 (-0.402, -0.283)], and SO2, O3, and Tmin effects were statistically insignificant. Positive association was also observed with 'chronic stress' [0.464 (0.423, 0.505)], with violent crime and felony assault rates explaining most variability [factor loadings = 0.852 and 0.844, respectively]. Also, PM2.5 was positively associated with 'chronic stress', and percent population Hispanic.

CONCLUSIONS: Chronic stress, particularly from neighborhood crime, and PM2.5 exposures may be associated with pediatric seizure and epilepsy risk.

Keywords: Air pollution, Temperature, Non-chemical stressors, Children's environmental health, Environmental epidemiology

Short-term association between ambient temperature and renal disease mortality in Japan from 1979 to 2019: a time-stratified case-crossover analysis

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BACKGROUND AND AIM:Renal diseases are sensitive to extreme ambient temperatures. However, existing findings on the association between renal disease-related mortality and temperature were mostly limited to the summer season. Changes of this association over time are also not well understood. This study aims to examine the association between daily temperatures and renal disease mortality in 47 prefectures of Japan from 1979 to 2019.

METHOD: We collected daily average temperature and mortality due to renal diseases (ICD-10: N00-N39), acute renal injury (N17) and chronic renal diseases (N18). A two-stage analysis based on a time-stratified case-crossover study design was performed. First, we applied a distributed lag nonlinear model with quasi-Poisson regression to examine the associations between daily mortality and temperature in each prefecture. Meta-analytical approach was used to combine the estimated associations across prefectures. Heat and cold effects were defined as the risk of mortality at 97.5th and 2.5th percentiles of mean temperature compared to the risk at the minimum mortality temperature percentile. We conducted additional analyses stratified by subperiods(1979-1988 and 2009-2018), sex and age groups(0-64,65-84,and \geq 85 years).

RESULTS:We analyzed a total of 997,590 renal deaths over 41 years period in Japan. Low temperatures were associated with mortality due to renal diseases with a relative risk(RR) of 1.34 (95% CI 1.29-1.40). A similar association was observed for chronic renal disease [RR=1.33(95% CI 1.24-1.43)], and acute renal injury [RR=1.51(95% CI 1.33-1.71)]. Subperiod analysis showed that risks for high temperatures declined over time for mortality due to all renal and chronic renal disease. Similar cold risk was observed for all subgroups except for the 0-64 age groups.

CONCLUSIONS:Low temperatures may increase the risk of mortality attributable to renal diseases and chronic kidney disease, and the underlying mechanism requires further investigation. The attenuation of risk associated with high temperatures may imply population gradual adaption to heat.

Keywords: Mortality, Outcomes, Temperature, Temperature extremes

The association between prenatal and postnatal ambient temperature and rapid infant weight gain: a population-based cohort study

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BACKGROUND AND AIM:Rapid weight gain during infancy is a risk factor for childhood overweight. Studies have associated prenatal ambient temperature exposure with birthweight and we have previously described an association between ambient temperature during the first year of life and rapid infant weight gain. We aimed to assess the association between prenatal and postnatal ambient temperature and rapid weight gain in infants.

METHOD:Using data from the Israeli network of maternal and child health clinics, we conducted a population-based cohort study that includes 986,088 infants born at term with birthweight \geq 2.5 kg in 2011-2019. We assessed residential weekly mean ambient temperature during pregnancy and the first four postnatal weeks using a high-resolution hybrid spatio-temporal model. Weight gain velocity during infancy was modelled using the SuperImposition by Translation and Rotation (SITAR) method, a mixed-effects nonlinear model specialized for modelling growth curves. Rapid weight gain was defined as the highest tertile of weight gain velocity. We used distributed lag nonlinear models with modified Poisson regression to measure relative risks and 95% confidence intervals. Adjustments were made for socioeconomic status, population group, subdistrict, month and year of birth, and the alternate exposure period – prenatal or postnatal.

RESULTS: We found a positive association between ambient temperature exposure during pregnancy or postnatally and rapid weight gain in infants. Compared with the lowest mean weekly ambient temperature quintile (0.03-15.32°C), exposure to the highest quintile (26.68-37.90°C) throughout the entire pregnancy was associated with a cumulative adjusted relative risk of 1.38 (95% CI 1.30-1.47) for rapid weight gain. The same exposure during the first four postnatal weeks was associated with a cumulative adjusted relative risk of 1.17 (95% CI 1.13-1.21) for the highest quintile compared with the lowest.

CONCLUSIONS: Prenatal or early postnatal exposure to higher ambient temperature are each independently associated with rapid weight gain in Israeli infants.

Keywords: ambient temperature, infant growth, obesity, overweight

Prenatal exposure to PM2.5 constituents and weight growth trajectory from in utero to 3 years: a birth cohort study

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BACKGROUND AND AIM: This study aimed to examine the associations of prenatal exposure to PM2.5 constituents and weight growth trajectory from in utero to three years.

METHOD:The study was embedded in a birth cohort in China, including 16372 mother-child pairs. Prenatal PM2.5 and its constituents' [organic carbon(OC), elementary carbon(EC), ammonium(NH4+), nitrate(NO3-), and sulfate(SO42-)] concentrations were estimated based on maternal residential addresses. Head circumference, abdominal circumference, and femur length were measured by ultrasound examinations at 20-24, 29-32, and 37-41 gestational weeks, and estimated fetal weight (EFW) was calculated according to these indicators. Newborn's birthweight and children's weight at the age of 6 months, 1, 2, and 3 years were measured. Latent class growth modeling was used to identify weight Z-score growth trajectory from in utero to 3 years. Multinomial logistic regression was used to examine the associations of prenatal exposure to PM2.5 constituents with weight Z-score growth trajectories.

RESULTS:Three weight Z-score growth trajectories were identified: normal growth trajectory (26.6% and 17.7% in boys and girls, respectively), faster growth trajectory (63.0% and 66.7%), and accelerated growth trajectory (10.4% and 15.6%). Compared with normal growth trajectory, an interquartile range (IQR) increase in prenatal exposure to PM2.5, OC, EC, NH4+, and SO42- was associated with 1.135 (95%CI:1.050-1.228), 1.239 (95%CI:1.080-1.421), 1.199 (95%CI:1.086-1.324), 1.105 (95%CI:1.035-1.179), and 1.319 (95%CI:1.138-1.529) times higher risk of faster growth trajectory, respectively. Prenatal exposure to PM2.5, OC, EC, NH4+, NO3-, and SO42- was also associated with higher risk of accelerated growth trajectory. The results were robust in sensitivity analysis with inverse probability weighting and excluding preterm birth.

CONCLUSIONS: The study suggested that prenatal exposure to PM2.5 and its constituents was associated with higher risk of faster and accelerated growth trajectory from in utero to 3 years. Public health policy on regulation of harmful PM2.5 constituents should be developed to protect lifelong health,

Keywords: Particle components, Birth outcomes, Public health, Environmental epidemiology

Association of stillbirths and preterm birth with wildfire-specific PM2.5 in Sydney, Australia between 2006 and 2020

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BACKGROUND AND AIM: Exposure to fine particulate matter of less than 2.5 µm (PM2.5) has been associated with a higher rate of stillbirth and preterm birth. PM2.5 from wildfires may have different toxicological effects than non-wildfire PM2.5, and the specific effects of wildfire smoke on birth outcomes are not well understood. We conducted a study in Greater Metropolitan Sydney, Australia (2006-2020) to assess the association between wildfire-specific PM2.5 rates of stillbirth and spontaneous preterm birth. Both overall exposure and trimester-specific exposure periods were evaluated to identify potential sensitive periods.

METHOD:Daily PM2.5 concentrations were estimated using inverse-distance weighting from monitoring station readings. Wildfire days were identified using visual identification via satellite imagery of extreme days (PM2.5 at or above the 95th percentile). Seasonal trend loess decomposition was used to identify 'excess' expected PM2.5 concentrations deemed to be wildfire-specific PM2.5. Cox proportional hazards models were used to estimate the effects of wildfire-specific PM2.5 exposure on stillbirths and preterm births, controlling for potential confounders.

RESULTS:A total of 993,846 births were analysed. Median exposure to wildfire PM2.5 throughout pregnancy was 0.13 μ g/m (interquartile range: 0.04 - 0.31 μ g/m3). A one unit μ g/m3 increase in wildfire-specific PM2.5 was associated with 2.1% (HR: 1.021, 95% CI: 0.979–1.064) increased risk of stillbirth and 0.2% (HR: 1.002, 95% CI: 0.983–1.022) higher risk of preterm birth. Higher exposure during the first and third trimesters was associated with a higher stillbirth hazard (HR: 1.042, 95% CI: 1.006 –1.080 and HR: 1.047, 95% CI: 1.02–1.075, respectively). For preterm births no trimester-specific effect was identified.

CONCLUSIONS: Wildfire-specific PM2.5 exposure during the first and third trimesters was associated with an increased risk of stillbirth. Our findings emphasize the importance of studying potential sensitive periods of exposure. Considering the increasing frequency and intensity of wildfires globally, greater attention should be paid to pregnant women as a vulnerable subpopulation.

Keywords: birth outcomes, particulate matter, survival

Prenatal Exposure to Toxic Air Contaminants and the Risk for Cerebral Palsy

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BACKGROUND AND AIM: Cerebral palsy (CP) is the most common neuromotor disorder in childhood and the causes for most CP cases are unknown. Environmental neurotoxicants, including toxic air contaminants (TACs), can affect fetal neurodevelopment. We conducted a statewide study in California to investigate whether prenatal exposure to TACs is associated with CP in childhood. METHOD: We performed a case-cohort study of 799 CP cases and 147,820 controls selected among singleton births with geocoded maternal residential addresses located within a 5-mile radius around a TACs monitoring station in California. CP diagnostic records were ascertained from the Department of Developmental Services. We focus on 30 TACs (19 volatile organic compounds (VOCs) and 11 metals) selected a priori using the EPA ToxCast. We estimated the Risk Ratio (RR and 95% CI) for CP according to pregnancy- and trimester-averaged exposures to each TAC, adjusting for maternal socioeconomic measures. We used 36-48 months after delivery as a "negative control exposure" period to evaluate uncontrolled confounding. We utilized the quantile-based g-computation to estimate the mixture effects of multiple VOCs or metals.

RESULTS:Per interquartile-range increase of the ambient exposure level of four VOCs (acetaldehyde, acetone, styrene, trichloroethylene) and four metals (antimony, iron, lead, manganese) during pregnancy were associated with 8-19% higher risk for CP. The estimated joint effects from prenatal exposure to the four VOCs as a mixture and CP was RR=1.21, 95% CI: 1.11-1.37, and the four metals RR=1.31, 95% CI: 1.17-1.47. Stronger associations were observed for exposure in the first and second trimesters. No associations were found for VOCs and metals exposures in the negative control period suggesting limited evidence for uncontrolled confounding bias.

CONCLUSIONS: Prenatal exposures to VOCs and metals from ambient air pollutants were associated with CP risk in California. Toxic air pollutants may be a novel environmental risk factor for CP that requires further scrutiny.

Keywords: Air pollution, Neurodevelopmental outcomes, Causal inference, Chemical exposures, Mixtures analysis

Forecasting Particulate Matter (PM10) Using Machine Learning Algorithms in Agadir

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BACKGROUND AND AIM: This study aims to develop a machine learning model to forecast PM10 concentrations in the city of Agadir, Morocco.

METHOD:Long short-term memory (LSTM) neural networks, decision tree, and random forest models were used to forecast PM10 pollution levels for the next time step. LSTM was based on data from 5 previous time steps and decision tree/random forest were based on data from 1 previous time step. Meteorological conditions such as temperature, wind components, and other atmospheric compositions, including PM2.5, were selected as predictors based on the decision tree and random forest models. The models were trained on data from 2015 to 2019 and tested on data from 2020. RESULTS:The LSTM model outperformed traditional models with a mean absolute error (MAE) of 0.0003 μ g/m3, while random forest and decision tree achieved MAEs of 0.0023 μ g/m3 and 0.0032 μ g/m3, respectively, on PM10 concentrations in Agadir, with an average of 0.021845 μ g/m3. CONCLUSIONS:Using past data is important for accurate PM10 forecasting with LSTM models, which can help policymakers take actions to reduce air pollution and protect public health in cities like Agadir and other urban areas.

Keywords: big data, modeling

Identifying moving vehicles in global cities for environmental applications using highresolution satellite imagery and deep learning

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BACKGROUND AND AIM: The global impact of vehicle emissions on air quality, health and climate are considerable, yet traffic data are at best fragmented and at worst non-existent. Therefore, there is an urgent need for a common approach to developing large urban traffic datasets. We aimed to quantify vehicle flow and speed on each road in Barcelona, Spain, using high-resolution satellite imagery and Deep Learning (DL).

METHOD: We trained a DL object detection algorithm (You Only Look Once version 3) to identify vehicles, road by road, in Barcelona (2017-2019), based on high-resolution WorldView-2/-3 satellite imagery (50 cm). Additionally, we developed a novel geospatial method to estimate vehicle speed from satellite images by exploiting the fraction of a second gap between each image capture from the 8 multi-spectral sensors on board the WorldView-2/-3 satellites.

RESULTS:Our best performing vehicle detection model had a precision (percentage of model detections that are correct) of 71% and a recall (percentage of vehicles in the image scene identified by the model) of 72%. The model detected 601,450 vehicles in 10 satellite images across Barcelona, with estimated average speeds of 7km/h on residential roads and 77km/h on motorways. The validation between satellite-vehicle speed estimates and Google Directions API showed good agreement (NMB: 0.1, NMGE: 0.2). The validation between satellite-vehicle flow and traffic counters showed that the satellite method is predicting correct vehicle flow across Barcelona, however there is a lot of variability road by road (NMB: 0.03, NMGE: 0.49).

CONCLUSIONS:High-resolution satellite imagery can be used in object detection to identify vehicles on all roads in cities and vehicle speed can be calculated from satellite multi-spectral sensors. This dataset can be linked to emissions and air pollution models to provide an important dataset for epidemiologists, especially in LMICs where traffic counts and local air pollution measurement is limited.

Keywords: air pollution, exposure assessment-air pollution, big data

Machine learning and GIS-based spatial analysis of cardiovascular disease in South Korea

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BACKGROUND AND AIM: Cardiovascular diseases (CVD) are the leading cause of mortality worldwide, according to the World Health Organization. Thus, it is essential to manage CVD using various factors including air pollution, extreme meteorological conditions, and socioeconomic vulnerability, but it is very difficult as the factors are intricately related to CVD. To solve such a problem, machine learning (ML) can be effective as it can address the nonlinear relationship between multiple data. Recent CVD analysis studies have been conducted using ML techniques at an individual level. However, few studies have been conducted at a neighborhood level, helping identify regional risk factors for CVD. Therefore, this study aimed to examine the relationship between CVD mortality and neighborhood-level factors, including air pollution, weather conditions, and sociodemographic factors, based on ML algorithms in South Korea.

METHOD:Spatial analysis was performed using municipal-level data averaged from 2010 to 2019. Regression-based model (i.e., ElasticNet) and tree-based models (i.e., random forest (RF) and light gradient boosting model (LGBM)) were applied to examine the relationship. A recent explainable AI technique, Shapley Additive exPlanations (SHAP), was adopted to analyze the contributions and interactions of factors in the LGBM.

RESULTS:Nested five-fold cross-validation results showed that tree-based models outperformed the ElasticNet, with a correlation coefficient of 0.85 and an index of agreement of 0.9. The spatial distribution of the LGBM-derived CVD mortality estimated extreme values well, indicating that LGBM was able to simulate hotspots much better than RF. In SHAP analysis, socio-demographic factors mainly contributed to estimating the high CVD mortality, indicating that CVD mortality is significantly affected by social vulnerability compared to air pollutants. In addition, the larger the daily temperature difference and the larger the SO2 concentrations, the higher the estimated mortality. CONCLUSIONS:This ML-based spatial analysis can potentially assist public health decision-makers in establishing CVD-related initiatives considering latent regional risk factors.

Keywords: Big data, Cardiovascular diseases, Spatial statistics, Socio-economic factors, Air pollution

OP-050[Air pollution » Other (to be specified with keywords in the keywords section)]

Ozone forecasting based on new powerful hybrid models: CHIMERE-NARX & CHIMERE-NARX-DWT

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BACKGROUND AND AIM: Taking into account the limitations from which suffers the dynamic air quality modelling, two hybrid models based on CHIMERE-NARX and CHIMERE-NARX-DWT were built. METHOD: two hybrid models based on CHIMERE-NARX and CHIMERE-NARX-DWT were built and validated by observation from collected from the Mediouna station in Casablanca, Morocco, from February 1st to March 27th 2021.

RESULTS:As result, first hybrid successfully increased the correlation coefficient from 88 to 93% and reduced RMSE from 23.99 μ g/m3 to -3.54μ g/m3. The second hybrid successfully balanced the weight of NARX at night against the day, increasing the correlation coefficient to 98% and decreasing RMSE to -0.02μ g/m3.

CONCLUSIONS: This study presents a new generation of post-processing based on deterministic model processes.

Keywords: CHIMERE model, machine learning, hybrid models, Ozone prediction, North Africa

Machine Learning versus Land Use Regression: Fine-scale spatial predictions of on-road air pollution levels in Bengaluru, India

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BACKGROUND AND AIM:Land Use Regression (LUR) is a well-established methodology that uses land use parameters to predict fine spatial scale long-term average pollution levels. With the recent advancements in AI, machine learning models are being applied to make air pollution predictions. The aim of this study is to develop a classical linear model LUR (LM-LUR) and compare its performance against RF-based model's performance in predicting on-road air pollution levels, using the same predictors for both models.

METHOD: The on-road air pollution data was collected using a mobile monitoring approach in Bengaluru, India. The pollutants include the mass concentration of PM2.5, black carbon (BC) and ultrafine particles (UFPs). We collected the on-road pollution data covering a distance of ~400 kilometers, between November 2021 and June 2022. The route consists of a variety of road classes with 12 repeat measurements. After applying the corresponding correction factors, a grid-wise (50-meter length) aggregation was made, and the central tendencies were estimated. Around 8000 gridded on-road concentrations were available for the model training.

For LM-LUR modeling, the European Study of Cohorts for Air Pollution Effects (ESCAPE) methodology was followed. For RF-LUR, hyperparameter tuning was performed using a grid-search approach. The model performances were evaluated based on the hold-out validation method and quantified using the Root Mean Square Error (RMSE) and Normalized RMSE (NRMSE) of the test data set.

RESULTS:RF-LUR model showed better performance for all the pollutants compared to LM-LUR model. An improvement of ~25 to 40% was observed in the RF-LUR test data NRMSE values. The performance of RF-LUR was further quantified based on various configurations of hold-out validation exercises.

CONCLUSIONS: The study shows that RF-LUR outperforms LM-LUR in predicting on-road air pollution levels using the same predictors for both models. The findings highlight the potential of using machine learning models for air pollution predictions.

Keywords: Traffic-related, Particle components, Modeling

Estimation of daily PM2.5 in Korea during 2015-2020 with a high spatial resolution random forest model

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BACKGROUND AND AIM: Estimating daily series of PM2.5 concentrations with high spatial resolution is important to assess the health effects associated with exposure to PM2.5. Despite its importance, there are no studies developing machine learning models to estimate daily PM2.5 with a high spatial resolution.

METHOD: This study used a machine learning model based on random forest algorithm to estimate daily PM2.5 at a resolution of 1 km × 1 km across the contiguous Korea. The model included multiple predictors inclusive of satellite data, meteorological variables, land-use variables, and others. RESULTS: Total number of monitoring stations for PM2.5 were 471 during the period 2015-2020. In the total areas, the random forest model showed a R2 of 0.857, RMSE of 5.544, and MAE of 3.886 for train/valid/test split dataset over the whole study period.

CONCLUSIONS: This study provides the high-resolution daily PM2.5 prediction estimates with excellent performance. Our models can be used to evaluate the more precise health impacts of PM2.5.

Keywords: PM2.5, High spatial resolution, Machine learning model, Republic of Korea

Comparisons of land-use regression with machine learning and microenvironmental exposure models for short-term exposure estimates of PM2.5

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BACKGROUND AND AIM:Air pollution is a major public health concern worldwide, with PM2.5 being one of the most harmful pollutants. The land use regression with machine learning (LUR_ML) and microenvironmental exposure (ME) models have been used to estimate PM2.5 exposure, but their performance in population-based studies is not well-understood. We conducted a study in Taiwan to compare the predictive performance of LUR_ML and ME models.

METHOD: We collected PM2.5 personal sampling and microenvironmental measurements for 53 elderly volunteers across four regions (including urban, sururban, rural, and industrial sites) of Taiwan over four seasons (2016-2018). We used LUR_ML and ME models to estimate daily PM2.5 exposure concentrations and compared their predictive performance. We also conducted personal monitoring, household (indoor and outdoor), and ambient measurements for PM2.5. We validated the model predictions with daily personal concentrations of PM2.5 exposure.

RESULTS:Our results showed that the LUR_ML (R2 = 0.72) and ME (R2 = 0.94) models were highly correlated with ambient PM2.5 concentrations from the air quality monitoring station (AQMS), while both models were moderately correlated (R2 = \sim 0.50) with personal exposure to PM2.5. The LUR_ML model may underestimate personal PM2.5 exposure in daily concentrations. We observed regional variations in the models' predictive performance.

CONCLUSIONS:Our study supports the use of LUR_ML and ME models in specific regions for PM2.5 in epidemiological studies of air pollution.

Keywords: fine particle, prediction model, machine learning, microenvironment, validation

Early life exposure to particulate matter and adult-onset hypertension: investigation of association and effect modification in a US nationwide cohort

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BACKGROUND AND AIM:Long-term exposure to particulate matter (PM) air pollution has been associated with increased risk of cardiovascular disease and hypertension in adults. Early-life exposure during critical windows of development may be essential for future disease onset, especially in vulnerable subpopulations, but few studies have been able to examine this. We investigated the association of childhood PM exposure with adult-onset hypertension, and potential effect modification by demographic characteristics.

METHOD: Study participants were from the Growing Up Today Study (GUTS), two prospective US nationwide cohorts. The cohorts were established in 1996 and 2004 by enrolling children who were then between the ages of 9 and 14 (GUTSI) or 10 and 17 (GUTSII). Follow-up questionnaires have been sent to participants approximately annually. Incident hypertension was identified by self-report on questionnaires. We assessed cumulative average exposure to PM2.5, PM10, and PM2.5-10 at participants' residential address throughout childhood (9-18y). We followed the participants from age 18 until the onset of hypertension, loss to follow-up, or the end of follow-up (year 2021), whichever came first. We applied Cox proportional hazards models adjusted for potential confounders at the individual and area-level. We considered potential effect modification by sex, obesity, region, and family history of hypertension.

RESULTS: Among 18,059 participants, 1,553 hypertension cases were reported during an average follow-up of 12.8 years. Average exposure throughout childhood was $11.9\pm2.9 \ \mu$ g/m3 for PM2.5, $20.5\pm5.4 \ \mu$ g/m3 for PM10, and $7.8\pm4.1 \ \mu$ g/m3 for PM2.5-10. Our results showed no association between childhood PM exposure and adult-onset hypertension (e.g., Hazard Ratio: 1.00, 95% confidence interval 0.92-1.09 per 5 μ g/m3 increase in PM2.5). Suggestive positive associations were observed among females, non-obese participants, residents in Midwest and South, and with family history of hypertension, but, p-values for interactions were all above 0.1.

CONCLUSIONS:Our results did not support an association between early-life PM exposure and adultonset hypertension. Keywords: Air pollution, Particulate matter, Cardiovascular diseases, hypertension

Association of aircraft noise around four major UK airports with subclinical atherosclerosis and hypertension

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BACKGROUND AND AIM: While there is a large body of research on annoyance and sleep disturbance from aircraft noise, there is very limited epidemiological evidence on aircraft noise and cardiovascular disease despite good biological plausibility. The aim of this study was to investigate associations of aircraft noise around four major UK airports (Birmingham, London Heathrow, London Gatwick, and Manchester) with cardiovascular disease risk factors.

METHOD: The UK Biobank cohort recruited 502,651 individuals aged 40-69 years across the UK during 2006-2010, with ~105,000 participants living near the four airports. Modelled annual average aircraft noise in 2006 and 2011 were provided by the Civil Aviation Authority for Lnight (night-time) and Lden (24-hour period with penalty weighting for evening and night noise) metrics. Outcomes were systolic and diastolic blood pressure (S/DBP) readings in clinic, hypertension (doctor-diagnosed, clinic measurement or on medication) and carotid intima-media thickness (cIMT), a biomarker of subclinical atherosclerosis. We used multivariable linear, logistic, and mixed regression models, adjusting for clinical, demographic, socioeconomic, lifestyle, and environmental covariates including nitrogen dioxide (NO2).

RESULTS:Initial results show that associations with measured clinic blood pressure were close to null, but odds of having hypertension were 1.15 times greater (95%CI 1.08, 1.22) for those living in the highest aircraft noise exposure category (Lden>63dB), compared with the lowest (Lden≤51dB). There was a 4.87% (95%CI 2.37, 7.14) increase in mean cIMT, with a larger association in males, for those in the highest noise exposure category compared to the lowest. Similar results were seen for exposure to aircraft Lnight >45 db.

CONCLUSIONS:Daytime and nocturnal exposure to aircraft noise from 4 major UK airports was associated with hypertension and a greater extent of carotid atherosclerotic vascular disease, independent of NO2 air pollution. These findings contribute to evidence suggesting that aircraft noise exposure might be a contributing risk factor for cardiovascular disease.

Keywords: Built environment, Noise, Cardiovascular diseases, Environmental epidemiology

Individual protective measures for air pollution and cardiopulmonary health: A systematic review and meta-analysis

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BACKGROUND AND AIM: Individual protective measures (IPMs) on air pollution are protective against cardiac and pulmonary health, but information on their effectiveness is relatively scarce. In this systematic review and meta-analysis, we investigated the effects of air purifiers, air-purifying respirators, and cook stove changes on cardiopulmonary health outcomes.

METHOD: We searched PubMed, Scopus, and Web of Science from 1st January 1990 - 31st December 2022, 90 articles and 39760 participants were included. Two authors independently searched and selected the studies, extracted information, and assessed each study's quality and risk of bias. We performed meta-analyses when three or more studies were available for each IPMs, with comparable intervention and health outcome.

RESULTS:Systematic review showed that IPMs were beneficial in children and elderly with asthma along with healthy individuals. Meta-analysis results showed a reduction in cardiopulmonary inflammation using air purifiers than in control groups (with sham/no filter) with a decrease in interleukin 6 by $-0.247 \mu g/mL$ (95% confidence intervals [CI] = -0.413, -0.082). A sub-group analysis for air purifier as an IPMs in developing counties reduced fractional exhaled nitric oxide by -0.208 ppb (95% confidence intervals [CI] = -0.394, -0.022). However, evidence describing the effects of air purifying respirator and cook stove changes on cardiopulmonary outcomes remained insufficient. CONCLUSIONS:Air purifiers can aid as an effective IPMs against air pollution. The useful effect of air purifiers is likely to have a greater effect in developing countries than in developed countries.

Keywords: Air pollution interventions, air purifier, air-purifying respirator, cookstove change, cardiopulmonary health

Impact of exposure to ambient PM_{2.5} on the prevalence of hypertension among Women of Reproductive Age in India

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BACKGROUND AND AIM:Air pollution is one of the leading risk factors for cardiovascular disease in developed and developing countries. Exposure to PM_{2.5} increases blood pressure (BP), elevating the risk of hypertension. There is limited epidemiological evidence for the same in low and middle-income countries. This study is conducted to examine whether exposure to PM_{2.5} is associated with hypertension among women of reproductive age (WRA, 15–49 years).

METHOD:The analysis involves health data from the National Family Health Survey-5 (NFHS-5) and satellite-driven PM_{2.5} exposure at 1-km×1-km spatial resolution. Hypertension was defined as systolic BP \geq 140 mmHg and/or diastolic BP \geq 90 mmHg. A logistic regression model was used to estimate the effects of PM_{2.5} on hypertension in WRA, adjusted for confounders such as socioeconomic (SES) indicators, age, smoking, place of residence, education level, and cooking fuel. Further moderating effects of socioeconomic indicators, such as smoking, BMI, education, etc., were explored by multiplicative interaction with PM_{2.5}.

RESULTS:The adjusted odds ratio (OR) of hypertension was estimated at 1.052 (95% CI: 1.047–1.057) for a 10 μ g/m³ increase in ambient PM_{2.5} exposure. Significant moderating effects were observed among smokers, with an OR of 1.11 (95% CI: 1.106–1.165) against an OR of 1.050 (95% CI: 1.045–1.055) for non-smokers. The poorest socioeconomic class was the most susceptible group among all SES classes, with an OR of 1.076 (95% CI: 1.064–1.089). Similar moderating effects were observed for BMI and education level.

CONCLUSIONS: The study found a statistically positive association between ambient $PM_{2.5}$ exposure and hypertension among WRA. The effort will be further extended to study the differential effects of $PM_{2.5}$ constituents on hypertension.

Keywords: Ambient PM2.5, Air pollution, Hypertension, Women

Individual and joint associations of long-term exposure to air pollutants and cardiopulmonary mortality: A 22-year cohort study in Northern China

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BACKGROUND AND AIM: Evidence on the associations between long-term exposure to multiple air pollutants and cardiopulmonary mortality is limited, especially for developing regions with higher pollutant level. We aimed to characterize the individual and joint associations of long-term exposure to air pollutants with cardiopulmonary mortality, and to identify air pollutant that primarily contribute to the mortality risk.

METHOD: We followed 37,442 participants in four cities in northern China from 1998-2019. Annual PM2.5, PM10, SO2 and NO2 were estimated using daily average values from satellite-derived machine learning models and monitoring stations. Time-varying Cox proportional hazards model was used to evaluate the individual association between air pollutants and mortality from non-accidental causes, cardiovascular diseases (CVDs), non-malignant respiratory diseases (RDs) and lung cancer, accounting for demographic and socioeconomic factors. Effect modifications by age, gender, income and education level were also examined. Quantile-based g-Computation was applied to evaluate the co-effects and the relative weight of contributions.

RESULTS:During 785,807 person-years of follow-up, 5,812 (15.5%) died from non-accidental causes, among which 2,932 (7.8%) were from all CVDs, 479 (1.3%) from non-malignant RDs, and 552 (1.4%) from lung cancer. Long-term exposure to PM10 (mean [baseline]: 136.5 μ g/m3), PM2.5 (70.2), SO2 (113.0) and NO2 (39.2) were consistently associated with all mortality outcomes. A monotonically increasing curve with linear or supra-linear shape with no evidence of a threshold was observed for the exposure-response relationship of mortality with individual or joint exposure to air pollutants. PM2.5 consistently contributed most to the elevated mortality risks related to air pollutant mixture, followed by SO2 or PM10.

CONCLUSIONS: There was a strong and positive association of long-term individual and joint exposure to air pollutants with cardiopulmonary mortality in high-exposure settings, with PM2.5 potentially being the main contributor. The shapes of associations were consistent with a linear or supra-linear exposure-response, with no lower threshold observed.

Keywords: Multi-pollutant, Long-term exposure, Mortality, Mixtures analysis

Long-term exposure to ambient ozone and Creactive protein level: a longitudinal cohort study

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BACKGROUND AND AIM:C-reactive protein (CRP) is a biomarker for systematic inflammation and the risk of cardiovascular diseases. Few studies investigated the long-term effect of ozone (O₃) exposure on CRP levels. This study aims to examine the association of chronic exposure to O₃ with CRP in a general population.

METHOD: Participants were adults from the Taiwan MJ cohort and attended regular medical examinations. The concentrations of O₃, particulate matter of diameters $\leq 2.5 \ \mu m (PM_{2.5})$, and nitrogen dioxide (NO₂) were estimated from each participant's address using satellite-based spatial-temporal regression models. The two-year average exposure of the year of medical check-ups and the preceding year was calculated to represent the long-term exposure. High-sensitivity CRP concentrations were measured using overnight fasting blood samples of participants. We excluded observations with CRP higher than 10 mg/L to rule out acute infection. Linear mixed effects models with individual-specific random terms were applied in the analysis. We performed both single-pollutant and multiple-pollutant analyses.

RESULTS: We included 45,705 adults from the cohort between 2006 and 2016. Their median level of CRP was 0.89 (interquartile range: 0.45-1.81) mg/L. In the single-pollutant model, every 10 µg/m³ increment of O₃ was associated with a CRP increase of 4.09% [95% confidence interval (CI): 2.88–5.31%]. After separately adjusting PM_{2.5} or NO₂, CRP ascended by 3.59% (95%CI: 2.39–4.81%) or 6.27% (95%CI: 4.62–7.94%) per 10 µg/m³ of O₃. In the three-pollutant model, O₃ rising 10 µg/m³ elevated CRP level by 4.75% (95%CI: 3.10–6.42%), second only to PM_{2.5} [6.28% (95%CI: 5.07–7.51%)] and outweighing NO₂ [0.73% (95%CI: 0.03–1.44%)].

CONCLUSIONS:Long-term exposure to O_3 was positively associated with CRP level and hence systematic inflammation. This association was consistently prominent using multiple-pollutant models. Further studies are warranted to demonstrate the association of chronic exposure to O_3 with cardiovascular health.

Keywords: Long-term exposure, Multi-pollutant

Is fine particulate matter air pollution or greenness associated with cause-specific mortality in US men diagnosed with prostate cancer?

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BACKGROUND AND AIM:Cardiovascular disease (CVD) and prostate cancer (CaP) mortality are leading causes of death among men with CaP. Higher exposure to fine particulate matter (PM2.5, particles \leq 2.5 µm in aerodynamic diameter) air pollution has been associated with increased CVD mortality in US cancer survivors. Additionally, higher residential vegetation cover (greenness) has been associated with lower CVD mortality. We assessed associations of PM2.5 and greenness with mortality in a registry-based cohort of men diagnosed with CaP.

METHOD:Using data from men with CaP diagnosed from 2000 to 2015 in the California, Louisiana, Massachusetts, New Jersey, Ohio, Pennsylvania, and Seattle-Puget-Sound cancer registries, we estimated hazard ratios and 95% confidence intervals (CI) for CVD and CaP mortality using Cox models. We linked exposures to masked residential addresses at diagnosis: 1) annual averaged PM2.5 from spatiotemporal models (1km resolution) and 2) annual average greenness (30m resolution Normalized Difference Vegetation Index (NDVI) averaged within a 270m circular distance buffer). In multi-exposure (PM2.5 + greenness) models, we used age as the underlying timescale, adjusting for diagnosis period, stage, marital status, a principal components-based neighborhood socioeconomic status index, population density, and an inverse probability weight for competing cause of death. RESULTS:By the end of follow-up (December 31st, 2018), 239,124 of the 795,798 men diagnosed with CaP had died (82,588 CVD deaths; 74,321 CaP deaths). PM2.5 (scaled per 5 μ g/m3) was positively associated with CVD (HR 1.04; 95% CI 1.03, 1.05) but not CaP mortality, whereas greenness (scaled per 0.1 increase in NDVI) was negatively associated with both CVD (HR 0.98; 95% CI 0.98, 0.99) and CaP mortality (HR 0.94; 95% CI 0.93, 0.95).

CONCLUSIONS: In a large registry-based CaP cohort, we showed that long-term exposure to PM2.5 and residential greenness may influence CVD and CaP mortality. Environmental risk factors may contribute to survival differences among men with CaP.

Keywords: Cancer and cancer precursors, Survival, Air pollution, Particulate matter, Green space

OP-061[Built environment » Green space]

Does green space make people move or move away? A relocation analysis of green space and physical activity

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BACKGROUND AND AIM: There is growing evidence to suggest accessible green space improves health outcomes via facilitating physical activity. However, most evidence to date comes from cross-sectional studies and are subject to self-selection bias (e.g., people moving to greener neighbourhoods for opportunities of physical activity). Relocation studies provide a unique opportunity to address several biases in existing literature.

METHOD:Participants from the Australian '45 and Up' cohort of >250,000 persons aged 45 and older were assessed on self-reported physical activity (outcome) and two metrics of residential green space (exposure) at two consecutive time points (mean follow-up time 6.3 years), interacted with relocation between time points. Green space exposure was assessed using the proportion of available parkland from Australian Bureau of Statistics census and annual mean Normalised Difference Vegetation Index (NDVI). Both exposures were assessed within a 1600m Euclidean buffer. Covariates included socioeconomic status, age, follow-up time and sex. Linear regression models were weighted using inverse probability censoring weights to adjust for informative censoring due to attrition. RESULTS:Fifteen percent of participants relocated between baseline and follow-up, with relocation associated with around 30 mins/week higher physical activity at the univariate level. Available parkland was negatively associated with physical activity ($\beta = -5.4$ mins/week, 95% CI -11.0 to 0.2 mins/week)-at follow-up in participants that did not relocate. However, in those who relocated to greener areas, the association was positive, with 5.7 mins/week higher (95% CI: 0.2-11.3 mins/week) physical activity at follow-up for a one percent change in green space proportion. A similar effect was observed for NDVI, though this was smaller and highly variable.

CONCLUSIONS: Those who relocated to greener areas increased their physical activity, while those whose residential area became greener did not. Self-selection bias may thus partially explain the observed positive effect of green space on physical activity in our analysis.

Keywords: Environmental epidemiology, green space, physical activity, relocation

Nature's remedy: uncovering pathways linking greenspace to behavioural problems in Polish children

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BACKGROUND AND AIM:A number of cross-sectional studies have found a beneficial relationship between greenspace and children's behavior. Nevertheless, nearly no research investigated the mechanistic linkages behind the association. Our study ought to examine how the availability of green spaces in Poland is related to behavioural problems among school-aged children, and to determine the significance of nature perception, neighborhood social cohesion, and physical activity in this relationship.

METHOD:Data was obtained from the case-control NeuroSmog study, in which children with and without Attention Deficit Hyperactivity Disorder (ADHD) were enrolled. Analytic sample consisted of 679 children aged 10 to 13 years. Parents reported internalizing, externalizing, and total behavioural problems via the Child Behaviour Check List (CBCL), as well as information about the mediators and domestic garden. Tree and grass cover were extracted in 500m Euclidean buffers around lifelong residences. Structural equation modeling (SEM) was used to examine the psychosocial pathways and their interplay linking the three greenspace metrics to behavioural problems.

RESULTS: We found that greenspace was only indirectly related to less behavioral problems. SEM results revealed that tree cover was related to both physical activity and greenspace perception, and physical activity was subsequently linked to both internalizing and total behavioral problems. Moreover, greenspace perception was associated with neighbourhood cohesion which was then linked to both externalizing and total behavioral problems. When stratified by ADHD status, the pattern in controls was very similar to that of the entire sample except that the associations of tree cover through greenspace perception to externalizing problems and tree cover to greenspace perception to neighborhood cohesion to internalizing problems became significant. Only the association between tree cover and physical activity persisted among ADHD cases.

CONCLUSIONS: Greenspace was associated with less behavioural problems in Polish schoolchildren

through greenspace perception, neighbourhood cohesion, and physical activity. No direct link was observed.

Keywords: Green space, Behavioural problems, Child Behavior Checklist, Children, Mental Health

OP-063[Built environment » Green space]

Place-based directionality of associations between greenness and coronary heart disease

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BACKGROUND AND AIM: Environmental vegetation, or greenness, imparts many distinct benefits to nearby residents and is inversely associated with rates of cardiovascular disease, the primary cause of death worldwide. Yet, little is known about how this association varies among unique intersections of places and populations and there is insufficient evidence to subsequently inform place-based greenness implementation approaches.

METHOD:To evaluate the importance of place in associations between greenness and coronary heart disease (CHD), we classified all 69,076 census tracts of the contiguous United States with complete data into 108 unique intersectional categories of population density, urbanicity, plant hardiness zones, and socioeconomic vulnerability. We utilized linear regression models to assess associations between Normalized Difference Vegetation Index (NDVI) indicator of greenness and CHD prevalence within each place classification while adjusting for age, obesity, smoking, and socioeconomic vulnerability. RESULTS:Nationwide, we observed higher NDVI associated with lower CHD, but large variations when comparing associations within place categories. We observed stronger significant inverse associations, with mean coefficient estimates of -1.68, -0.44, and -0.02, respectively. Contrastingly, we observed positive associations among categories with low socioeconomic vulnerability, within cities, and high population density, with mean coefficient estimates of 1.12, 0.38, and 0.30, respectively. There was substantial variation of association directionality within cities and dense areas, consistent associations among SES groups, and more consistence within hardiness zones than between.

CONCLUSIONS: These results demonstrate the importance of place- and people-based contexts when evaluating links between greenness and health. Importantly, more evidence is needed to understand place-specific associations of both positive and negative influences of greenness to maximize benefits and minimize detriments of future interventions. Place-based understanding of optimal greenness for health co-benefits could leverage billions of dollars spent annually on greenness interventions worldwide to better improve public health impacts.

Keywords: Greenness, CVD, CHD, Geography, Implementation

The association between neighborhood greenness and hospitalization for cardiorespiratory diseases in Brazil

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BACKGROUND AND AIM: The beneficial effects of greenness on human health have been widely documented. However, to date, there are no nationwide studies in Brazil, a country with challenges related to land use planning, deforestation, and a growing burden of diseases due to environmental health risk factors. This study aimed to investigate the association between greenness and hospitalization for cardiorespiratory diseases in Brazil.

METHOD: We accessed hospital admissions data from 967,771 zip codes (total of 26,724,624 admissions) covering Brazil for the period between 2008 and 2018. We used the Normalized Difference Vegetation Index (NDVI) to assess the greenness in each zip code. Five different exposure metrics were used, including the average NDVI within the zip code boundaries and the average NDVI within buffers of 500; 1,000; 1,500; and 2,000m surrounding each zip code. We applied a quasi-Poisson regression model to verify the association between greenness and hospitalizations for circulatory and respiratory diseases, adjusted for air pollution, weather variables, and SES. The analyses were stratified by sex, age group, health outcome, and Brazilian regions. RESULTS:The national meta-analysis for the whole population showed a reduced risk of hospitalizations for circulatory diseases in areas with more green spaces. An IQR increase in average NDVI within the zip code boundaries was associated with 17% (95% CI: 8%, 27%) decrease in cardiovascular admissions. In contrast, we did not find robust associations for respiratory admissions. CONCLUSIONS:Our study highlights the potential health benefits of green spaces in reducing hospitalizations for circulatory diseases in Brazil, emphasizing the importance of policies and interventions that prioritize the preservation and creation of green areas in urban settings.

Keywords: Green space, Cardiovascular diseases, Respiratory outcomes

Brownfield land and health: a systematic review of the literature

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BACKGROUND AND AIM: Brownfield land is vacant or derelict land that was previously used for industrial or commercial purposes. Brownfield land is increasingly being targeted for housing development, however, depending on the previous use and remediation activity, it might pose potential risks to the health of residents on or in the vicinity of redeveloped sites. This systematic review of the literature synthesises the empirical evidence on the associations between brownfield land and health.

METHOD: We systematically searched EMBASE, MEDLINE, Global Health, Web of Science, Scopus and GreenFile using a study protocol registered on PROSPERO (CRD42022286826). The search strategy combined the keywords "brownfield" and its interchangeable terms such as "previously developed land", and any health outcomes such as "respiratory diseases" and "mortality". Publications identified from the search were screened for eligibility by two authors, and data were extracted from the selected articles. Study quality was assessed based on the Newcastle-Ottawa Scale.

RESULTS:Of the 1,987 records retrieved, 6 studies met the inclusion criteria; 5 cross-sectional studies (including 3 small-area analyses) and 1 longitudinal study. There was considerable heterogeneity in the exposure metrics and health outcomes assessed. All studies found significant positive associations between brownfield land proximity or density with at least one health relevant outcome, including self-reported general health, mortality, birth defects, serum metal levels and accelerated immune aging. CONCLUSIONS:Brownfield land may negatively affect the health of nearby residents. The epidemiological evidence on health effects associated with brownfield land in local communities, however, remains inconclusive and limited. Further studies are required to build the evidence base to inform future housing policies and urban planning.

Keywords: Built environment - Other (Brownfields), Chemical exposures, Outcomes, Environmental disparities

The associations of preconception urinary phthalate metabolite concentrations with the serum metabolome and outcomes of infertility treatment

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BACKGROUND AND AIM:Phthalate exposure has been linked with diminished fertility in women. Thus, the objective of our study was to utilize untargeted high-resolution metabolomics to identify serum metabolites and pathways associated with maternal preconception urinary phthalate metabolite concentrations and investigate whether any of these metabolic features or pathways may mediate the association between urinary phthalate metabolites and live birth.

METHOD:Our analysis included 184 women in the Environment and Reproductive Health (EARTH) study that underwent in vitro fertilization at a fertility clinic in New England (2005-2016). On the same day during ovarian stimulation, women provided a serum sample, which was analyzed for metabolomics using liquid chromatography coupled with high-resolution mass spectrometry, and a urine sample, which was analyzed for 11 phthalate metabolites. We used multivariable linear regression models to identified metabolic features associated with urinary phthalate metabolite concentrations and live birth, followed by enriched pathway analysis. We then used a meet in the middle approach to identify overlapping pathways and features

RESULTS:A total of 10,803 and 12,968 metabolic features were detected in the serum in the C18 negative and HILIC positive columns, respectively. Pathway enrichment analysis revealed 50 unique pathways in the C18 negative and HILIC positive columns that were significantly associated with at least one of the 11 urinary phthalate metabolites or molar sum of di-2-ethylhexyl phthalate metabolites. The classes of pathways that were most often associated with urinary phthalate metabolites were lipid metabolism, amino acid metabolism, and oxidative stress. Three pathways-carnitine shuttle, biopterin metabolism, and bile acid biosynthesis- were also identified as being associated with at least one phthalate metabolite and live birth.

CONCLUSIONS:Our study provides insight into the serum metabolites and biological pathways, including lipid and amino acid metabolism and oxidative stress, which may underlie the observed associations between phthalate exposures and lower fertility in women.

Keywords: Phthalates, Endocrine disrupting chemicals, Internal exposome, Female reproductive outcomes, Birth outcomes

OP-067[Chemical exposures » Endocrine disrupting chemicals]

Polycyclic aromatic hydrocarbons and volatile organic compounds negatively affect thyroid function in pregnant women

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BACKGROUND AND AIM: The thyroid-stimulating hormone (TSH) level plays an important role in fetal development and pregnancy outcomes. Polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) are known environmental hazards that cause adverse effect on the reproductive health. This study aimed to confirm the association between the urinary concentrations of PAHs, VOCs, and TSH levels in pregnant women.

METHOD:We analyzed 242 urinary samples of pregnant women from "No Environmental Hazards for Mother-Child pairs" cohort study which was conducted from 2022 to 2023 in Korea. We analyzed four PAHs (1-OHP, 2-NAP, 1-PHE, and 2-FLU) and two VOCs (t, t-MA and BMA) using LC-MS/MS. The TSH levels in pregnant women were measured using blood sampling in the first trimester. The level of TSH was categorized as normal (0.1–2.5 mIU/L) and abnormal (over 2.5 mIU/L).

RESULTS:The detection rate of PAHs (1-OHP, 2-NAP, 1-PHE, and 2-FLU) ranged from 77.3 to 100%, and the geometric mean ranged from 0.049 to 2.388 μ g/g creatinine. The detection rates of VOCs (t, t-MA and BMA) were 99.6 and 99.6%, and the geometric mean levels were 44.298 and 2.816 μ g/g creatinine, respectively. In the univariate logistic regression model, t, t-MA was significantly associated with abnormal TSH levels (B = 0.462, p = 0.031). After adjusting for confounding factors, t, t-MA also showed an association with abnormal TSH levels in the multivariate model (B = 0.440, p = 0.042).

CONCLUSIONS: Exposure to VOCs is significantly associated with negative TSH levels. Further studies are needed to evaluate this causal relationship.

Keywords: polycyclic aromatic hydrocarbons, volatile organic compounds, thyroid stimulating hormone

Prenatal exposure to phthalates and fetal growth in the SEPAGES cohort relying on repeated urine collection

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BACKGROUND AND AIM: Most previous studies looking at the associations between prenatal exposure to short half-life chemicals and fetal growth relied on biological measurement at a single time point, which inadequately represents exposure over the course of pregnancy. Most studies focus on birthweight without assessing different growth parameters and velocities over time, preventing them to highlight potential period of fetal vulnerability. We examined the associations between pregnancy urinary phthalate metabolites and fetal growth outcomes, both measured twice during pregnancy. METHOD: Among 484 pregnant women, we assessed 13 phthalate and two DINCH (1,2-Cyclohexane dicarboxylic acid, diisononyl ester) metabolite concentrations from two within-subject weekly pools (median 18 and 34 gestational weeks, respectively). Biparietal diameter, head and abdominal circumferences, and femur length were measured during two routine pregnancy follow-up ultrasonographies (median 22 and 32 gestational weeks, respectively). Associations between each phthalate and outcome parameters were investigated using adjusted linear regression models. To account for exposure measurement error and correct the dose-response function, we performed regression calibration as sensitivity analysis.

RESULTS:Detection rates were above 99% for all phthalate MiBP (mono-iso-butyl phthalate) and MnBP (mono-n-butyl phthalate) were positively associated with most fetal growth parameters measured at the second trimester. Specifically, MiBP was positively associated with increased biparietal diameter, head and abdominal circumference, while MnBP was associated with increased head and abdominal circumference at second trimester, with stronger associations observed among males than females. Pregnancy MnBP exposure was also positively associated with biparietal diameter and femur length at third trimester. Regression calibration analysis gave similar results overall. CONCLUSIONS:In this prospective pregnancy cohort, prenatal exposure to MiBP and MnBP was associated with increased fetal growth parameters, with stronger associations among males. Further investigation on the effects of phthalates on child health would be relevant for improving current knowledge on their long-term effects.

Keywords: Endocrine disrupting chemicals, Phthalates, Pregnancy outcomes

Inferring effects of time-varying prenatal exposures on pregnancy loss from live-birthidentified conceptions: A simulation study

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BACKGROUND AND AIM:Identifying the determinants of pregnancy loss is a critical public health concern. However, it is difficult to enumerate the outcome, and so past studies have been limited to medically-identified losses or small, highly selected cohorts. Instead, we show through a simulation study of the effect of nitrogen dioxide (NO2) on pregnancy loss that researchers can use records of live births and gestational ages to identify live-birth-identified conceptions (LBICs)—the difference between the total number of conceptions and those lost for a given time window—to infer effects about pregnancy loss.

METHOD: We simulated ten years of conceptions, pregnancies, losses, and births under several confounding patterns (no confounding, seasonal conceptions, temperature-influenced loss, long-term conception trends, and the previous three combined), and two NO2 effect forms (no effect and moderate effect). We used a time-series design and fit quasi-Poisson distributed lag models adjusted for season, year, and temperature. We considered two approaches to estimate the week-specific and 40-week cumulative effects of NO2 on pregnancy loss: 1) direct interpretation of estimated regression coefficients from the quasi-Poisson model and 2) g-computation to estimate the corresponding additive effects.

RESULTS:Across all scenarios, our models, on average, correctly identified the critical window with appropriate coverage (range: 90% to 100%) and low percent bias (range: -0.51% to 1.5%). For example, under a moderate NO2 effect and combined confounding structure, the average bias and coverage for the additive cumulative association was 1.1% (standard deviation: 6.28%) and 96%, respectively.

CONCLUSIONS: We demonstrated through simulations that our method relying on LBICs (typically available in administrative datasets) offers a viable approach to infer effects on pregnancy loss under realistic confounding scenarios.

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Keywords: air pollution, traffic-related, pregnancy outcomes, causal inference

Prenatal polycyclic aromatic hydrocarbon exposure and neurodevelopment among children in Puerto Rico

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BACKGROUND AND AIM: Polycyclic aromatic hydrocarbons (PAHs) are widespread environmental contaminants produced through the combustion of fuels, tobacco, smoked meat, wildfires, and hazardous waste. PAH exposure has been associated with adverse health impacts; however, few studies have examined exposure in relation to neurodevelopment. Our study aims to investigate the impacts of prenatal PAH exposure on the odds of early neurodevelopmental delay. METHOD: We measured 7 hydroxylated PAH metabolites in spot urine samples up to three times during pregnancy in the PROTECT cohort using tandem mass spectrometry: 1-hydroxynaphthalene (OH-NAP), 2-OH-NAP, 2-hydroxyfluorene (OH-FLU), 1-hydroxyphenanthrene (OH-PHE), the sum of 2and 3- OH-PHE, 4-OH-PHE, and 1-hydroxypyrene (OH-PYR). Neurodevelopmental delay was identified using score cutoffs from the Ages and Stages Questionnaire, 3rd edition (ASQ-3, Spanish), across communication, gross motor, fine motor, problem-solving, and personal-social domains at 12, 24, 36, and 48 months. We utilized logistic regression (n=97) and linear mixed models (n=297) to assess associations between geometric mean PAH concentrations across pregnancy and above versus below ASQ-3 domain cutoffs, adjusting for age, sex, maternal education, and environmental tobacco smoke. RESULTS: Our results unexpectedly show mostly decreased odds of neurodevelopmental delays with higher exposure for several domains in both models (p < 0.05). However, male children showed higher odds of delayed development across communication, fine motor, gross motor, and personal-social domains. Particularly, 2-OH-FLU, 1-OH-PYR, and 1-, 2,3-, and 4-OH-PHE exposure were associated with delays in gross and fine motor function (interaction p-value<0.2). For example, 1-OH-PHE was associated with 1.05 times odds of delay in fine motor function (95%CI: 0.97, 1.14) in males versus 0.93 (95%CI: 0.85, 1.01) times odds of delay in females.

CONCLUSIONS:Our preliminary results suggest that PAH exposure may impact neurodevelopment in male children. These findings prompt further investigation into mechanisms of PAHs on motor function and how hormonal or neurotransmitter differences by sex may play a role in susceptibility.

Keywords: Children's environmental health, chemical exposures, environmental epidemiology, biomarkers of exposure
Gestational exposure to phthalates, phthalate replacements and their mixture in relation to eicosanoid biomarkers during pregnancy

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BACKGROUND AND AIM: Humans are exposed to complex mixtures of phthalates. Gestational exposure to phthalates has been linked to preeclampsia and preterm birth through potential pathways such as endocrine disruption, oxidative stress, and inflammation. Eicosanoids are bioactive signaling lipids that are related to a variety of homeostatic and inflammatory processes.

METHOD: We investigated associations between urinary phthalates and their mixtures with plasma eicosanoid levels during pregnancy using the PROTECT cohort in Puerto Rico (N=655). After adjusting for covariates, we estimated pair-wise associations between the geometric mean of individual phthalate metabolite concentrations across pregnancy and eicosanoid biomarkers using multivariable linear regression. We used bootstrapping of adaptive elastic net regression (adENET) to evaluate phthalate mixtures associated with eicosanoids and subsequently create environmental risk scores (ERS) to represent weighted sums of phthalate exposure for each individual.

RESULTS: After adjusting for false-discovery, in single-pollutant analysis, 14 of 20 phthalate metabolites or parent compound indices showed significant and primarily negative associations with multiple eicosanoids. In our mixture analysis, associations with several metabolites of low molecular weight phthalates – DEP, DBP, and DIBP – became prominent. Additionally, MEHHTP and MECPTP, metabolites of a new phthalate replacement, DEHTP, were selected as important predictors for determining the concentrations of multiple eicosanoids from different pathway groups. A unit increase in ERS was positively associated with several eicosanoids from the cytochrome p450 pathway group, such as (\pm)11,12-DHET (β =0.994, 95%CI: 0.309,1.679), 17(S)-HETE (β =0.37, 95%CI: 0.092,0.648), 9(10)-EpOME (β =0.107, 95%CI: 0.034,0.181), and 9s-HODE (β =0.332, 95%CI: 0.08,0.584). ERS was also associated with lipoxygenase pathway group, such as 12-OxoETE (β =0.123, 95%CI: 0.028,0.217) and 15-OxoETE (β =0.122, 95%CI: 0.015,0.229). CONCLUSIONS: Gestational exposure to phthalates and phthalate mixtures were associated with eicosanoid levels during pregnancy. Results from the mixture analyses underscore the complexity of physiological impacts of phthalate exposure and call for further in-depth studies to examine these relationships.

Keywords: phthalates, pregnancy outcomes, mixture analysis, modeling

Increasing temperature levels are associated with less severe depression: results from the DeprAir project

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BACKGROUND AND AIM: Evidence between ambient temperature effects and mental health is very limited. The aim of the study is to investigate the relationship between ambient apparent temperature (AP) and the severity of major depressive disorder (MDD) in 396 patients enrolled from the DeprAir project

METHOD:Participants have been recruited among patients accessing the Psychiatry Unit of the Policlinico Hospital (Milan, Italy) for mild, moderate or severe depression between September 2020 and December 2022. After collecting informed consent, we administered a questionnaire on personal, lifestyle and clinical characteristics, assessed MDD severity through psychiatric rating scales (MADRS, HAM-D, CGI, SDS, GAF) and collected blood samples. AP concentrations were estimated from temperature, humidity and wind speed measured by the network of monitoring stations of the regional environmental protection agency. Based on his/her residential address, each subject was assigned the mean levels of AP in the two weeks preceding recruitment.

Multivariate linear regression models were performed adjusting for age, sex, education, occupation, month, year and source of recruitment, and NO2 in the two weeks preceding recruitment. Results are expressed as β (95%CI) with the unit of measure of the given severity scale.

RESULTS:In 396 patients affected by MDD (median age: 52 years, females: 65%), we observed negative associations between AP and MADRS (-0.57; (-1.03; -0.12), p=0.013), HAMD (-0.55; (-1.02; -0.08), p=0.021) scales as well as the scores of the Disability (-0.14; (-0.26; -0.02), p=0.026), Relationship (-0.11; (-0.22; -0.00), p=0.043), and Family (-0.13; (-0.24; -0.02), p=0.021) domains of DISS scale. In all these scales, lower values indicate minor severity. Similarly, we observed higher values of GAF scale, indicating minor severity, for increasing levels of AP (0.55; (0.02; 1.08), p=0.042)

CONCLUSIONS: These results suggest that higher temperatures levels contrast MDD severity. Completion of data collection for all participants will allow us to strengthen our conclusions.

Keywords: Temperature, climate, depression, severity

Exposure to mixture of pollutants impacts the severity of major depressive disorder: results from the DeprAir project

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BACKGROUND AND AIM:Recent studies showed that air pollution might play a role in the etiology of mental disorders. However, exposure to air pollution occurs with a multitude of pollutants. We evaluated the relationship between exposure mixture to air pollution and the severity of major depressive disorder (MDD) in 396 patients enrolled from the DeprAir project, using two different approaches.

METHOD:Participants have been recruited among patients accessing the Psychiatry Unit of the Policlinico Hospital (Milan, Italy) for MDD between September 2020 and December 2022. After collecting informed consent, we administered a questionnaire on personal, lifestyle and clinical characteristics, assessed MDD severity through psychiatric rating scales (MADRS, HAM-D, CGI, SDS, GAF). Air pollution concentrations were estimated as daily means in 1x1 km cells using a chemical transport model developed by regional environmental protection agency. Based on personal residential addresses, each subject was assigned to mean levels of PM10, NO2, and O3 of the two weeks preceding recruitment. Bayesian kernel regression (BKR) and weighted quantile sum (WQS) models were performed to verify the association between MDD severity and exposure to combined mixture of three pollutants. Models were adjusted for age, sex, education, occupation, month, year and source of recruitment.

RESULTS:Overall, we observed a significant positive association between mixture exposure and the HAM-D scale using both BKR (quantile 75 vs 10: 12.80, 95% CI: (1.84; 23.77)) and WQS (1.85, 95% CI: (0.33; 3.37)). When looking at single pollutants no effects were seen for PM10, while positive associations were observed for NO2 and O3. Effects of mixture exposure were greater in the warm seasons, especially in summer. No associations were observed in winter.

CONCLUSIONS:Our results suggest that exposure to pollutants mixture potentially affect MDD severity. Gaseous pollutants seem to play a more relevant role. Completion of data collection for all participants will strengthen our conclusions.

Keywords: Air pollution, depression, severity, exposure mixture

OP-074[Built environment » Green space]

Effects of Forest Healing Program on Physical Health, Mental Health, and Health Behavior

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BACKGROUND AND AIM:Although interest in the health promotion effect of forest therapy is increasing, there is a lack of research to investigate changes in health indicators and exercise behavior for the mid-to long-term impacts of Forest Therapy effects. This study examines changes in physical health, mental health, and exercise behavior until one, two, and four weeks after the end of the program to establish a healthcare foundation for forest healing programs and provide a foundation for developing a standardized evaluation system.

METHOD: This study conducted blood pressure and heart rate variability pre- and post-evaluation on 99 adults participating in the forest healing program and conducted follow-up experiments on five mental health indicators(State-Trait Anxiety Inventory of anxiety, Beck Depression Inventory to evaluate anxiety and depression, Profile of Mood States-Brief, Euro-Quality of Life-5 Dimension to evaluate quality of life, and Positive Effect and Negative Effect Schedule to measure positive and negative mood). In addition, a follow-up experiment was conducted on questions that could evaluate exercise time according to exercise intensity and questions that could assess changes in exercise type using Global Physical Activity Questionaire (GPAQ).

RESULTS: Anxiety, Depression, Mood, Quality of Life, Heart rate, and Blood pressure control showed significant differences before and after the program. In addition, the effect of controlling depression and increasing medium-intensity exercise time continued until one week, two weeks, and four weeks after the end of the program.

CONCLUSIONS: The results of this study can confirm the tracking effect of various health indicators and clearly distinguish between indicators suitable for short-term observation and indicators requiring long-term observation. In addition, it is the first paper to discover that the experience of forest healing programs can affect exercise behavior, suggesting that continuous health behavior tracking investigation is needed.

Keywords: Shinrin-yoku, forest healing, physiological effect, psychological effect, health behavior

Lithium in Drinking Water and Autism Spectrum Disorder

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BACKGROUND AND AIM:Lithium is a natural-occurring and trace element that has mood-stabilizing effects. Maternal therapeutic use of lithium was associated with adverse birth outcomes. In animal models, lithium modulates Wnt/ β -catenin signaling that is important for neurodevelopment. We evaluated whether autism spectrum disorder (ASD) in offspring is associated with maternal exposure to drinking water lithium during pregnancy.

METHOD: We conducted a nationwide case-control study in Denmark including 8842 children diagnosed with ASD born 2000–2013 and 43,864 controls matched by birth year and sex from the birth registry. Geocoded maternal residential addresses during pregnancy were linked to lithium levels (range 0.6 to 30.7 μ g/L) in drinking water estimated using kriging interpolation based on 151 waterworks measurements of lithium across all regions in Denmark. ASD diagnoses were ascertained from the Danish Psychiatric Central Register. We estimated odds ratios (OR) and 95% confidence interval (CI) for ASD according to prenatal lithium exposure as a continuous (per inter-quartile-range (IQR)) or a categorical (quartile) variable, adjusting for socio-demographic factors and ambient air pollutants levels. We also conducted stratified analyses by birth years, child's sex, and urbanicity. RESULTS:Every IQR increase in prenatal drinking water lithium was associated with 23% higher odds for ASD (OR=1.23, 95% CI 1.17, 1.29). Elevated odds for ASD were estimated starting from the second quartile (7.36-12.67 μ g/L) of prenatal lithium, and the OR for the highest quartile (>16.78 μ g/L) compared with the reference group (<7.39 μ g/L) was 1.46 (95% CI 1.35, 1.59). The estimated associations were unchanged when adjusting for air pollution exposures, and no differences were apparent in stratified analyses.

CONCLUSIONS: Maternal prenatal exposure to lithium from naturally occurring drinking water sources in Denmark was associated with an increased ASD risk in the offspring. This study suggests the potential fetal neurotoxicity of lithium from drinking water that needs to be further investigated.

Keywords: Neurodevelopmental outcomes, Spatial statistics, Water quality

OP-076[Chemical exposures » Other (to be specified with keywords in the keywords section)]

Associations between phosphate flame retardants and steroid/reproductive hormones at pubertal age: the Hokkaido Study

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BACKGROUND AND AIM: Phosphate flame retardants and plasticizers (PFR) are a class of chemicals causing concern about endocrine disrupting properties. Associations between PFR levels and infertility outcomes have been reported, but their association with reproductive and steroid hormone levels at pubertal age is not well known. The aim of this study is to assess PFR levels in urine and investigate their association with these hormones at pubertal age.

METHOD: The Hokkaido Study is an ongoing birth cohort. At age 9-12, children living in Sapporo area were asked to visit a pediatrician for face-to-face health check-up, and blood and urine samples were collected. Thirteen PFR metabolites in urine and 14 steroid hormones in plasma were measured by LC/MSMS. Luteinizing hormone (LH), follicle stimulating hormone (FSH), Inhibin B and Insulin like factor E (INSL3) were measured by ELISA. Specific gravity corrected PFR metabolites were molar summed based on their parent compounds. Both PFRs and hormones were log-natural transformed and adjusted for age and BMI after stratification by sex.

RESULTS: In this study, 231 boys and 198 girls were included. Median levels of metabolites of Σ TCIPP, Σ TPHP, Σ EHDPHP, Σ TBOEP, and TDCIPP were 1.20 nM, 1.10 nM, 0.89 nM, 0.63 nM, and, 0.39 nM, respectively. Among boys, all PFRs except Σ EHDPHP were positively associated with estradiol, whereas Σ TPHP was inversely associated with estradiol (E2). TDCIPP, Σ TPHP, and Σ TBOEP were positively associated with E2/testosterone ratio (E2/T). Σ TBOEP, Σ EHDPHP, Σ TCIPP were inversely associated with INSL3. Among girls, Σ TPHP was also associated with E2 and E2/T. Σ EHDPHP and Σ TPHP showed positive association with Inhibin B.

CONCLUSIONS: The results suggest that exposure to PFRs is associated with altered steroid and

reproductive hormone levels at pubertal age children. The results should be interpreted with caution, as the study has a cross-sectional design.

Keywords: phosphate flame retardants and plasticizers, Children's environmental health, Endocrine disrupting chemicals, Environmental epidemiology,

Exposure of children to glyphosate in Morocco: Urinary levels and predictors of exposure

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BACKGROUND AND AIM:Glyphosate is one of the most frequently used organophosphorus plant protection products worldwide, and has recently been classified as probably carcinogenic to humans by the International Agency for Research and Cancer (IARC)

METHOD: We aimed to evaluate the urinary levels of glyphosate and its metabolite aminomethylphosphonic acid (AMPA) in Moroccan children, to identify the main predictors and to perform a risk assessment. Data was collected during a cross sectional study of 48 children from an intensive agricultural area. Urinary glyphosate and AMPA were extracted using solid phase extraction (SPE) and analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS).

RESULTS:Urinary glyphosate and AMPA were extracted using solid phase extraction (SPE) and analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Overall, glyphosate and AMPA were detected in 73% and 75% of urine samples, respectively. The mean concentrations were 0.97 μ g L- 1 (2.06 μ g/gcreatinine) for glyphosate and 0.79 μ g L- 1 (1.52 μ g/gcreatinine) for AMPA. Children younger than 5 years had a higher AMPA and glyphosate urine concentration than children aged 6-12. Children living near the pesticide spraying fields (<50 m) had 14.91 μ g L- 1 and 2.35 μ g L- 1 more glyphosate and AMPA, respectively, than children living in urban counties. The HQs were calculated considering 0.5 mg/kg BW/day as an acceptable daily intake (ADI), which EFSA has established as a healthbased reference value for both analytes.

CONCLUSIONS: This study provides further evidence on factors associated with glyphosate exposure, especially in developing countries

Keywords: Pesticide exposure, Glyphosate, Aminomethylphosphonic acid, Socio-demographic factors, Children

Influence of PAHs and Genetic Polymorphisms on Urinary PAHs Metabolite and DNA Damage among Malaysian Children in Urban Traffic Area

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BACKGROUND AND AIM: Polycyclic Aromatic Hydrocarbon (PAHs) is one of a major group of genotoxic carcinogens found in urban atmospheric pollution. This study investigated the association between particulate PAHs with urinary 1-hydroxypyrene (1-OHP) and DNA damage among Malaysian children in urban traffic area. In addition, this study assessed the influence of genetic polymorphisms of PAHs metabolizing enzymes (CYP1A1, GSTT1, GSTM1) on urinary 1-OHP and DNA damage in children. METHOD: This cross-sectional comparative study was conducted at eight schools in high traffic (HT) area and low traffic (LT) area in Klang Valley. The indoor and outdoor samples of particulate matter PM2.5-bound PAHs were collected using a MiniVol and guantified using Gas Chromatography-Mass Spectrometry (GC-MS). DNA damage was assessed in buccal cells using Comet Assay, while urinary 1hydroxypyrene (1-OHP) was quantified using High-Performance Liquid Chromatography. PAHsmetabolizing enzymes were studied for polymorphisms using PCR-RFLP and multiplex PCR. RESULTS: Total PAHs concentrations in the schools in HT area were higher than LT area ranging from 4.4 to 5.76 ng/m3 and 1.36 to 3.79 ng/m3, respectively. The urinary 1-OHP concentration was significantly higher among children in HT as compared to LT (0.07 vs 0.04 µmol/mol-creatinine). The DNA damage was significantly higher among children in HT as compared to LT. There was no modifying effect of CYP1A1, GSTM1 and GSTT1 genotypes on urinary 1-OHP and DNA damage. The multiple linear regression analysis showed that PAHs exposure was the significant predictor associated with urinary 1-OHP and DNA damage in Malaysian children, after controlling the possible confounders. CONCLUSIONS: This study provided evidence that children attending schools near heavy traffic area are more likely to be exposed to environmental PAHs and had a significantly higher risk of cancer than children attending schools in low traffic areas. Effective mitigation measures need to be taken to reduce PAHs pollution in school environments.

Keywords: Traffic-related, Exposure assessment, Children's environmental health

Cumulative risk assessment of exposure to a mixture of pesticides among Czech adults and children from the CELSPAC-SPECIMEn cohort

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BACKGROUND AND AIM:Current-use pesticides (CUP) are extensively applied in both agricultural and urban settings. Exposure occurs mainly via the dietary pathway; however, other pathways such as inhalation or skin contact are also important. Because of multiple exposures to pesticides as well as other environmental contaminants, single-substance health risk assessment could underestimate any real health impact and, therefore, cumulative risk assessment is needed.

METHOD:In this study, urinary levels of 12 CUP metabolites were investigated among 110 parent-child pairs during two seasons of 2020. We estimated daily intakes of parent pesticides using a toxicokinetic model according to three possible scenarios considering the amount of the metabolite excreted in urine. To assess the possible risk of combined exposure to a mixture of pesticides with respect to effects on the nervous system, the EFSA cumulative risk assessment approach was deployed. RESULTS:Metabolites of pyrethroids, chlorpyrifos, and tebuconazole were detected in more than 60% of the samples. CUP urinary metabolite levels were significantly higher in children in comparison to adults, except for tebuconazole. If any seasonal difference occurred, winter samples were those with significantly higher concentrations. The risk of pesticide mixtures based on the total margin of exposure (MOET) calculations was assessed within two cumulative assessment groups: chronic functional effects on the motor division (CAG NAM) and the brain and/or erythrocyte acetylcholinesterase inhibition (CAG NAN). Generally higher risk was observed for CAG NAN, however, using a realistic scenario, none of the median MOETs was below 100 and thus did not indicate any risk.

CONCLUSIONS:Nevertheless, the risk observed using the worst-case scenario suggests the need for continuous evaluation of exposure to such compounds and for extension of the range of commonly analysed substances, especially in children. Additionally, further research is needed to distinguish between excretion factors in children and adults in order to responsibly evaluate associated health risks.

Keywords: Chemical exposures, Pesticides, Mixtures, Exposure assessment, Risk assessment

Organophosphate Flame Retardants Mixture associated with Increased Urinary Oxidative Stress Biomarkers among School Children: The Hokkaido Study

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BACKGROUND AND AIM: Exposure to organophosphate flame retardants (PFRs) has been reported to be associated with increased risks of asthma and allergies. Oxidative stress contributes to the development of asthma, allergic diseases and inflammation. This study examined the association of individual and mixture exposure to PFRs with urinary oxidative stress biomarkers among school children.

METHOD: The study is a part of the Hokkaido Study on Environment and Children's Health. School children aged 9-12 years living in Sapporo and its suburbs were included. The concentration of 13 PFRs metabolites and 3 oxidative stress biomarkers including 4-hydroxynonenal (HNE), hexanoyl-lysine (HEL), and 8-hydroxy-2'-deoxyguanosine (8-OHdG), were measured in spot urine samples (n=412). Multiple regression analysis, Quantile-based g-computation (qg-computation) and Bayesian kernel machine regression (BKMR) were used to analyze the associations.

RESULTS:The median for HNE, HEL and 8-OHdG were 21.6 (μ g/mL), 106.4 (nmol/L), 9.52 (ng/mL), respectively. For the individual PFRs, a natural log unit increase in Σ TPHP was associated with increased levels of all oxidative stress biomarkers, Σ TBOEP was positively associated with 8-OHdG levels. PFRs mixtures were positively associated with HEL (β , 95% CI: 0.08, 0.01–0.15) and 8-OHdG (0.05, 0.01–0.10). For the individual contributions of each chemical among the PFRs mixture, the highest weight (%) in the positive direction were TDCIPP (35.8%), Σ TPHP (33.%) and Σ TBOEP (23.2%) for HEL, Σ TBOEP (53.7%) and Σ TPHP (46.3%) for 8-OHdG.

CONCLUSIONS: PFRs were positively associated with HEL, HNE and 8-OHdG among 9-12 year-old children. The main contributors to the association were TPHP, TBOEP and TDCIPP metabolites. A study reported that higher levels of 3 PFRs metabolites levels were associated with increased HEL, HNE among 7-year-old children. This study found consistent results after examining both individual and mixture exposure to PFRs. PFRs could be associated with allergic diseases through increased oxidative biomarkers.

Keywords: Organophosphate Flame Retardants, Mixtures analysis, Biomarkers of exposure, Children's environmental health, Environmental epidemiology

Metabolic profiles of traffic noise exposures: a discovery analysis in the NFBC1966 cohort in the LongITools project

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BACKGROUND AND AIM: Environmental noise pollution is a risk factor for multiple health outcomes, but its molecular imprints in the body remain uncertain. We aim to investigate associations of road, rail and air traffic noise exposures with the metabolic profile in young adults with targeted NMR metabolomics.

METHOD: We used data from Northern Finland Birth Cohort 1966 (N = 5491, mean age 31 years, 51.7% women) to examine the associations of modelled residential road, rail and air traffic noise levels (separately) with fasting 228 NMR metabolic traits encompassing lipids, lipoproteins, fatty acids, amino acids, phospholipids, glycolysis and miscellaneous other metabolites. We linked modelled traffic noise levels to the residences of the participants in year 1997 when the clinical examinations took place. We used linear regression adjusted for sex, education, income, body mass index, smoking, alcohol consumption, air pollutant and built environment and corrected for multiple testing to examine the associations.

RESULTS: The number of participants exposed to the road, rail and air traffic noise > 50 dB were 1646, 392 and 39, respectively. Exposure to road, rail and air traffic noise was associated with 26, 7 and 47 metabolic traits, respectively ($P \le 0.002$). All three modelled noise levels were negatively associated with phenylalanine. Rail and road traffic noise was negatively associated with low-density lipoprotein (LDL) triglycerides. However, positive associations were observed between road traffic noise and VLDL triglycerides, intermediate-density lipoprotein and high-density lipoprotein cholesterol compositions.

CONCLUSIONS: These findings suggest multiple associations between traffic noise exposure and metabolites. We will conduct a multi-cohort analysis in the LongITools to further examine the associations.

Keywords: road, rail and air traffic noise exposure, NMR metabolomics

Influence of air pollution and climate variability on dengue in Singapore – A time-series analysis

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BACKGROUND AND AIM: The associations between air quality and respiratory and cardiovascular health outcomes have been well examined. Less conclusive are studies assessing the relationship between air quality and dengue, a mosquito-borne illness which continues to pose a risk to more than half the world's population. We examined this relationship in Singapore, a tropical city-state located in the South-East Asian region where the burden of dengue is among the highest across the globe. METHOD: Assuming a negative binomial distribution, we analyzed the short-term associations between all laboratory-confirmed dengue reports and variations in PM2.5, PM10, CO, O3, NO2 and SO2 in Singapore from 2009 to 2019 using the Distributed Lag Non-linear Model (DLNM) framework. We accounted for the effects of long-term trend, seasonality, day-of-the week effects, the immediate and lagged effects of ambient temperature and air quality, and changes in human population size. RESULTS:PM2.5 (RR90th percentile: 1.28, 95% CI: 1.11,1.49), PM10 (RR90th percentile: 1.30, 95% CI: 1.12, 1.51), and CO (RR90th percentile: 1.30, 95% CI: 1.06, 1.61), were positively associated with dengue up to a period of 48 days with observed maximum threshold effects, while O3 and NO2 were negatively associated with dengue. There was a positive, non-linear association between ambient temperature and dengue. We observed strong evidence of ambient temperature modifying the association between particulate matter and dengue risk. Our results remained resilient in sensitivity analysis.

CONCLUSIONS: In conclusion, particulate matter and carbon monoxide concentrations exhibited a positive association with dengue reports. Variations in the concentrations of these air pollutant species may inform short-term dengue control resource augmentation plans.

Keywords: Dengue, PM2.5, PM10, Air quality, Temperature

Ambient Temperature and Preeclampsia: A Historical Cohort Study

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BACKGROUND AND AIM:Previous studies found inconsistent associations between ambient temperature during pregnancy and risk of preeclampsia. If such associations are causal, they may have an impact on the future burden of preeclampsia in the context of climate change. The aim of this study was to estimate the association between the exposure to ambient temperature during pregnancy and incidence of early- and late-onset preeclampsia, and to identify critical exposure periods.

METHOD: This is a historical cohort of 130,340 pregnancies (5,142 preeclampsia cases) from southern Israel, merged with temperature assessments from a hybrid satellite-based exposure model. We used distributed-lag and cause-specific hazard models to study time to preeclampsia, and identify critical exposure periods.

RESULTS: We found a positive association between temperature and preeclampsia during the entire gestation period, which was stronger in the 3rd trimester. The associations existed with both earlyand late-onset preeclampsia; however, the associations with early-onset disease were somewhat stronger, limited to the first weeks of pregnancy and third trimester, and with larger confidence intervals.

CONCLUSIONS: Exposure to high temperatures at the beginning and, particularly, the end of gestation, is associated with increased risk of preeclampsia in southern Israel.

Keywords: pregnancy outcomes, environmental epidemiology

OP-084[Climate » Health co-benefits]

The role of built environment on the health effects of ambient temperature: Systematic review of the literature

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BACKGROUND AND AIM: Emerging evidence suggests that built environment atributes can modify climate change-related health effects, thus leading to a geographical distribution of these effects and to potential leveraging factors for climate adaptation and mitigation efforts.

METHOD:In this systematic review, we searched four online databases (Pubmed, EMBASE, BVS, Google Scholar) from inception to March 8, 2023, without language or temporal restrictions for observational studies (cohort, cross-sectional, case-control, and before and after) or ecological studies (before and after, time series, etcetera) that assessed the effect modification of climate-change-related health effects according to build environment atributes or air pollution, irrespective of the outcomes being assessed. We excluded studies that addressed indirect outcomes, such as the effect on vectors for vector-borne diseases. Study selection was conducted in duplicate. Currently, the study is on extraction phase. From each study, we will extract descriptive information and association measurements (absolute or relative) along with sample size. For each effect modification, we will extract crude and adjusted or interaction measurements. A qualitative summary will be conducted, as considerable heterogeneity is expected. The literature will be described in relation to studies characteristics, critical appraisal, and according to built environment attributes.

RESULTS: We identified 7,533 results, of which 325 were selected for full-text apparisal and 169 were included; 98 were published after 2020. The most frequent outcome is all-cause mortality. The urban attributes most frequently assessed were air pollution and green spaces. Most studies are conducted in Europe and China.

CONCLUSIONS: There has been an steep increase in the literature that addresses the effect modification of climate-related health effects due to built environment and air pollution. A better understanding of the role of these attributes helps to identify vulnerable population and sources of environmental inequality, and to identify attributes that can be levareged for climate adaptation and mitigation efforts to achieve maximizing health co-benefits.

Keywords: Built environment, Climate, Health co-benefits, Air pollution, Mortality, Temperature

Bayesian-spatial distributed lag non-linear models: A temperature-mortality case study in Barcelona

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BACKGROUND AND AIM: In the context of climate change, the interest in the health effects of environmental exposures has remarkably increased. The development of the distributed lag non-linear models (DLNM) has become rapidly the referent framework when studying temperature-mortality short-term associations. DLNMs facilitates the modelling of the non-linear and lagged effect of temperatures on mortality. However, the small-area analysis of temperature-mortality is still scarce. METHOD:In that sense, here we present four models. The first two models generalize standard DLNMs to a Bayesian framework, using a case-crossover design (model 1) and the common DLNM time-series configuration, where time trend and seasonality are modelled by using splines (model 2). We propose models 3 and 4 specifically for dealing with unstable estimates from small numbers in small-area analyses. These two models are extensions of model 1 and model 2 respectively, where we use Leroux models to spatially-smooth in one-stage approaches the coefficients of the exposure-response relationships for each small area. We apply all proposed models to a case-study for assessing the temperature-mortality relationships in the 73 neighborhoods of Barcelona during summer months. 39.569 deaths were considered in the period 2007-2016, 19 of them corresponding to the neighborhood with the lowest number of deaths.

RESULTS: Curves defining the relative risks of mortality were unstable and unreliable in the independent models, with regions with extremely high and low risks distributed all over the city. Spatial models benefit from adjacent regions to smooth the association and reveal hidden spatial patterns of risk. In addition, the flexibility of these Bayesian models allowed us to explore the results of these epidemiological models in new intuitive ways.

CONCLUSIONS: This novel multidimensional approach brings the opportunity to estimate ecological temperature-mortality models in a smaller spatial scale to better understand the socioeconomic and built environment factors driving the effect of temperature on human health.

Keywords: Spatial statistics, Environmental epidemiology, Modeling, Mortality, Temperature

The Impact of Temperature and Relative Humidity on Ventricular Arrhythmias in Patients with Implanted Cardiac Devices in North Carolina, 2010-2021

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BACKGROUND AND AIM:Medical professionals are considering ways to use remote monitoring to identify at-risk populations, reduce outcome disparities, and provide timely interventions to vulnerable patients. We examined the effect of climate change-relevant warm season weather conditions on the risk of potentially life-threatening arrhythmias [ventricular tachycardia (VT)/ventricular fibrillation (VF)] in patients with implanted cardiac devices.

METHOD: We used remote monitoring data on daily VT/VF occurrence in the one year following cardiac device implantation in 526 patients enrolled in the University of North Carolina Cardiovascular Device Surveillance Registry between 2010-2021. Local average temperature and relative humidity (RH) exposure during mid-April to mid-October was estimated using weather station data. Associations between meteorology and VT/VF occurrence, overall and by demographic and neighborhood characteristics, were estimated using a case time series design with distributed lag non-linear models. Models were adjusted for temporal trends and physical activity.

RESULTS:VT/VF events occurred on 1,404 of the 96,144 person-days. Temperature was not associated with VT/VF, nor did it confound the association with RH. In contrast, high RH increased VT/VF risk in the 1-2 days following exposure. When RH increased from the median (73.8%) to the 95th percentile (90.0%), the odds of VT/VF occurring the next day increased by 11.7% (95% CI: 3.4%, 20.7%). Patients in neighborhoods with low urbanicity and high area deprivation, as well as male, older (>65yr), and white patients, had an elevated risk of VT/VF when exposed to high RH. CONCLUSIONS:Exposure to humid conditions during the warm season increased risk of VT/VF in patients with implanted cardiac devices, with key differences by individual- and area-level characteristics. Additional research in larger populations is needed to determine generalizability of these findings. Remote monitoring data may provide opportunities to increase resilience and reduce inequalities in patient outcomes. This work was supported by an ORISE fellowship and does not necessarily reflect EPA policy.

Keywords: Cardiovascular diseases, Short-term exposure, Environmental epidemiology, Built environment, Temperature extremes

Ambient Temperature and Nervous System Diseases-related Mortality in Japan from 2010 to 2019: A Time-Stratified Case-Crossover Analysis

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BACKGROUND AND AIM:Despite the substantial disease burden caused by nervous system diseases, few studies have examined the association between ambient temperature and nervous system diseases, especially during cold seasons. Evidence for specific disease subgroups such as Alzheimer's and Parkinson's is also lacking. This study examined the association between short-term changes in ambient temperature and nervous system diseases-related mortality in ten Japanese prefectures from 1 January 2010 to 31 December 2019.

METHOD:A two-stage analysis based on a time-stratified case-crossover study design was conducted. A conditional quasi-Poisson regression model with a distributed lag non-linear model for temperature was applied followed by a multivariate random-effects meta-analysis to obtain average associations. Mortality due to all and cause-specific nervous system diseases (major neurodegenerative diseases, Alzheimer's, and Parkinson's) were analyzed, with consideration for sex and age (0–84 and 85+ years old) subgroups.

RESULTS: We analyzed 162,315 death cases due to nervous system diseases. Cold was associated with all categories of nervous system diseases-related mortality, but not heat. The estimated relative risks for cold, obtained by comparing the 2.5th percentile of daily mean temperature distribution to the minimum mortality temperature (MMT), were 1.43 (95 % CI: 1.28–1.60), 1.37 (95 % CI: 1.17–1.59), 1.53 (95 % CI: 1.07–2.01), and 1.54 (95 % CI: 1.13–2.10) for all nervous system diseases, major neurodegenerative diseases, Alzheimer's, and Parkinson's, respectively. These associations were also observed in the sex and age subgroups in general but without evidence of effect modification. Heat (the 97.5th percentile of daily mean temperature distribution vs. MMT) was associated with Parkinson's disease-related mortality among those aged 85 years and over. CONCLUSIONS:Cold was associated with an increased risk of nervous system disease-related mortality. The effect of heat was not observed, except for mortality among the elderly aged 85 years and older with Parkinson's disease.

OP-089[Birth and pregnancy outcomes » Pregnancy outcomes]

Association between urinary parabens and maternal thyroid hormones by different trimesters in pregnant Taiwanese women (TBCS)

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BACKGROUND AND AIM:Parabens are widely used as preservatives in various personal care products, pharmaceuticals, and foodstuffs. Previous studies had already linked parabens exposure to thyroid dysfunction in pregnant women, however the data of Taiwan pregnant women were few. So, we aimed to investigate the background level of urinary paraben in pregnant women in southern Taiwan and estimate the correlation between parabens concentration and thyroid hormone in different trimester. METHOD:A total of 97 pregnant women were recruited at a medical center between 2013 and 2014. Urine and cord blood samples were collected in three trimesters. Analyzed four types of parabens including methylparaben (MeP), ethylparaben (EtP), propylparaben (PrP), and butylparaben (BuP) by using LC-MS-MS. The cord and maternal serum levels of T4, free T4, T3, TSH, and thyroxine-binding globulin (TBG) were measured using an electrochemiluminescence immunoassay.

RESULTS:The urinary MeP and PrP were the main compounds in all parabens from 97 pregnant women in different trimesters. The median and 95% CI of urinary MeP in the third trimester was 513 ng/mL [95%CI: 413-679], followed by PrP in the second trimester [130 ng/mL; 109-156]. The MeP was 5.5 times higher than US pregnant women from NHANES (789.0 vs 143.58 µg/g creatinine). Even the lowest paraben was detected in BuP, which is still more than 100 times higher than other Asian countries. After adjusting the confounder, urinary Ln-EtP (In-transformed) was negative associate with Ln-TBG (β =0.119, P=0.037) in third trimester, also Ln-BuP had a positive association between Ln-T3 and Ln-T4 (β =0.109, P=0.096; β =0.065, P=0.099). Moreover, we observed a positive association between Ln-MeP and Ln-TBG (β =0.147, P=0.054) at second trimester, which means 1% increase in Ln-MeP was associated with 14.7% increase in Ln-TBG.

CONCLUSIONS: For this study cohort, we observe high concentration of parabens exposure, also pregnant women exposure to parabens in different trimester may alter thyroid hormone indicator homoeostasis.

Keywords: Endocrine disrupting chemicals, Pregnancy outcomes, Exposure assessment-biomarkers of exposure

OP-090[Reproductive outcomes » Male reproductive outcomes]

Mixtures of phenol and phthalate exposure biomarkers in relation to semen parameters among men from a fertility clinic

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BACKGROUND AND AIM: Epidemiologic studies on the associations of urinary phenols and phthalate metabolites, as a mixture, with semen quality are rare. We examined whether mixtures of urinary concentrations of bisphenol A, methylparaben, propylparaben and several phthalate metabolites were related to semen parameters among men from a fertility center (2004-2017).

METHOD: This study included 420 men who contributed 875 paired urine and semen samples (median=2, range=1-8 sample per person). Semen parameters (volume, concentration, total count, total motility, normal morphology) were measured following WHO guidelines. We estimated the joint effects of the chemical biomarker mixture on the semen parameters applying quantile g-computation with robust standard errors to account for within-man exposure-outcome correlations and weights to account for the informative difference in the number of repeated measures per participant. We adjusted models for age, BMI, race, education, physical activity, history of varicocele, year of sample collection, abstinence time and specific gravity.

RESULTS:The 420 men had a median (IQR) age of 36.5 (32.8; 39.4) years and body mass index (BMI) of 26.9 (24.5; 29.6) kg/m². Median (IQR) sperm concentration, total count and motility were 59.2 (27.9; 103.1) mil, 136.1 (66.8; 254.4) mil/mL, and 47 (28; 64) %, respectively. A quartile increase in urinary concentrations of the chemical exposure biomarker mixture was not associated with ejaculated volume (Beta = -0.067, 95% CI = -0.237, 0.102), sperm concentration (Beta = 0.040, 95% CI = -0.013, 0.093), total sperm count (Beta = 0.004, 95% CI = -0.058, 0.065), motility (Beta = 1.14, 95% CI = -2.31, 4.58) or percent with normal morphology (>4%) (Beta = -0.012, 95%

CI = -0.060, 0.037).

CONCLUSIONS:Overall, we observed no associations between the urinary chemical exposure biomarker mixture and semen parameters. Further studies are needed to corroborate these findings among other men and to evaluate mixtures of phenol and phthalate replacements.

Keywords: Phenols, Phthalates, Semen, Mixtures, quantile-g computation.

Association of the phthalate level and perturbed lipid profiles in a Taiwanese child cohort

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BACKGROUND AND AIM: Phthalates are one of the important environmental hormones. However, the adverse health effects and mechanism in response to phthalate in children were not fully elucidated. The aim of this study was to examine associations between urinary phthalate level and the serum lipidome in a Taiwanese children population.

METHOD:In this study, 256 children (average 9-year-old) from two individual Taiwanese cohorts were enrolled. A high-performance liquid chromatography/mass spectrometry (LC/MS) was used to monitor the 12 phthalate metabolites in child urine. Meanwhile, the serum lipid profiles, which focused on phosphatidylcholine (PCs) and sphingomyelin (SMs), of children were assessed by a LC/MS-based lipidomic approach. The partial least squares analysis and multiple linear regression analysis were used to suggest the critical phthalate exposure and to examine the relationship of phthalate exposure and lipid responses in children.

RESULTS:Our results showed that mono(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono(2-ethyl-5-oxohexyl) phthalate, and monoethyl phthalate were most common phthalates existed in Taiwanese child urine (over 90% detection rate). The results of partial least squares analysis revealed that the MEHHP level were associated with the distinct lipid profiles among the total of 12 phthalates. The results of multiple linear regression showed that increased diacyl-PCs and lyso-PCs, as well as decreased ether-linked PCs (including O-alkyl-acyl-PCs and O-alkenyl-acyl-PCs) and SMs were correlated with a higher MEHHP exposure.

CONCLUSIONS: These lipid changes may be associated with very low-density lipoproteins secretion, pro-inflammatory effects, anti-oxidative capacity, and neurotoxicity. Our results suggested that Di(2-ethylhexyl) phthalate, the parent compound of MEHHP, exposure may cause systemic lipid perturbation in children, which may be involved in several important physiological function. In addition, the lipidomic approach is a powerful tool to monitor health effects in response to environmental levels of toxicants in human population.

Keywords: Endocrine disrupting chemicals, Phthalates, Children's environmental health, other (lipidomics)

OP-092[Chemical exposures » Phenols]

Urinary concentrations of phenols/parabens and changes in body size and composition: The Study of Women's Health Across the Nation (SWAN)

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BACKGROUND AND AIM: Phenols and parabens widely used in personal care products are considered obesogens but evidence of the link between these chemicals and adiposity markers is scant. We examined the associations of urinary concentrations of phenols and parabens with longitudinal changes in body size and composition in midlife women.

METHOD: This study included 1,393 women aged 45-56 years in 1999-2000 from the Study of Women's Health Across the Nation Multi-Pollutant Study (SWAN-MPS). Body weight, waist circumference, and proportion fat mass were measured at near-annual visits from 1999 to 2006. Urinary concentrations of bisphenols, triclosan, 2,4-dichlorophenol, 2,5-dichlorophenol,

benzophenone-3, and parabens were measured at SWAN-MPS baseline (1999-2000) and three years later (2002-2003), the mid-point of follow-up. Generalized additive mixed effects models with splines of time were fitted to capture non-linear trajectories of body size and composition. We computed the predicted means of adiposity measures at baseline, 3 years and 5 years and computed the difference in means by tertiles of phenols and parabens.

RESULTS:The predicted means of waist circumference at 5 years of follow-up were higher in the highest tertile vs. the lowest tertile for 2,4-dichlorophenol (difference=0.55cm, 95% CI: 0.07 to 1.03); triclosan (difference=0.50cm, 95% CI: 0.02 to 0.98); and benzophenone-3 (difference=0.43cm, 95% CI: -0.05 to 0.91), although there were no differences in means at baseline. We also observed a significant difference in mean of body weight between the highest vs. lowest tertiles of 2,4-dichlorophenol (difference=0.69kg, 95% CI: 0.27 to 1.11) at 5 years of follow-up. We

found a borderline significant difference in mean of proportional fat mass for 2,4-dichlorophenol (difference=0.18, 95% CI: -0.05 to 0.41) at 3 years of follow-up, but the difference was attenuated and not significant at 5 years of follow-up.

CONCLUSIONS:Our findings suggest potential obesogenic effects of 2,4-diclorophenol, 2,5-diclorophenol, triclosan, and benzophenone-3 among mid-life women.

Keywords: Phenols, body composition, body weight, midlife women, longitudinal study

Exposure assessment of the relationship between urinary paraben and early renal injury in a middle-aged adult population in Taiwan

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BACKGROUND AND AIM:Parabens are a class of preservatives used in the cosmetics industry and are widely used in personal care products (PCPs), pharmaceuticals and food. Epidemiological studies concerning the relations of exposure to parabens with renal function were limited. Our aims are to investigate the potential sources of paraben exposure, estimate the daily intake (DI) of four parabens based on their urinary levels and evaluate association between urinary paraben and renal function in a middle-aged adult population in Taiwan.

METHOD: We recruited 591 subjects aged from \geq 40 to <65 years old (yrs) who have participated in Taiwan Environmental Survey for Toxicants study from 2013-2016. Urinary parabens including methylparaben (MeP), ethylparaben (EtP), propylparaben (PrP), and butylparaben (BuP) have been analyzed by liquid chromatography/ tandem mass spectrometry. The cross-sectional analysis of the association between urinary paraben and biomarkers of renal function have also been established. RESULTS:The median of urinary paraben levels were 442, 42.9, 107 and 5.92 µg/L in MeP, EtP, PrP and BuP, respectively, which were also 10 times higher than other countries. Subjects aged from \geq 55 to <65 yrs had higher urinary MeP, EtP levels and DI than those aged from \geq 40 to <55 yrs. The median of DI was higher in lotion, perfume and nail polish users than those seldom used. However, there were no significant difference between two aged groups, DI and PCPs usage, or the cumulative usage of PCPs by gender. The median of creatinine, microalbumin, urinary protein and uric acid were significantly higher in men than in women, the albumin to creatinine ratio was significantly higher in women than in men.

CONCLUSIONS: The urinary paraben concentration of middle-aged adults in Taiwan was significantly higher than those in US, Canada, and Korea. There was no significant difference among paraben levels, age and gender. PCPs usage was a source of paraben exposure.

Keywords: Chemical exposures, Endocrine disrupting chemicals, Exposure assessment, Biomarkers of exposure

Exposure to greenspace and ADHD in the context of physical activity, neighborhood safety and neighborhood cohesion: Analysis in Polish children

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BACKGROUND AND AIM: Previous research has shown a protective association between greenspace exposure and attention deficit hyperactivity disorder (ADHD) in children. However, none of the previous studies examined potential pathways relevant for this association. Our study aimed to examine whether there is an association between tree/grass cover and availability of garden and ADHD diagnosis, and whether greenspace perception, physical activity, neighborhood safety and neighborhood social cohesion play a role in this association.

METHOD:Data was obtained from the case-control NeuroSmog study, in which children with and without ADHD were enrolled. Analytic sample consisted of 696 children aged 10 to 13 years. ADHD diagnosis was established or ruled out according to the International Classification of Diseases 11th Revision (ICD-11) criteria. Parents reported information about the mediators and the availability of domestic garden via questionnaires. Tree and grass cover were extracted in 500m Euclidean buffers around lifelong residences. Structural equation modeling was used to examine the pathways and their interplay linking the three greenspace measures to ADHD.

RESULTS:We found that greenspace was indirectly related to ADHD diagnosis: tree cover was positively related to both perceived greenspace and physical activity, and physical activity was subsequently negatively related to ADHD diagnosis. Moreover, garden was positively related to perceived greenspace, which in turn was related to neighborhood social cohesion. Neighborhood safety was positively related to both perceived greenspace and neighborhood social cohesion. CONCLUSIONS:Greenspace was only indirectly related to ADHD diagnosis in Polish schoolchildren through physical activity. Increased physical activity may have a protective role in the context of ADHD for this age group.

Keywords: Green space, ADHD, physical activity, neighborhood cohesion, neighborhood safety

Association between green space exposure and liver enzymes in adult workers: A longitudinal cohort study

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BACKGROUND AND AIM:A previous study found a negative association between cord blood levels of liver enzymes and green space exposure during pregnancy. However, studies on such an association with adult liver enzyme levels are currently nonexistent. We investigated associations between long-term green space exposure and serum liver enzymes [aspartate aminotransferase (AST) and alanine aminotransferase (ALT)] in adult workers of the Electricity Generating Authority of Thailand (EGAT) in the Bangkok Metropolitan Region (BMR), Thailand.

METHOD: We conducted secondary analyses using data from 2,022 individuals (aged 25 to 55 as of 2009) in the EGAT3 cohort study from 2009 to 2019. Serum liver enzymes were measured in 2009, 2014, and 2019. The Normalized Difference Vegetation Index (NDVI), obtained from satellite data, was used to measure the level of greenness. The Kriging method was used to determine the average concentration of each air pollutant (PM10, O3, NO2, SO2, and CO). In this study, average NDVI and air pollutant concentrations were used at the sub-district level in BMR from 2008 to 2019. Each participant was exposed for an average of one year prior to their follow-up date. We used linear mixed effects models to assess the associations of NDVI with AST and ALT. We also tested the robustness of the results by adding air pollutants to the models.

RESULTS:Interquartile range increase in NDVI was associated with lower AST [-2.18% (95%CI: -3.74, -0.60)] after relevant confounders were controlled. The association between NDVI and AST was influenced by air pollutants, especially SO2. In contrast, we observed no association between NDVI and ALT.

CONCLUSIONS: There was an inverse association between NDVI and AST but not ALT in the EGAT cohort of adult workers. Air pollution has a significant impact on the association between NDVI and AST. Further studies in other settings and populations are required to confirm our findings.

Keywords: Long-term exposure, green space, air pollution, liver enzymes

Associations between greenness and rhinitis in the Constances cohort

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BACKGROUND AND AIM:Rhinitis is one of the most common diseases, for which environmental factors probably play a role. Among them, greenness could be a potential protective or deleterious factor, and these relationships may differ according to the degree of urbanicity. Furthermore, the associations could be different between allergic rhinitis (AR) and non-allergic rhinitis (NAR) phenotypes, but no study has investigated the effect of greenness exposure on NAR. Our aim was to investigate the associations between greenness exposure and rhinitis among adults from the population-based cohort Constances.

METHOD:Questionnaire responses at inclusion (2012-2019) were used to define current rhinitis (CR), allergic (AR) and non-allergic rhinitis (NAR). Greenness exposure was estimated using Normalized Difference Vegetation Index (NDVI) within 300 meter around each participant's residential address. Cross-sectional analyses were all stratified by urban unit defined by the French National Institute of Statistics and Economic Studies (Insee), as greenness decreases with increasing urbanicity. Logistic models adjusted for age, sex, smoking status, education level and French deprivation index were used. Main analyses were performed as complete cases. Sensitivity analyses were conducted using marginal model, multiple imputations, and with other NDVI buffers.

RESULTS: Among the 168,787 participants included in the analyses, 35.4% had CR, 24.6% AR, and 10.8% NAR. An increase of 0.10 NDVI was significantly associated with a decreased risk of CR in center cities (OR: 0.95 (95%CI: 0.94-0.97)), isolated cities (0.91 (0.88-0.94)), and suburban areas (0.94 (0.92-0.95)) and for both AR and NAR. No significant association was found in rural areas for CR and for either AR or NAR. These results remained consistent in sensitivity analyses. CONCLUSIONS: Exposure to greenness was associated with a decreased risk of rhinitis in urban areas

CONCLUSIONS: Exposure to greenness was associated with a decreased risk of rhinitis in urban areas and thus could be a potential lever for public-health policies to reduce rhinitis prevalence.

Keywords: Environmental epidemiology, Green space, Respiratory outcomes, Allergies, Built environment

OP-097[Neurologic and mental health outcomes » Mental health outcomes]

Effects of urban green land use types on parental depression and anxiety during pregnancy

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BACKGROUND AND AIM: While residential green spaces have been shown to have beneficial effects on mental health, few studies have examined their impact on parental mental health during pregnancy, particularly in urban areas. This study aims to examine the association between urban green land use types (UGLUTs) and parental depression and anxiety during each trimester, using data from an ongoing cohort study: the Longitudinal Examination Across Prenatal and Postpartum Health in Taiwan. METHOD: We analyzed participants who were recruited between January 2011 and March 2020 during their prenatal visits and lived in the Greater Taipei Area. Parental depression and anxiety status were evaluated at each trimester using the Edinburgh Postpartum Depression Scale and the State-Trait Anxiety Inventory-State scale, respectively. UGLUTs, which includes school, park, and forest area, were estimated within a designated radius surrounding participants' residences. Multiple regressions were used for examination.

RESULTS:A total of 1,116 couples were included in the analysis. During each trimester, mothers reported higher levels of depression and anxiety than fathers. In final models, we observed school areas (per 1 km² increased, β =-3.38 (95% C.I.= (-5.16, -1.6)) were beneficial for maternal depression during the first trimester, while park areas (per 1 km² increased, β =-16.01 (95% C.I.= (-23.92, -8.10) at the first trimester, and β =-16.45 (95% C.I.= (-24.16, -8.74) at the second trimester) were beneficial for maternal anxiety. Although, forest areas were beneficial for paternal depression and anxiety, no significant was observed.

CONCLUSIONS:Our results provide valuable insights into the relationship between green space and parental mental health during pregnancy in an urban setting, highlighting the important role of urban green spaces in promoting maternal mental health.This work was supported by National Science and Technology Council, Taiwan (MOST111-2314-B038-043-MY3, MOST108-2314-B-038-083-MY, MOST105-2314-B-038-031-MY3, NSC102-2314- B-038-038-MY3, NSC99-2628-B-038-015-MY3).

Keywords: Green space, mental health, parents

Associations between neighbourhood green space and multiple birth outcomes across two metropolitan areas in Australia

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BACKGROUND AND AIM: Beneficial effects of green space on birth outcomes have been reported. However, insights on key windows of exposure and underlying mechanisms are needed. METHOD: Births in Sydney (2016-2019) were retrieved from NSW Midwives Data Collection. Births in Brisbane (2000-2014) were retrieved from Queensland Health Perinatal Data Collection. Satellite image-derived normalized difference vegetation index (NDVI) and night time light (NTL) index were used. For each city, linear regression models were used to assess associations between green space and birth weight, and logistic models to estimate the risks of preterm birth (PTB), low birth weight (LBW), and small for gestational age (SGA) per interguartile range (IQR) increase in NDVI. We examined the trimester-specific associations, and heterogeneities by exposure to night time light. RESULTS: The study included 193264 singleton births in Sydney and 155606 singleton births in Brisbane. An IQR increase in green space during whole pregnancy was associated with 25.6 g (95%CI 21.4 to 29.8) increase in birth weight in Sydney, and 12.1 g (9.48 to 14.6) in Brisbane. The odds ratios were 0.96 (95%CI 0.94 to 0.99) for LBW, 0.98 (0.95 to 1.01) for PTB, and 0.96 (0.93 to 0.98) for SGA per IQR increase in NDVI during whole pregnancy for participants in Sydney. Similarly, reduced odds of adverse birth outcomes were observed in Brisbane. Trimester specific models demonstrated a consistent pattern of associations in the same direction across all outcomes. We found that effects of green space exposure on birth outcomes attenuated after adjusting for NTL, but stronger effects among babies of mothers from areas with more NTL.

CONCLUSIONS: These findings suggest a beneficial association between neighbourhood green space and healthier pregnancies in urban areas. We provide novel evidence of interactions between green space and NTL.

Keywords: green space, birth weight, preterm birth, small for gestational age, night time light

Health risk assessment of PM2.5 and PM2.5bound trace elements in Pretoria, South Africa

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BACKGROUND AND AIM: In Africa, there is a shortage of studies that assess the risks of air pollution on human health. A study was therefore conducted in Pretoria, South Africa, employing the health risk framework of the US EPA.

METHOD:PM2.5 samples were collected on PTFE filters over 24 hours and every third day at an urban background site during 16 April 2017 to 28 February 2020 (n=350). X-ray fluorescence was used to analyse the elemental composition. The study was carried out for total PM2.5 and the eight trace elements (Br, Cl, K, Ni, S, Si, Ti and U) for which the United States Environmental Protection Agency (US EPA) lists reference concentrations. The World Health Organization (WHO) air quality guideline of 5 μ g/m3 and the yearly South African National Ambient Air Quality Standard of 20 μ g/m3 were used as reference dosages for total PM2.5. Inhalation was assumed to be the predominant route of exposure.

RESULTS:The average PM2.5 concentration during the 34-month study period was 23.2 µg/m3. The 24-hour WHO guideline of 15 µg/m3 was exceeded on 217 of the 350 sampling days and the 24-hour South African standard of 40 µg/m3 was exceeded on 53 days. The average PM2.5 levels were significantly higher during autumn and winter compared to spring and summer. The HQ values for total PM2.5 were 1.17, 3.47, and 3.78 for adults, children, and infants, respectively. Trace elements K, Cl, S and Si had non-carcinogenic risks above 1 for adults throughout the year, with Si being the highest during autumn (1.9) and S during spring (5.5). HQ values for K and Cl were highest during winter. Ni posed a cancer risk throughout the year, whilst As posed a cancer risk during winter. CONCLUSIONS:Ambient PM2.5 and its trace element components pose a risk to human health in Pretoria.

Keywords: Health risk assessment, PM2.5, trace elements, South Africa

Personal, household, and community PM2.5 exposure by cooking and heating fuel use and other key characteristics in the CKB-Air study

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BACKGROUND AND AIM:We aimed to assess the integrated and time-resolved personal, household, and community PM_{2.5} exposure patterns associated with different cooking and heating fuels and other key characteristics in rural and urban China.

METHOD: The CKB-Air study involved parallel measurements of personal, household, and community PM_{2.5} in summer (MAY-SEP 2017) and winter (NOV 2017-JAN 2018) in ~380 participants from one urban and two rural communities in China, with ~61,000-81,000 person-hours of data across different locations after data cleaning. Age- and sex-adjusted geometric means of PM_{2.5} were calculated, by key participant characteristics overall and by season. Spearman correlation coefficients between PM_{2.5} levels across different locations were computed.

RESULTS:Solid fuel users had ~90% higher personal and kitchen 24-hour average $PM_{2.5}$ exposure than clean fuel users or those who did not cook or heat. They also had a more substantial increase (~75%) in personal and household $PM_{2.5}$ in winter (versus summer) compared to other participants
(~20%), whereas community levels were 2-3 times higher in winter regardless of fuel use. Overall, solid fuel users had markedly higher weighted annual average PM_{2.5} exposure (personal: 77.8 [71.1-85.2] μ g/m³, ~90% higher; kitchen: 103.7 [91.5-117.6] μ g/m³, ~130% higher; living room (62.0 [57.1-67.4] μ g/m³, ~65% higher) than clean fuel users. There was a remarkable diurnal variability in PM_{2.5} exposure among the participants, with 5-minute moving average 700-1,200 μ g/m³ in typical meal times. Personal PM_{2.5} was moderately correlated with living room (Spearman r: 0.64-0.66) and kitchen (0.52-0.59) levels, but only weakly correlated with community levels, especially in summer (r_summer_range: 0.15-0.34) and among solid fuel users (r_summer_range: 0.11-0.31). CONCLUSIONS:Solid fuel use for cooking and heating was associated with estimated annual personal and household PM_{2.5} exposure levels at 15-20 times the WHO Air Quality Guideline. Household PM_{2.5} was a better proxy of personal exposure than community PM_{2.5} in this setting.

Keywords: Particulate matter, Exposure assessment, Air pollution

OP-101[Methods » Causal inference]

Ambient carbon monoxide and sepsis risk: Triangulation of evidence in Hong Kong

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BACKGROUND AND AIM: While exposure to certain kinds of air pollutants has been associated with increased sepsis risk, carbon monoxide (CO), a well-known environmental toxicant at high level (>3000 ppm), has attracted substantial interest from scientists due to its therapeutic potential on sepsis ('blood poisoning') at low concentrations (50~500ppm). Yet it remains unknown whether our ambient exposure to CO $(0.5 \sim 5ppm)$, which is ubiquitous and inevitable, can affect human health. This study aims to infer the causal relationship between ambient CO and sepsis risk. METHOD: Daily data of sepsis emergency hospital admissions, air pollution, and weather in Hong Kong were collected for the period of 1998-2008. A thoughtful selection of three distinct methods -traditional generalized additive model (GAM), dynamic system approach empirical dynamic modelling (EDM), and constraint-based causal discovery method Peter-Clark-momentary-conditionalindependence plus (PCMCI+) -- were applied for the data analysis and causal inference. RESULTS: A negative effect of ambient CO on sepsis emergency hospital admission was consistently identified in all three methods used. In GAM, this protective effect of CO is found at lag1 and lag2 days. In EDM, this beneficial effect emerges at lag0, lag1, and lag2 days, with a peak at lag1 day; and CO effect size varies with CO concentrations. In PCMCI+, similar effect is also detected, at lag2 day. CONCLUSIONS: This study selected 3 distinct methods, GAM, EDM, and PCMCI+, to analyze the same time series dataset for the triangulation of evidence on the relationship between ambient CO and emergency admissions of sepsis. Causal analysis supports the hypothesis that CO bears a negative causal influence on sepsis risk. Ambient CO exposure as low as 0.5-5ppm may exhibit a protective effect on sepsis. The findings of this study can not only help complement the spectrum of CO health effects but contribute to environmental health policy making.

Keywords: Air pollution, Short-term exposure, Environmental epidemiology

Air Pollution Indexes, a Latin América focused scoping review and recommendations

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BACKGROUND AND AIM: Air quality indices are risk communication tools that allow decision makers and the general population to know the effects of air pollution on their health and make decisions that reduce exposure; its use is promoted by the World Health Organization as a strategy for countries to improve air quality and adhere to its air quality guidelines. The aim was systematically mapping which indexes are used in cities and countries in Latin America, which new indexes were proposed, their building and validation methods, and gaps in knowledge.

METHOD: We reviewed articles published between 2013 and 2023 in Pubmed and Latin American databases (Scielo, Redalyc and Dialnet), and gray literature documents from government sources; Prisma's indications for scope review were followed, and documents were processed in the Endnote 20 software.

RESULTS:314 documents were obtained after duplicates removal, which were filtered by title and abstract, leaving 56 for full text reading. All countries use independent pollutant type indices, following the US EPA index; none of the indices is based on human health effects, and none of them have had validation processes for their operation and communication to the public. No documents were found that evidence the use of indices in several countries. Of the existing indices, the most stringent follow intermediate objectives 2 and 3 of the WHO guidelines, but not the guideline value. Few indices are linked to alert or contingency systems for air quality.

CONCLUSIONS: Air quality indices are a useful tool in risk management and communication, but few countries in the region implement them. It is recommended to promote its use so that the population knows the effects on their health and promote air quality management.

Keywords: air pollution indices and human health, knowledge translation, risk communication

Vertical characteristics and predictive model development of bioaerosols in Taipei Metropolis

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BACKGROUND AND AIM: Bioaerosols may cause various health effects. However, few studies were conducted to develop land use regression models for bioaerosols. Furthermore, the influence of height has not been discussed in such models. Thus, this study aims to identify vertical characteristics and develop predictive models of bioaerosols in Taipei Metropolis.

METHOD:The sampling was performed at two buildings in Taipei Metropolis from August 2016 to November 2020. Samples were collected from the first-, sixth-, and eleventh-floor balconies of one building, and the seventh and thirteenth-floor balconies of the other. Each air sample was collected for 24 hours using polycarbonate filters with a pore size of 0.4 μ m and a 3-piece 37mm plastic cassette holder. The samples were extracted and analyzed for fungal spores and endotoxin. Mixed models will be used to develop land use regression models, and an exponential correlation covariance structure will be used for controlling the autocorrelation of repeated measurements.

RESULTS: The highest fungal spore concentrations were observed in spring and on the ground level. The fungal spore levels ranged from 146 to 1821 spores/m³. The most prevalent fungal taxa were ascospores, *Aspergillus/Penicillium*, basidiospores, and *Cladosporium*. The concentrations of endotoxin ranged from 0.06 to >20.89 EU/m³, and the highest concentration was found in summer and on the ground level. Based on our preliminary analysis, wind speed and precipitation are the main predictors of fungal spore concentrations. Similarly, wind speed is negatively correlated with the concentration of endotoxin.

CONCLUSIONS: The results of this study will provide the vertical and seasonal characteristics of fungal spores and endotoxin in a metropolis. Besides, land use regression models will be developed to evaluate potential bioaerosol exposure of health impacts on the public.

Keywords: exposure assessment, microbes, modeling

Hourly LUR modelling of hyperlocal long-term average NO2 using mobile monitoring data

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BACKGROUND AND AIM: The association between time-activity based exposure and health outcomes is debated due to the lack of spatiotemporal maps of hyperlocal long-term air pollution. The random roaming collection strategy of the mobile monitoring campaign results in air pollution being measured in large spatial coverage. However, most locations can rarely be measured uniformly for every hour. This work evaluated the merit of adding a temporal dimension to the land-use regression (LUR) model for interpolating hourly hyperlocal NO2 maps using spatiotemporally unstructured mobile measurements.

METHOD: We monitored 1-second NO2 in Amsterdam for 10 months (5.7 Million GPS points) and then aggregated these points into 50m road segments in one-hour intervals. We exanimated two spatiotemporal LUR models, namely ST-Kriging and GTWR (Geographical and Temporal Weighted Regression), and two spatial LUR models implemented separately in each hour, namely RF_LUR (random-forest based LUR) and SLR (Linear Stepwise Regression). Comprehensive spatial, temporal and spatiotemporal validations were performed against independent hourly long-term routine monitoring measurements (RIVM, n=9).

RESULTS: Different levels and spatiotemporal patterns were observed for different seasons and road types. NO2 at major roads during warm seasons was on average 2.5 times higher than residential locations during cold seasons. GTWR achieved the best performance and its timeseries of predictions was the smoothest across hours. While the other models were affected more erratically by the fluctuation of opportunistic mobile measurements caused by the random sampling. The spatiotemporal distribution of NO2 strongly followed the intra-urban commuting pattern.

CONCLUSIONS: The spatiotemporal LUR model can capture spatiotemporal autocorrelations hidden in opportunistic mobile measurements. The interpolated hourly hyperlocal NO2 maps stimulate the paradigm shifts towards dynamic exposures in epidemiology analysis.

Keywords: Oxides of nitrogen, Spatial statistics

Examining the spatial variation of heatwaverelated morbidity and mortality in Adelaide, Australia

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BACKGROUND AND AIM: Heatwaves are a growing concern to population health, causing increased morbidity and mortality. As the climate continues to warm, it is critical to understand the impact of heatwaves at a fine spatial scale to inform effective policy, planning, and interventions for the most affected communities. This study aimed to examine heatwave impacts on morbidity and mortality in Adelaide at a small geographical level using five indicators: General Practitioner (GP) visits, ambulance-callouts, Emergency Departments (ED) presentations, hospitalisations, and deaths. METHOD: We collected data on GP visits (2011-2016), ambulance-callouts (2005-2014), ED presentations (2005-2014), hospitalisations (2005-2014), deaths (2007-2017), and vulnerability factors (socio-demographic, health, and environmental). Using a space-time-stratified case-crossover design we quantified the impact of heatwaves (defined using Excess Heat Factor) on health outcomes during the warm-season (October-March) at the Statistical Area Level 2 (SA2) geography (representing suburbs). Effect modification by neighborhood characteristics was examined, and city-level estimates were pooled using random-effects meta-analyses. Results are reported as percent increase in risk according to heatwave-severity compared with non-heatwaves and mapped to spatially represent risks.

RESULTS:A dose-response relationship was evident between health outcomes and heatwaves in Adelaide across the heatwave-severity, with significant increases observed in GP visits, ambulance-callouts, ED presentations, hospitalisations, and mortality. Of concern, ambulance callouts showed the highest increase at 21% (95%CI: 18-25%) during severe/extreme heatwaves compared to non-heatwaves. Spatial variations in the impact of heatwaves were observed, with high-risk areas identified in the western and southern suburbs. These areas were associated with a higher proportion of people living in rented housing, living alone, living in flats, having diabetes, and low vegetation cover.

CONCLUSIONS: The impacts of heatwaves go beyond mortality, and hospitalisations to include frontline health services such as GPs, ambulance-callouts, and EDs. The significant increase in spatially variable health outcomes in Adelaide warrants geographically targeted public health strategies to reduce heatwave-associated health outcomes.

Keywords: Heatwave, Morbidity, Vulnerability, Mortality, Neighbourhood

Current and projected heatwave-attributable occupational injuries, illnesses, and associated economic burden in Australia: a national timeseries

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BACKGROUND AND AIM: The costs of climate change are substantial. These include costs from occupational illnesses and injuries (OIIs), which have been associated with increases during heatwaves. This study estimated retrospective and projected future heatwave-attributable OIIs and their costs in Australia.

METHOD:Climate and workers' compensation claims data were extracted from seven Australian capital cities representing OIIs from July 2005 to June 2018. Heatwaves were defined using the Excess Heat Factor. OIIs and associated costs were estimated separately per city with time-series distributed lag non-linear models. City estimates were pooled with multivariate meta-analysis to derive national estimates. Results were projected to 2030 (2016-2045) and 2050 (2036-2065).

RESULTS:Of all OIIs, 0.13% (95%eCI: 0.11-0.16%) were heatwave-attributable, equivalent to 120 (95%eCI:70-181) OIIs annually. 0.25% of costs were heatwave-attributable (95%eCI: 0.18-0.34%), equal to \$AU4.3 (95%eCI: 1.4-7.4) million annually. Estimates of heatwave-attributable OIIs by 2050, under Representative Concentration Pathway [RCP]4.5 and RCP8.5, were 0.17% (95%eCI: 0.10-0.27%) and 0.23% (95%eCI: 0.13-0.37%), respectively. National costs estimates for 2030 under RCP4.5 and RCP8.5 were 0.13% (95%eCI: -0.27-0.46%) and 0.04% (95%eCI: -0.66-0.60), respectively. These estimates for extreme heatwaves were 0.04% (95%eCI: 0.02-0.06%) and 0.04% (95%eCI: 0.01-0.07), respectively. Cost-AFs in 2050 were, under RCP4.5, 0.127% (95%eCI: -0.27-0.46) for all heatwaves and 0.04% (95%eCI: -0.01-0.09%) for extreme heatwaves. Attributable fractions were approximately similar to baseline when assuming theoretical climate adaptation. CONCLUSIONS:Heatwaves represent notable and preventable portions of preventable OIIs and economic burden. OIIs are likely to increase in the future, and costs during extreme heatwaves in 2030. Workplace and public health policies aimed at heat adaptation can reduce heat-attributable morbidity and costs.

Keywords: Temperature, Occupational exposures, Environmental epidemiology, Occupational epidemiology, Modeling

Associations of occupational heat exposure and stomach cancer in a population-based casecontrol study

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BACKGROUND AND AIM:Global warming is increasingly affecting human populations. Occupational heat stress occurs frequently, however little is known regarding potential long-term adverse health effects of chronic occupational heat exposure. In other recent work, we examined associations of lifetime occupational heat exposure and colorectal cancer in a large Spanish multi-case-control study (MCC-Spain). We observed no clear evidence for associations with ever occupational heat exposure overall, though there were some positive associations observed among women in the highest categories of lifetime cumulative exposure and duration. Here we extend work to examine potential

associations with stomach cancer.

METHOD:Data from a total of 459 incident stomach cancer cases and a common set of 3,440 matched controls recruited from 10 regions from 2008-2013 in MCC-Spain were examined. The Spanish job exposure matrix, MatEmEsp, was used to assign heat exposure estimates to participant lifetime occupational history. Three exposure indices were constructed: ever vs. never, duration (years), and cumulative exposure. We estimated odds ratios (ORs) and 95% confidence intervals (CIs) adjusting for 5-year age group, sex, education, body mass index, cigarette smoking status, and family history of stomach cancer.

RESULTS:Overall, 53.9% included cases and 37.7% of controls were ever occupationally exposed to heat. There was a positive association of ever occupational heat exposure and stomach cancer overall (odds ratio (OR) 1.45; 95% CI 1.10, 1.90). ORs were also elevated in the medium (OR 1.52; 95% CI 1.06, 2.17) and highest tertiles of lifetime cumulative exposure (OR 1.62; 95% CI 1.12, 2.34) (p trend < 0.05), as well as of duration of exposure (ORs 1.88; 1.24, 2.86 and 1.41; 0.98, 2.03 respectively) (p trend = 0.02).

CONCLUSIONS: Preliminary findings provide some evidence for a positive association of occupational heat exposure and stomach cancer risk in MCC-Spain; findings are being extended in a pooled analysis of data from three case-control studies.

Keywords: stomach cancer, occupation, heat

Heat Exposure and Acute Kidney Injury in a Sonoran Agricultural Population

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BACKGROUND AND AIM: Agricultural workers in the US-Mexico border region are exposed to heat and high intensity working conditions on a daily basis, increasing the risk for heat stress and other heatrelated health conditions. As an individual's body temperature increases and body mass is lost via sweat, acute kidney injury (AKI) can occur. The aim of this study is to assess the relationship between heat on AKI in agricultural workers

METHOD: A cohort of adult males working in agriculture (n=72) and the non-agricultural sector (n=21)in Sonora, Mexico was recruited in Spring 2019 and followed through summer. A guestionnaire including demographics, work history, historical heat exposure, medical history, and occupational exposures was administered at enrollment. Wet-bulb-globe temperature and anthropometric measurements were recorded. Physiological strain index (PSI) was calculated for each participant to estimate heat exposure. Urine was collected and analyzed for AKI biomarker neutrophil gelatinaseassociated lipocalin (NGAL) and creatinine. All measurements were collected twice, once in spring and once in summer. We compared NGAL levels in agricultural workers to office workers during both the spring and summer seasons, and evaluated changes in NGAL over time using t-tests. RESULTS: Agricultural workers reported higher levels of speaking an Indigenous language as their primary language in a predominantly Spanish-speaking area, lower education rates and pay, and higher rates of migration for work compared to non-agricultural workers. NGAL levels in agricultural workers were significantly higher in the summer than in the spring (p<0.001), suggesting that NGAL varies by season and that heat exposure may affect kidney functioning. However, NGAL levels were not different between agricultural and office workers, during either spring or summer (p>0.05). CONCLUSIONS: As the number of hot days and heat waves is expected to increase globally, it is expected that vulnerable populations, including agricultural workers, will experience increased heatrelated morbidity and mortality.

Keywords: Occupational Exposures, Environmental Disparities, Temperature

Heat-related illness among workers in British Columbia: Extreme hot weather in 2021 compared to 2001-2020

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BACKGROUND AND AIM: The summer of 2021 in British Columbia (BC), Canada, was characterized by unprecedented high temperatures, yielding substantial increase in attributable deaths. This study aimed to characterize the ambient temperature, and demographics, industry sectors, and occupations of workers with heat-related illness (HRI) from 2021 summer compared to historical averages. METHOD: We identified work-related HRI from accepted workers' compensation claims among workers aged 15 and greater in BC, 2001-2021. Incidence rates were calculated by age, sex, industry sector, and occupation, using working population estimates from Statistics Canada's Labour Force Survey. HRI claims that occurred during the 2021 summer were compared to those during summers from 2001-2020.

RESULTS:521 eligible claims were identified between June and August from 2001-2021, of which 107 (20.5%) occurred in 2021. The incidence rates for 2021 and typical summers were 3.97 (95% confidence interval, 3.26-4.80) and 0.93 (0.85-1.03) claims per 100,000 workers, respectively. This difference represents a 327% increase. The 99th, 95th, and 90th percentiles of summertime daily maximum temperatures by Local Health Areas accounted for 20.6%, 49.5%, and 64.5% of claims, respectively, in 2021. Whereas in typical summers, they accounted for 8.5%, 32.4%, and 46.4% of claims, respectively. Incidence rates in 2021 were amplified, but consistent with typical summers, in that they were higher among younger workers, male workers, those working in public administration industry sector, and those with occupations related to primary industry; trades, transport, and equipment operators; and processing, manufacturing, and utilities. Strikingly, rates in 2021 were exacerbated in industry sectors of transportation and warehousing; and agriculture, forestry, fishing, and hunting, as well as intermediate-level occupations in primary industry and health occupations. CONCLUSIONS:The unprecedented hot weather in 2021 placed some workers at higher risk of HRI. The study findings may inform development and improvement of prevention strategies targeting atrisk workers. This research was funded by WorkSafeBC.

Keywords: climate, temperature, temperature extremes

Impact of indoor/ambient temperature on urinary biomarkers for oxidative stress among the elderly: a panel study in Hong Kong

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BACKGROUND AND AIM: The subclinical pathophysiological responses to temperature and their contribution to development of health abnormalities are not well understood. Hence, this study aimed to measure indoor temperature, which more accurately reflects individual exposure than ambient temperature, and examined its short-term impact on urinary biomarkers for oxidative stress. We also compared the potential health effects of indoor temperature to those of ambient temperature. METHOD: We conducted a panel study of 45 healthy elderly individuals aged 60 and above in Hong Kong during 2021-22. Each participant was followed for 6 consecutive days in the summer and winter campaign, respectively. Temperature/Relative Humidity (RH) data loggers were placed in the participant's residence and monitored indoor climate throughout the sampling periods. Urine samples were collected on each sampling day at a 24-h interval and tested for the levels of two established biomarkers for oxidative stress, i.e., 8-hydroxy-deoxy-guanosine (8-OHdG) and malondialdehyde (MDA). Ambient weather data were extracted from Hong Kong Observatory and matched to participants' residence. We applied generalized mixed-effect models to estimate the associations of indoor/outdoor temperature with the levels of biomarkers, controlling for potential covariates and within-participant correlation.

RESULTS:Of the 45 participants, 25 were females and the median age (interquartile range) was 83 (80 - 85) years old. We found that increased mean 0-24h indoor temperatures were associated with decreased levels of 8-OHdG and increased levels of MDA in urine samples, after controlling for covariates. Similar associations were found for ambient temperature but with different magnitudes of estimated effects.

CONCLUSIONS: This study provides insight into the role of indoor temperature exposure in potential pathophysiological mechanisms of oxidative stress responses and highlights the need to monitor personal-level exposure to environmental stressors when assessing its health impact. The findings will inform future climate research and temperature regulation intervention.

Keywords: Biomarkers of exposure, Climate, Environmental epidemiology, Short-term exposure, Temperature

Associations between daily PM2.5 exposure and hospitalizations for COVID-19

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BACKGROUND AND AIM: The COVID-19 pandemic has resulted in over 103 million COVID-19 cases in the United States (US). However, studies of associations between environmental exposures and COVID-19 hospitalizations are limited. We examined associations between fine particulate matter (PM2.5) and COVID-19 hospitalizations within the National COVID Cohort Collaborative (N3C) – a national electronic health record (EHR) resource.

METHOD:This study utilized 83,353 individuals with a hospital-confirmed SARS-CoV-2 infection between January 1, 2020 and December 31, 2020. Information on SARS-CoV-2 infection, COVID-19 hospitalizations, disease history, and demographics were collected from EHRs. PM2.5 exposures were estimated using ground-based regulatory monitoring data. Daily PM2.5 observations were averaged over the 21 days prior to each COVID-19 hospitalization and were linked with each individual based on residential zip code. Core Based Statistical Area (CBSA; a geographical unit for urban areas)-specific analyses were performed followed by regional meta-analyses. Associations were modeled using a time-stratified case-crossover approach, control periods matched on month, year, and day of week, that adjusted for temperature, precipitation, dew point, day of week, CBSA-specific days since pandemic start, and county-level COVID-19 cases. Associations are reported as the odds ratio (OR) and 95% confidence interval (CI).

RESULTS:There was substantial variation in associations by CBSA and Census region. Associations were observed in the South region (OR = 1.04; 95% CI = 1.01, 1.08) with the other regions having generally null associations. In the South, associations were larger for those with those cardiovascular disease (OR = 1.07; 95% CI = 1.04, 1.11), metabolic disease (OR = 1.06; 95% CI = 1.02, 1.10), and age < 65 (OR = 1.07; 95% CI = 1.02, 1.11).

CONCLUSIONS: In this study, PM2.5 exposure was associated with COVID-19 hospitalization in the southern US. This could have important implications for understanding how the SARS-CoV-2 pandemic unfolded. This abstract does not necessarily represent EPA policy.

Keywords: COVID19, Air pollution, hospitalizations, electronic health records

OP-112[Air pollution » General]

The impact of sulfur dioxide in industrial areas of Taiwan during the COVID-19 epidemic period

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BACKGROUND AND AIM:To prevent the spread of COVID-19, it caused the tremendous effect on international industry chain. In Taiwan, there was no policy to restrict industrial activities due to COVID-19. Therefore, our study compared the changes in sulfur dioxide (SO₂) concentrations in industrial areas of Taiwan during the COVID-19 epidemic period.

METHOD: We collected hourly SO₂ data from five industrial area air quality monitoring stations of Taiwan EPA from 2015 to 2022. Using one-way ANOVA analysis, we compared the differences of the average daily SO₂ concentrations among the level 3 alert period ($5/19 \sim 7/25$) and the preceding and following periods in 2021. And we compared the average daily SO₂ concentrations among the level 3 alert period in 2021 and corresponding periods in 2020 and 2022. In addition, the average monthly data from 2015 to 2019 were used for Theil-Sen trend estimation to predict the SO₂ concentrations during 5/19 to 7/25 in 2020~2022 to calculate the difference between the actual and predicted SO₂ concentrations.

RESULTS:The average daily concentration of SO₂ during the level 3 alert period was 1.75±0.81 ppb, which was significantly lower than the preceding period of 2.05±0.89 ppb, and it recovered to 2.00±0.81 ppb after the alert period. Furthermore, the average daily SO₂ concentrations for the same period ($5/19 \sim 7/25$) from 2020 to 2022 were 2.03±0.58 ppb, 1.75±0.81 ppb, and 1.52±0.50 ppb, respectively, with a significant decrease in concentrations. According to Theil-Sen trend estimation, the predicted SO₂ concentrations were decreasing year by year. But the actual values for 2020, 2021, and 2022 increased by 16%, 22.8%, and 37% compared to the predicted values.

CONCLUSIONS: The SO₂ concentrations in Taiwan decreased with stricter precaution for COVID-19 prevention. However, the actual concentrations were higher than predicted ones, and the differences were increasing with the worsening of the COVID-19 epidemic.

Keywords: COVID-19, Air pollution, Occupational exposures, Environmental epidemiology

COVID-19 infection risk assessment in a kindergarten utilizing continuous air quality monitoring data

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BACKGROUND AND AIM:Researchers and transnational public health organizations have recognized aerosol transmission as an essential route of COVID-19 transmission. Therefore, improving ventilation systems is now adopted as a core preventive measure. As young children aged 2-6 in kindergartens generally lack vaccine protection and multiple infection clusters have been identified during the pandemic, we aimed to evaluate the effectiveness of ventilation systems and the risk of aerosol transmission in kindergartens in Taiwan.

METHOD: From August to November 2021, we conducted on-site visits and continuously monitored indoor air quality indicators, such as PM2.5, carbon dioxide (CO₂), relative humidity, and temperature, in a kindergarten located in northern Taiwan. We utilized the Wells-Riley model to estimate the basic reproduction number (R0) of each classroom and staff office, with input parameters including the number of occupants, duration of their stay, and indoor/outdoor carbon dioxide concentration. Contagious settings were defined as those where the R0 estimates exceeded 1. We conducted a scenario and sensitivity analysis to assess the effect of simulated improvement measures. RESULTS:During school hours, the average concentration of CO₂ in each classroom and staff office exceeded 900 ppm. The R0 estimates gradually increased from Monday to Friday and throughout school hours, corresponding to the hourly and daily distribution of the CO2 concentration, which could not dissipate completely during off-duty time. The R0 estimates during school hours ranged from 3.01 to 3.12 in classrooms with a maximum of 30 occupants. To lower the R0 estimates, a substantial reduction in the number of occupants, the duration of their stay, and/or indoor CO₂ concentration is needed.

CONCLUSIONS: The risk of outbreaks of cluster infections in kindergartens should not be underestimated. Feasible strategies to mitigate this risk include improving ventilation systems through engineering controls and limiting the number of indoor occupants and their residence time through administrative controls.

Keywords: COVID-19, Modeling, Occupational exposures, Policy and practice, Science communication

School-level COVID-19 preventive measures and infection rates in England's primary and secondary schools in the Autumn 2021: an ecological analysis

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BACKGROUND AND AIM: We aimed to describe the school-based COVID-19 preventive measures implemented in English schools in the Autumn 2021, when the SARS-CoV-2 Omicron variant was emerging, and explore their ecological associations to incident SARS-CoV-2 infections in pupils. METHOD: We used data from England's COVID-19 Schools Infection Survey (SIS), a nationally representative sample of publicly-funded primary and secondary schools. Between November and December 2021, headteachers completed questionnaires about the implementation of preventive measures, which we grouped into four hazard-control domains: elimination (e.g. stay-at-home when sick), engineering (e.g. improving ventilation), administrative (e.g. pupil bubbles) controls, and personal protective equipment (PPE; e.g. facemasks). We investigated their association with school-level COVID-19 infection rates in pupils (from laboratory reports) during the Autumn 2021 term using negative binomial regression models adjusting for school-level characteristics.

RESULTS:Overall 107 headteachers completed the questionnaires (76 primary and 31 secondary schools). Most schools were in urban areas (78.5%), and about 40% of eligible pupils had received at least one COVID-19 vaccine dose. The levels of implementing preventive measures varied among schools, with most schools implementing engineering controls (84%) and elimination controls (57.5%), while fewer schools used administrative controls (43.3%). More secondary schools (58.7%) implemented PPE than primary schools (26.81%). After adjusting for covariates, we found no associations at the school-level between control measures and COVID-19 incidence in pupils in the Autumn 2021 term.

CONCLUSIONS: We describe a useful framework to investigate SARS-CoV-2 infection control measures in schools, in a period of intense community transmission. The variability in implementation between schools likely reflects the local epidemiological situation, risk perception, health-seeking behaviour, and implementation challenges. Rapidly changing epidemiological circumstances and adaptive changes to preventative measures may have contributed to a blurring of ecological associations. Further studies using a similar hierarchy of controls framework are needed.

Keywords: COVID-19, Infectious diseases, Public health, Occupational exposures

OP-115[Air pollution » Traffic-related]

Air pollution mortality benefits of sustained COVID-19 mobility restrictions in Australian cities

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BACKGROUND AND AIM:In many cities around the world, emissions from road traffic, power generation and industry were substantially reduced during COVID-19 lockdown periods. We analyse the reductions in traffic-related air pollution (in Australian capital cities?) during the Australian lockdown period (March-April 2020) and then model the potential life expectancy benefits that could be realised if similar reductions were sustained through structural policy interventions. METHOD:Satellite-based observations were used to estimate ground-level nitrogen dioxide (NO2) concentrations in all Australian capital cities during: (a) a typical year with no prolonged air pollution events; (b) a hypothetical sustained reduction in NO2 of equivalent to the COVID-19 lockdowns. We use the WHO recommended NO2 exposure-response coefficient for mortality (1.023, 95% CI: 1.008–1.037, per 10 μg/m3 annual average) to assess gains in life expectancy and population wide years of life from reduced exposure to traffic-related air pollution. Sensitivity analyses evaluated the influence of alternative theoretical minimum exposure levels and an alternative NO2 exposure-response coefficient derived from an Australian study.

RESULTS: Although COVID-19 related reductions in NO2 varied widely between Australian cities, 3314 years of life would be gained annually if those NO2 concentrations were maintained.

CONCLUSIONS:As unprecedented policy scenarios, the COVID-19 lockdowns of Australian cities give us insight into the potential reductions in exposure to traffic-related air pollution from policies that limit the motor vehicle use. This paper provides an indication of the effect such a change in exposure would have on mortality if the change was sustained over decades. Future work should focus on the effectiveness of long-term measures in providing these sustained reductions in road traffic pollution in cities, for example by reducing motor vehicle use, improving engine and fuel standards, wider use of electric vehicles and reduced need for commuting.

Keywords: Long-term exposure, COVID-19

Risk assessment of airborne transmission of novel coronavirus (COVID-19) in long-distance transport

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BACKGROUND AND AIM: Airborne transmission is a major route of transmission of the novel coronavirus, including confined space like in public transportation of long-distance transport. This study evaluates the current air-conditioning ventilation of long-distance transport and estimates the risk of airborne transmission of disease.

METHOD:During 2020 to 2021, we recruited 32 long-distance bus drivers to evaluate effects of ventilation status on indoor air quality and risk of airborne transmission of novel coronavirus among drivers in a public transportation company. The continuous data of long-distance bus driving were recorded, including vehicle ventilation status, indoor carbon dioxide concentration (CO2) and number of passengers. The Well-Riley model was used to assess differences in basic reproduction number (RO) between groups by ventilation status.

RESULTS:A total of 108 transportations were included in the study analysis, including Taipei to Nantou, Chiayi, or Yuanlin. Of these, 52 were in the poor ventilation group. Multiple linear regression analysis found that turning on the ventilation device significantly reduced CO2 concentrations by 252.2 ppm with 95% CI [111.3 to 393.2]. The CO2 concentrations increased significantly by 35.1 ppm (95% CI [23.5 to 46.8] for each additional passenger. The basic reproduction number (R0) was 1.45 [0.68 to 2.15] in the poorly ventilated group and was significantly higher than that in the ventilation group (R0= 0.95 [0.44 to 1.43]).

CONCLUSIONS:Open a ventilation system can effectively reduce the CO2 concentration in longdistance passenger buses. The Well-Riley model assessment found that there is still a risk of outward transmission of novel coronavirus in poorly ventilated buses.

Keywords: COVID-19, Infectious diseases, Occupational exposures, Risk assessment

Urinary metals and incident Heart Failure in Indigenous communities in the US: Evidence from the Strong Heart Study

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BACKGROUND AND AIM: Exposure to metals, which is highly prevalent among Indigenous communities in the US, has been identified as an independent risk factor for cardiovascular disease. Heart Failure (HF) is a leading cause of death, yet the role of metal exposure on HF and HF subtypes remains understudied. We evaluate the prospective association between urinary metal levels and incident HF in the Strong Heart Study, the largest cohort of American Indian adults.

METHOD: Urinary inorganic arsenic(iAs), cadmium(Cd), molybdenum(Mo), selenium(Se), tungsten(W) and zinc(Zn) were measured at baseline (1989-1991)(n=2,076, mean age 56.3 years, 58% women). HF events were ascertained through 2019 by a physician-panel following a standardized protocol. Participants with ejection fraction (EF) available were classified as $EF \ge 50\%$ (preserved), and EF<50% (reduced). Progressively adjusted Cox proportional hazards models were used to identify the risk of incident HF and subtypes by an interquartile range (IQR) change in urine metals. RESULTS:444 participants developed incident HF (92EF≥50%, 118EF<50%, 234unclassified). Baseline levels of all metals were higher among participants who developed HF. In models adjusted by sociodemographic and clinical covariates, the hazard ratio (95%CI) for incident HF per IQR change in metal levels were 0.95(0.7, 1.29) for iAs, 1.08(0.84, 1.39) for Cd, 1.33(1.03, 1.72) for Mo, 1.11(0.84, 1.39) for Se, 1.69(1.25, 2.29) for Zn, and 1.04(0.83, 1.3) for W. The associations varied by HF subtype, with no significant associations between metal levels and $EF \ge 50\%$ while for EF < 50%, the HR (95%CI) per IQR metal level was 1.55(0.86, 2.78) for iAs, 1.26(0.78, 2.03) for Cd, 2.44(1.50, 3.99) for Mo, 1.67(0.96, 2.92) for Se, 2.14(1.18, 3.89) for Zn, and 1.61(1.06, 2.47) for W). CONCLUSIONS: We identified an association between baseline urine levels of several essential and non-essential metals and incident HF risk in the Strong Heart Study, with strongest associations for EF<50%. These findings can help identify novel modifiable risk factors of HF and inform prevention.

Keywords: metals, biomarkers of exposure, cardiovascular disease, heart failure, American Indians

Serum mercury is not associated with incident diabetes in a cohort of older Americans: findings from the REGARDS study

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BACKGROUND AND AIM:Laboratory studies suggest that mercury exposure may induce oxidative stress and cause pancreatic islet β -cell dysfunction. Although it is biologically plausible, data are inconsistent linking mercury exposure to the incidence of type 2 diabetes.

METHOD:A sub-cohort (N=2,666) was randomly selected from the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. The study population consisted of 1,227 participants (mean age=63) without baseline diabetes and had returned for the second measure of diabetes status. Serum mercury was assessed at baseline and was categorized into quartiles. Multivariable-adjusted odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) were estimated using logistic regression. In the sensitivity analysis, multiple imputation was used for missing data in the REGARDS random sub-cohort.

RESULTS:After controlling for potential confounders including demographic, behavioral, and medical factors, no statistically significant association was observed between serum mercury concentration and the incidence of type 2 diabetes. The adjusted odds ratio (OR) and 95% confidence interval (CI) across quartiles 1 to 4 were 1.00, 0.91 (0.47 - 1.76), 1.24 (0.65 - 2.37, and 0.84 (0.41 - 1.70), p for trend =0.40. In the sensitivity analysis with multiple imputation, the observed non-significant association persisted.

CONCLUSIONS: This study does not support an association between mercury exposure and the incidence of type 2 diabetes in a cohort of general Americans.

Keywords: Public Health, Environmental Epidemiology, Food/nutrition

Patterns of exposure to toxic and essential elements in whole blood in the Baltimore Memory Study

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BACKGROUND AND AIM:We aimed to identify patterns of toxic and essential element exposures. METHOD:The Baltimore Memory Study is a cohort study of cognitive and cardiovascular outcomes that enrolled 1,140 adults 50-70 years in 2001-2002. In 2022, we measured 22 elements, including lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), strontium (Sr), vanadium (V), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), and zinc (Zn) in whole blood from stored samples in 710 (62%) participants using inductively coupled plasma-mass spectrometry. Participants with sufficient sample volume were not different from persons without. We used k-means cluster analysis (CA) and principal component analysis (PCA) to characterize exposure patterns. We evaluated associations between each element and neighborhood and individual-level variables using linear regression.

RESULTS:The k-means algorithm identified two clusters. One cluster (56% participants) had higher levels of toxic (Pb, Cd, Sr, and V) and higher essential (Zn, Mo, Sr, V) elements. There were few differences in sociodemographics between clusters. Five principal components explained 65% of the total variance: Sr-V-Mo-Zn (18%), Cu-Fe (16%), As-Hg (12%), Cd-Pb (11%), and Mn (8%). Women had higher levels Pb, As, Cd, Cu, and Fe but lower Se and Zn. Pb, As, Cd, Sr, and Cu were higher in Black participants, while Fe, Mn, and Se were lower. Greater education and wealth were associated with higher Hg, Fe, and Mn, and lower Cd, Sr, and Cu. Worse neighborhood psychosocial hazards were associated with higher Pb, Cd, Sr, and Cu, and lower Hg, Fe, Mn, and Se. Smokers had higher Pb, Cd, and Fe but lower Se. Higher intake of vegetables and fruits was associated with higher Cd, Hg, and Se, and lower Pb.

CONCLUSIONS: Patterns of exposure to toxic and essential elements in the Baltimore Memory Study suggest common behavioral and neighborhood sources.

Keywords: metals, mixture

Pooled-cohorts Genome-Wide association study of metals: Introduction to the Metal-GWAS Initiative

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BACKGROUND AND AIM:Previous genome-wide association studies (GWAS) of metal biomarkers have been modest in sample size. We propose to use a multi-cohort approach to evaluate how levels of metal biomarkers are influenced by genetic variation, which can point to biological mechanisms for metal toxicokinetic and gene-environment effects of metal exposures.

METHOD:Six cohorts have currently joined the metal-GWAS: Hortega, AWHS and MCC (Spain), and MESA, REGARDS and SHS (US). In a pilot analysis, we used data from AWHS (N=1,867) and Hortega (N=1,401) participants with available metal concentrations and TOPMED-imputed SNPs. After quality control and SNPs selection -1541 candidate genes related to metals transport or toxicity identified using NCBI-Gene database-, we retained 228,915 SNPs that were commonly available in both cohorts. Subsequently, we first conducted a GWAS with urinary levels of antimony, arsenic (sum of inorganic and methylated species adjusted for arsenobetaine), cadmium, chromium, copper and zinc, separately in both studies. Second, for each metal, we meta-analysed coefficients and standard errors. RESULTS:At a suggestive statistical significance level of 0.001, there was evidence of an association between a number of SNPs with urine metal biomarkers (94 for arsenic, 68 for cadmium, 102 for chromium, 170 for copper, 84 for antimony and 26 for zinc). The SNP with the lowest p-values was annotated to PTCH1 (F-statistic [F] =17.2) for antimony, CNGA3 (F=37.2) for arsenic, SLC38A4 (F=13.9) for cadmium, ANO1 (F=19.4) for chromium, BAK1 (F=2.3) for copper and SLC30A2 (F=14.3) for zinc.

CONCLUSIONS: Proteins encoded by the identified top genes have been reported to have a role on

metal-related health endpoints. The Metal-GWAS Initiative will create the necessary structure for large collaborative efforts to assess, in the most possible robust and reproducible way, potential metal-related health effects and associated gene-environment interactions. Other epidemiologic studies with available metal and genomic data are welcome to join (Contact: Maria Tellez-Plaza; m.tellez@isciii.es).

Keywords: metals, metalloids, single-nucleotide polymorphisms (SNPs), genome-wide association studies (GWAS), genetics consortium

Lead and cadmium exposure and biomarkers of subclinical cardiovascular disease in the National Health and Nutrition Examination Survey 1999-2004

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BACKGROUND AND AIM:Exposure to contaminant metals like lead and cadmium increase the risk of cardiovascular disease (CVD), but less is known on the effects of metal exposure on subclinical CVD. We evaluated associations of lead and cadmium exposure with biomarkers of myocardial stress and cardiac damage: N-Terminal pro-B-type Natriuretic Peptide (NT-proBNP), and high sensitivity cardiac troponins I (hs-cTnI) and T (hs-cTnT).

METHOD:Blood lead and cadmium and serum cardiac biomarkers were measured in 10,172 adults aged ≥20 years without a history of CVD who participated in the 1999-2004 National Health and Nutrition Examination Survey (NHANES). We used logistic regression to estimate odds ratios (OR, 95% CI) for elevated cardiac biomarkers (defined as >90th percentile) per interquartile range increase in blood lead and cadmium concentrations. We additionally modeled metal concentrations as quartiles of exposure. All models were adjusted for demographics, tobacco use, body mass index, hypertension, diabetes, and kidney function.

RESULTS: The median concentrations of blood lead and cadmium were 1.70 µg/dL and 0.40 µg/L, respectively. We observed positive associations between metals and elevated NT-proBNP (lead: OR 1.08 [95% CI: 0.98-1.18]; cadmium: OR 1.03 [95% CI: 0.91-1.16]), hs-cTnT (lead: OR 1.08 [95% CI: 0.99-1.19]; cadmium: OR 1.05 [95% CI: 0.96-1.16]), and hs-cTnI (lead: OR 1.05 [95% CI: 0.98-1.14]; cadmium: OR 1.03 [95% CI: 0.94-1.12]) per interquartile range increase in metal concentrations. We observed similar results when the metals were modeled as quartiles, with statistically significant associations comparing the fourth to first quartile of exposure between lead and hs-cTnT (OR 1.62 [95% CI: 1.05-2.50]) and cadmium and NT-proBNP (OR 1.70 [95% CI: 1.06-2.73]).

CONCLUSIONS: In US adults, lead and cadmium measured in whole blood were positively associated with biomarkers of myocardial stress and cardiac damage. This provides evidence of lead and cadmium exposure as risk factors for CVD.

OP-123[Air pollution » General]

Longitudinal disparities in air pollution exposure by racial residential segregation in the United States: a meta-analysis of harmonized multicohort

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BACKGROUND AND AIM: Ambient air pollution has declined in the United States since the passage of the Clean Air Act, however disparities by race and ethnicity persist. Racial residential segregation may contribute to differential reductions in air pollution.

METHOD: We harmonized data from eight longitudinal cohort studies: Nurses' Health Study I and II, Health Professionals Follow-up Study, Women's Health Initiative Clinical Trial and Observational Study, Cardiovascular Health Study, Multi-Ethnic Study of Atherosclerosis, and Reasons for Geographic and Racial Differences in Stroke. Annual residential address-level mean NO2 and PM2.5 were estimated from national spatio-temporal models. Neighborhood segregation was measured using a spatial adaptation of the multi-race divergence index created from US Census tract-level data. We evaluated differences in the rate of change in NO2 from 1991 and PM2.5 from 1999 through 2016 by divergence z-score and race using adjusted log-linear generalized estimating equations. Cohort-specific results were combined using fixed effects meta-analysis.

RESULTS:Our total sample included 425,593 adults (85% female; 8.9 million person-years). Adjusted mean NO2 exposure decreased over time by 57% for Black (from 21.6 to 9.3 ppb) and 55% for White participants (14.4 to 6.5 ppb); PM2.5 declined by 48% (15.3 to 7.9 μ g/m3) and 45% (13.2 to 7.2 μ g/m3) respectively. Among Black participants, exposures were consistently higher in more segregated neighborhoods, where the rate of decline lagged: each standard deviation increase in divergence was associated with slower average 5-year declines by 0.30% for NO2 (95% CI: 0.21, 0.39) and 0.34% for PM2.5 (95% CI: 0.29, 0.39). In contrast, among White participants increasing segregation was associated with faster rates of decline in NO2 [-2.35% (-2.42, -2.27)] and PM2.5 [-0.96% (-1.01, -0.91)].

CONCLUSIONS: Improvements in air quality have not been equitably distributed. Black populations continue to experience higher levels of air pollution, particularly in more segregated neighborhoods. These disparities may fuel enduring inequities in health outcomes.

Keywords: Air pollution, environmental disparities, environmental justice, socio-economic factors

OP-124[Climate » Health co-benefits]

A 'synthetic population' model for evaluating the impacts of city-level climate change mitigation policies on health and health inequalities

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BACKGROUND AND AIM: Modelling the health effects of climate change mitigation policies can provide evidence to guide decision-making, but the effects of policies are likely to vary across population groups and conventional methods do not generally account for these differential effects. To improve current methods, we developed a novel modelling framework for assessing the effects of climate policies on health and health inequalities.

METHOD: The model generates a large (>1M) georeferenced 'synthetic population' of individuals with characteristics (age, gender, socioeconomic status) and health risks (mortality and disease rates) representative of the population. Environmental exposures (ambient and indoor air pollution, housing-related risks) and health-relevant behaviours (dietary consumption, transport behaviours) are assigned to each individual, accounting for variations in each with respect to population characteristics using evidence on their joint distributions. The effects of policy actions on health are modelled by applying published exposure-response functions at individual-level.

RESULTS: The model is illustrated for a policy example in London. Linking to outputs from existing models of air pollution (Greenhouse Gas and Air Pollution Interactions and Synergies, GAINS) and transport-related physical activity (Health-Oriented Transportation Model, HOT), we modelled the impact of switching from motorised to active travel (walking, cycling) under scenarios with different levels of switching in different population groups. The results show that the health benefits of the policy would result largely from increased physical activity rather than reduced air pollution exposure. Increasing active travel in some groups would have considerably greater benefit to overall population

health. In particular, the largest impact could be achieved by increasing active travel for groups who are currently least active.

CONCLUSIONS: The synthetic population model extends related methods to quantify the impacts of climate change mitigation policies on health inequalities. Other advantages of the model include targeting of actions at subgroups and accounting for double counting when multiple actions are considered in parallel.

Keywords: Health co-benefits, Health inequalities, Policy research, Built environment

Sociodemographic Disparities in Mercury Exposure from U.S. Coal-Fired Powerplants

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BACKGROUND AND AIM: Hazardous Air Pollutants (HAP) emitted by U.S. coal and oil-fired powerplants have been controlled by the *Mercury and Air Toxics Standards* (MATS) since 2012, yet sociodemographic disparities in potential mercury (Hg) exposure from powerplants have not been evaluated. Here we: (1) test whether potentially vulnerable groups disproportionately reside near powerplants, (2) examine whether these subpopulations benefited equally from changes in atmospheric Hg deposition, and (3) construct an end-member scenario for the highest powerplant Hg exposure following the MATS rule.

METHOD:We collated geospatial data on Hg emissions from U.S. powerplants before (ca. 2010) and after (ca. 2020) implementation of the MATS rule. We combined modeled atmospheric Hg deposition with U.S. Census data to examine the proportions of residential populations living close to powerplants, focusing on communities susceptible to high Hg exposures due to frequent fish consumption, low-income, <high-school education, and limited English proficiency.

RESULTS:Prior to MATS (ca. 2010), we found that proportions of residents within 5-km of powerplants (n = 512) who were high fish consumers, low-income, <high-school educated, or limited English-speaking households were significantly greater relative to the general population. Within 5-km of 2020 facilities, proportions of low-income individuals were greater near active plants relative to retired ones. Atmospheric Hg deposition from plants decreased by 90% across the contiguous U.S. between 2010-2020. However, a screening-level risk analysis for the largest emitting 2020 powerplants suggests facility attributable exposure of anglers who consume self-caught fish could still exceed the U.S. EPA reference dose for methylmercury.

CONCLUSIONS:Potentially vulnerable subgroups were disproportionately located around powerplants in 2010, suggesting a lack of distributional justice in plant siting. The socioeconomic status of residential areas <15km from powerplants may play a role in determining plant retirement. Ongoing Hg emissions from the largest remaining powerplants still present plausible exposure risks for some vulnerable groups.

Keywords: environmental justice, environmental disparities, air pollution, exposures, other (mercury)

The environmental conditions of mass incarceration: National estimates of environmental exposures impacting US incarcerated populations

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BACKGROUND AND AIM: In the US, ~2 million people are incarcerated in correctional facilities, yet nationwide estimates of environmental exposures impacting these populations are not yet available. Our objective was to estimate the total incarcerated US population (regionally and nationally) impacted by several major environmental exposures, both individually and in combination. METHOD: We analyzed 5,141 correctional facilities registered with the US Department of Homeland Security (2022) that met our inclusion criteria; these facilities incarcerated 2,343,173 people. We spatially linked facilities to the following dichotomized exposures: average public water arsenic and uranium concentrations > US Environmental Protection Agency regulatory standards (2000-2011); annual mean PM2.5 and NO2 concentrations > World Health Organization guidelines (2005-2018); any county-level wildfire event (2018-2020); and any county-level power outage of 8+ hours (2018-2020). We then summed the total incarcerated population with assigned exposures exceeding these thresholds. We repeated our analysis stratified by US Geological Survey Climate Adaptation Regions. RESULTS:Nationwide, 98.8% of the incarcerated population under study (N= 2,314,159) was assigned to at least one exposure exceeding our thresholds. The most prevalent exposures nationwide were elevated PM2.5, power outages, and wildfires, with 92%, 41%, and 21% of the incarcerated population exposed, respectively. Both the average 2018 PM2.5 annual mean concentration for the nation (5.22 μ g/m³) and correctional facilities (7.21 μ g/m³) exceeded the WHO threshold (5 μ g/m³). An estimated 113,288 (4.8%) incarcerated people were exposed to elevated PM2.5, power outages, and wildfires between 2018-2020; these facilities were most often located in the Southeast (34.6%), Southwest (32.6%), and South Central (19.7%) regions.

CONCLUSIONS: We identified elevated annual mean PM2.5 levels as a key environmental exposure of concern for US incarcerated populations. Environmental exposures of concern for incarcerated populations differed regionally. Ongoing work includes incorporating available data for extreme heat, oil and gas wells, and ozone concentrations to expand our studies of compound environmental threats.

Keywords: environmental justice, environmental disparities, multi-pollutant, air pollution, wildfires

OP-128[Exposures » Other (to be specified with keywords in the keywords section)]

Geospatial modelling and socioeconomic inequalities of transportation, human, and nature-based sounds in Accra, Ghana

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BACKGROUND AND AIM: Urban environments are filled with mixtures of mechanical, human, and nature-based sounds, which can be detrimental, neutral, or even beneficial to physical and psychological health. The majority of epidemiological studies have focused on the harmful effects of transportation noise exposure, and there is a major gap in city-scale information on the distribution of other types of sounds which may impact health and wellbeing.

METHOD: Within a large-scale multi-pollutant measurement campaign in Accra, Ghana, we collected a novel dataset of audio recordings at 146 locations over 1yr. The recordings were processed with a pre-trained neural network to classify different types of sounds and then modelled with Random Forest land use regression (LUR) to make predictions across the city with both day and night-time models. We also investigated possible socioeconomic (SES) inequalities by linking the sound predictions to small area data on household consumption, higher educational attainment, and unemployment. RESULTS:LUR model performance, assessed with 10fold cross-validation, was good for road-transport and animal sounds (R2 range 0.37 - 0.70), moderate for human speech and music (R2 range 0.21 - 0.42), and poor for nature sounds (R2 range: 0 - 0.10). The prevalence of road-traffic sounds was highest in the urban core and along major motorways (median: 63%-42%), human speech and music in low-income high-density residential neighbourhoods (median: 9%-23%), and animal sounds in peri-urban areas (median: 64-71%). There was a weak inverse association between road-traffic sounds and SES (Pearson correlation (r): -0.16 to -0.20). Conversely, animal sounds (like birds) are often described in soundscape surveys as 'calming' and 'pleasant' and were more prevalent in

wealthier neighbourhoods (r: 0.37).

CONCLUSIONS: We have illustrated a high-resolution approach to characterising the abundance of a variety of sound types at city scale, which can be incorporated into epidemiological investigations of the direct and interactive effects of harmful and/or potentially beneficial sound exposures.

Keywords: Noise, Exposure assessment, Environmental disparities, Spatial statistics

OP-129[Climate » Other (to be specified with keywords in the keywords section)]

Future health burden under a projected prescribed fire management scenario in California

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BACKGROUND AND AIM: To mitigate the growing wildfire risk in California, forest management agencies plan to increase the use of prescribed fire. We characterized the anticipated change in health impacts from exposure to smoke under a future fire-management scenario relative to the historical period (2008-2016).

METHOD:Daily concentrations of fine particulate matter (PM2.5) emitted by future prescribed fires were estimated using HYSPLIT dispersion models that simulated the burning of 500,000-acres classified as high priority. Daily smoke-PM2.5 concentrations from historical wildfires and prescribed fires were estimated based on satellite-derived data and historical fire records. Using previously estimated excess daily cardiopulmonary burden rates attributed to all-source PM2.5 in the historical period, we differentiated the burden by days impacted by smoke for each fire type and estimated smoke-PM2.5 concentration and applied concentration-specific burden rates to the future scenarios. RESULTS:The annual number of person-days of exposure to prescribed fire smoke was 15x more than past prescribed fires, although exposures were associated with lower concentrations. We estimated a reduction in high PM2.5 concentration from prescribed fire relative to the past. The increased number of days with low-concentration exposure across populated, high-priority areas was associated with an increased health burden in the future. The largest increase in burden was observed in northern-central and southern coastal regions.

CONCLUSIONS: This approach for characterizing the potential impacts of prescribed fire is a metric that integrates spatiotemporal differences in exposure, baseline morbidity, and population size and may be a useful tool to inform effective future implementation for public health protection and safety from wildfires.

Keywords: prescribed fire, wildfire, health burden, climate change

OP-130[Outcomes » Mortality]

Associations of Body Constitution and All-cause Mortality in Patients with Type 2 Diabetes

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BACKGROUND AND AIM: The present study aimed to examine the associations of baseline body constitutions with subsequent risks of all-cause mortality among Chinese persons with type 2 diabetes.

METHOD:Persons with type 2 diabetes enrolled in managed care in 2010 were participants (n=887) and they were followed up to 2015. Death status was determined via linkage of Taiwan National Death Datasets. BC status of Yin deficiency, Yang deficiency, and phlegm stasis was evaluated using a well-validated body constitution (BC) questionnaire at baseline. Hazard ratios (HR) of mortality for BC status were estimated using multivariate Cox proportional hazards model.

RESULTS:During the 6,807.2 person-years of follow-up from 887 participants with a mean follow up of 7.7 years, 190 persons died with an incidence density of 0.0279 person-years. Yin deficiency was independently associated with all-cause mortality (HR, 95% CI: 1.39, 1.02–1.90), while the association of phlegm stasis with all-cause mortality was borderline significant when diabetes-related factors were considered (1.47, 0.99–2.19). Yang deficiency was not a significant predictor. Stratification analysis indicated the absence of significant associations of all BC types with mortality in persons with good glucose control, whereas in persons with poor glucose control, body constitutions of Yang deficiency, Ying deficiency, or phlegm stasis were associated with 75%–88% increase in mortality.

CONCLUSIONS: This study shows TCM BCs of Yin deficiency is associated with all-cause mortality and glucose control modifies the associations of Yin and Yang deficiency with all-cause mortality. These findings may provide information for translation into TCM care for persons with type 2 diabetes.

Keywords: Traditional Chinese medicine, body constitution, all-cause mortality, type 2 diabetes mellitus

A Nationwide Population-Based Cohort Study Of The Association Between Visual Loss And Risk Of Suicide And Mental Illness In Taiwan

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BACKGROUND AND AIM: The psychosocial and health consequences of ocular conditions that cause visual impairment (VI) are extensive and include impaired daily activities, social isolation, cognitive impairment, impaired functional status and functional decline, increased reliance on others, increased risk of motor vehicle accidents, falls and fractures, poor self-rated health, and depression. We aimed to determine whether VI increases the risk and progression of mental illness, suicide, and mortality over time.

METHOD:In this large, nationwide, population-based, nested, cohort study, we used data from 2000 to 2015 in the Taiwan National Health Insurance Research Database (NHIRD), which includes all diagnoses of patients with VI. Baseline features, comorbidities, and prognostic variables were evaluated in a 1:4-matched analysis and comparison cohorts using Cox proportional hazards regression to study the association between VI and poor prognosis (mental illness, suicide, and mortality). The study outcome was the cumulative incidence of poor prognosis among the visually impaired and controls.

RESULTS: Among the 1,949,101 patients enlisted in the NHIRD, 271 had been diagnosed with VI. Risk factors for poor prognosis, and the crude hazard ratio was 3.004 (95% confidence interval 2.135–4.121, p<0.001). Participants with VI had an increased risk of poor prognosis, according to the sensitivity analysis with a poor prognosis within the first year and first five years. VI was associated with suicide and mental health risks.

CONCLUSIONS:VI increases the likelihood of a poor prognosis. Early detection through comprehensive examinations based on increased awareness in the clinical context may help maintain visual function and avoid additional complications.

Keywords: National Health Insurance Research Database, suicide, vision loss, mental illness
Perceptions and experiences of PFAS biomonitoring in Australian communities affected by environmental contamination

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BACKGROUND AND AIM:Understanding human exposure to persistent environmental pollutants is critical to informing public health responses and addressing community concerns in contaminated areas. We aimed to investigate community perceptions and experiences of human biomonitoring for PFAS in Australian towns impacted by environmental contamination.

METHOD: From 2016 to 2019, the Australian Government conducted the Voluntary Blood Testing Program for PFAS for current and former residents and workers of three Australian towns. From 2019 to 2020, we surveyed 812 people who provided a blood sample for the Program and used an inductive approach to thematically analyse responses on the usefulness of the blood testing for PFAS and related access to health services. We examined the association of the perceived usefulness of the blood testing with blood serum PFAS concentrations and psychological distress measures. RESULTS: We observed distinct thematic differences in community experiences and perceptions of the PFAS blood testing. Participants who reported that the blood testing was helpful communicated that the results confirmed their exposure. However, participants assumed that the test results could be used to make inferences to their health or that levels within reference values can be considered `safe'. In contrast, participants who indicated that the test was not helpful, or who were unsure, reflected on the uncertainty in the relationships between exposure and potential health effects. These participants had unanswered questions about their results after their post-test consultation.

CONCLUSIONS: Communities affected by local environmental contamination consistently request access to individual blood testing and results to understand their exposure. However, risk communication strategies related to the reporting of these results may not adequately consider the potential psychosocial implications. Globally, there is a need to evaluate and standardise approaches to reporting individual blood serum PFAS results, including the selection and reporting of reference values, in research and clinical settings.

Keywords: Biomarkers of exposure, Chemical exposures, Environmental epidemiology, PFAS, Policy and practice

Cost-Constrained Optimal Treatment Regimes under Bipartite Network Interference

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BACKGROUND AND AIM:Numerous studies have linked fine particulate matter (PM 2.5) to adverse health effects such as cardiovascular disease and stroke. Coal-fired power plants are a notable source for PM 2.5 generation in the US via sulfur dioxide emissions. As a result, policy makers have considerable interest in understanding the health effects of installing flue gas desulfurization equipment (i.e., "scrubbers") on coal-fired power plants. Due to significant monetary installation and upkeep costs, it is important to understand the effects of installing scrubbers at any given location before investing. This problem can be formalized as determining the cost-constrained optimal treatment regime (CC-OTR) under bipartite network interference (BNI), in which the intervention units (power plants) are different from the units that outcomes are observed on and treatment units can affect multiple outcome units. In this work, we introduce a Q-Learning approach for determining CC-OTR under BNI, derive the asymptotic properties of our proposed estimators, and demonstrate the method's efficacy through extensive simulation studies.

METHOD: We design a Monte Carlo simulation to test the proposed method on semi-simulated data inspired by Medicare fee-for-service beneficiary data. The method's mean \pm standard error of mean for decision accuracy and L2 total effect (TE) errors are calculated under different BNI network densities and effect sizes.

RESULTS: The decision error across all simulations is 0 ± 0 . Across all effect sizes, the TE error is 0.00059 \pm 0.00063. Across densities, when certain power plants have stronger interference effects, the TE error is 0.00059 \pm 0.00063. When all power plants have uniform interference effects, the TE error is 0.0011 \pm 0.00087.

CONCLUSIONS: To our knowledge, we present the first method for CC-OTR under BNI. This method can be applied broadly to determine optimal policy interventions subject to BNI.

Keywords: Bipartite Network Interference, Optimal Treatment Regime, Q-Learning

Counterfactual Event-Based Mediation Analysis of Socioeconomic Status for Cancer Patient Survival

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BACKGROUND AND AIM:Although many studies have examined the association between socioeconomic status (SES) and the prognosis of cancer, few studies have investigated the variables mediating this association, which can serve as possible targets for policy intervention. This study examined the effect of SES on cancer patient survival directly and indirectly by considering the cancer stage and medical treatment (ie, surgery) to identify multiple pathways from SES to health outcomes and simplify their mechanistic implications for certain cancers (lung, liver, colorectal, and stomach cancers).

METHOD: Mediation (survival) analysis based on a counterfactual framework of the Surveillance, Epidemiology, and End Results data from the National Cancer Institute of the United States was performed using the Cox proportional hazard model.

RESULTS: Mediation analysis based on a counterfactual framework revealed that the effect of SES on cancer survival can be further decomposed into direct and indirect effects through pathways mediated by the stage at diagnosis and surgery. In particular, the inconsistent mediation (or suppression) effects found for colorectal and stomach cancers are critical for evaluating the counterproductive effects of the cancer stage and treatment on survival.

CONCLUSIONS:SES can exert a direct or indirect effect on cancer patient survival, and the mediation analysis indicated that the discrepancy in the cancer stage and surgery is significantly caused by SES. Opportunities to reduce cancer inequality should be emphasized in policies or mechanisms with varied resources, recovery medication, health-care facilities, and access to medical facilities.

Keywords: Methods, causal inference

The Association Between Birth Weight and Childhood Cancer Risk in Taiwan

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BACKGROUND AND AIM: Previous studies have attempted to establish a link between birth weight and childhood cancer, but research among Asian populations is limited. In the present study, we aimed to investigate the relationship between birth weight and childhood cancer in Taiwan using nationwide population data.

METHOD: We utilized data from two large national databases – the Taiwan Birth Registration database and the Taiwan Cancer Registration database – to conduct our analysis. Our study comprised 7,857,354 infants born between 1978-2000; we excluded 451,434 premature and post-term births. Of these, 7,281 children were diagnosed with childhood cancer from 1979-2001. We divided newborns into five weight groups and used Cox proportional hazards model to investigate the association between birth weight and cancer risk, while controlling for variables such as gender, maternal age, and socioeconomic status.

RESULTS:After a follow-up period of 20 years and one hundred million person-years, we observed that birth weight between 3500-3999 gm was associated with a slight increase in hazard ratios (HRs) for certain childhood cancers, such as soft tissue sarcoma ([HR] =1.30, 95% CI=1.03-1.65) and germ cell tumors ([HR]=1.52, 95% CI=1.24-1.86). Additionally, birth weight over 4000 gm increased the risk of soft tissue sarcoma ([HR] =1.55, 95% CI=1.06-2.26) and bone tumor ([HR] =2.40, 95% CI=1.46-3.96), but decreased for leukemia ([HR] =0.82, 95% CI=0.68-0.99) and renal tumors ([HR] =0.53, 95% CI=0.29-0.99). Furthermore, large gestational age (LGA) was also associated with an increased risk of cancer ([HR] =1.30-1.56, 95% CI=1.03-2.57).

CONCLUSIONS:Our study suggests that higher birth weight and large gestational age may increase the risk of childhood cancer. Our findings add to the current knowledge on the association between birth weight and childhood cancer and highlight the importance of early life factors in the development of pediatric malignancies. Further research is needed to better understand the underlying mechanisms and to develop preventive strategies.

Keywords: birth weight, childhood cancer

Increased HbA1c During Pregnancy is Associated with In-utero Exposure to PM2.5 at Levels below Current Air Quality Guidelines

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BACKGROUND AND AIM:Previous epidemiological studies found increased risk of gestational diabetes associated with fine particle matter (PM2.5) exposure. However, there is a paucity of mechanistic evidence for such an association. We examined to what extent in utero exposure to PM2.5 perturbs the longitudinal trajectory of a maternal hyperglycemia biomarker (HbA1c) during pregnancy. METHOD:We measured HbA1c in 601 blood samples collected from 237 pregnant women in Rochester, NY (\leq 3 samples per woman). We matched participants' residential addresses to 1 km2 grids for which we estimated ambient PM2.5 concentrations for the 1-12 weeks prior to blood collection. We estimated the longitudinal trajectory of HbA1c during pregnancy using a generalized additive model with a smooth function of the gestational week of HbA1c measurement and a random subject effect. To this model we added the ambient PM2.5 concentrations to estimate the difference in HbA1c associated with PM2.5. Finally, we added an interaction term to determine whether the HbA1c-PM2.5 association differed across trimesters.

RESULTS:The median (IQR) 12-week PM2.5 concentration was 6.81 (5.99 – 7.45) μ g/m3. The median (IQR) Hba1c level was 5.18 (4.86 – 5.54) % with a U-shaped trajectory during pregnancy. Compared with the first trimester, HbA1c decreased by 0.14% (95%CI: 0.06% to 0.19%) in the second trimester and increased by 0.31% (95%CI: 0.22% to 0.40%) in the third trimester. Each IQR (1.46 μ g/m3) increase in 12-week PM2.5 concentration was associated with a 0.06% (95%CI: 0.00% to 0.12%) increase in Hba1c. Greater increases in HbA1c per IQR PM2.5 increase were observed in the first (0.08%, 95%CI: -0.01 to 0.16%) and third (0.07%, 95%CI: -0.01 to 0.14%) trimesters, than the second trimester (0.03%, 95%CI: -0.03 to 0.10%).

CONCLUSIONS: Exposure to PM2.5, especially in the 1st and 3rd trimesters and even at levels below $12 \mu g/m3$, may impair glucose metabolism in pregnant women.

Keywords: Particulate matter, Pregnancy outcomes, Obesity and metabolic disorders

Prenatal Exposure to Air Pollutants in Two Generations and Birth Outcomes in the Third Generation

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BACKGROUND AND AIM:Recognizing the transgenerational effects of numerous toxicants, we estimated the impact of prenatal air pollution exposure among mothers and grandmothers on third generation birth outcomes.

METHOD:Annual estimates of particulate matter (PM2.5) and nitrogen dioxide (NO2) at the census tract level were linked to California births corresponding to women born from 1982 onward (Generation 1 [G1]) and their offspring born from 1997-2011 (Generation 2 [G2]; N=666,837), representing prenatal exposure in two generations. Third generation birth outcomes, derived from G2 birth and prenatal records, include preterm birth (prior to 37 weeks gestation; PTB) and term low-birthweight (<2500 g and gestation 37+ weeks; TLB). Doubly robust, data-adaptive estimation of longitudinal modified treatment policies (LMTP) was used to estimate total effect risk differences (RDs) if each person's levels of PM2.5 and NO2 were both reduced by 10%, at each generation, adjusting for generation-specific temperature, race-ethnicity, age, parity, neighborhood poverty, rural/urban residence, and, for G2 only, public insurance and education.

RESULTS:At observed air pollutant levels, risk of PTB was 8.8% and risk of TLB was 2.2%. Jointly lowering G1 prenatal PM2.5 and NO2 by 10% resulted in a small reduction in third generation PTB risk compared to no change in exposure (RD=-0.04 [95% CI -0.08, -0.001), but did not result in reduction in TLB risk (RD=0.01 [-0.01, 0.03]). Reducing both PM2.5 and NO2 in G2 resulted in larger risk reductions for PTB (RD=-0.20 [-0.23, -0.17]) and TLB (RD=-0.02 [-0.04, -0.01]) compared to the G1 reductions.

CONCLUSIONS: Using a novel method of effect estimation for joint continuous exposures, we found reductions in PTB and TLB with 10% reduction in second generation PM2.5 and NO2, and smaller reductions in PTB with first generation exposure to air pollutants. Future research should explore mediation and effect modification of prenatal air pollution exposures across generations.

Keywords: Particulate matter, Oxides of nitrogen, Birth outcomes, Environmental epidemiology

Fine particulate matter and preterm birth: a causal survival approach

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BACKGROUND AND AIM: With the escalating threat of climate change, there is increasing interest in understanding the impact of environmental exposures on preterm birth (<37 weeks). The standard approach treats prematurity as a binary outcome and thus complicates analyses of exposures that depend on gestational age (e.g., cumulative exposure) as the exposure data does not always align with the at-risk window. We overcome this limitation by treating preterm delivery as a time-to-event outcome and use a survival framework to assess its association with particulate matter $\leq 2.5 \ \mu m$ (PM2.5).

METHOD: We used data on 9,446 births from 2011-2016 in a Massachusetts-based cohort. PM2.5 was taken from a 1-km grid model and assigned to address. We considered two exposure windows which depend on gestational week t: 1) the cumulative exposure to week t, and 2) 4-weeks prior to week t. We applied g-computation to estimate the effect—i.e., risk ratios (RRs) and differences (RDs)—of a hypothetical intervention reducing PM2.5 exposure to the new World Health Organization air quality guidelines of 5 μ g/m3. Models were adjusted for socio-demographics, time trends, temperature, and nitrogen dioxide.

RESULTS:There were 805 (8.5%) preterm births in this cohort. Average PM2.5 was 7.4 μ g/m3 for the cumulative exposure (95% had >5 μ g/m3) and 8.74 μ g/m3 for the 4-week window (97% had >5 μ g/m3). We found that setting the exposure ceiling to 5 μ g/m3 lowered the risk of preterm birth—the RR was 0.82 (95% CI: 0.67, 1.03) and the RD was -0.01 (95% CI: -0.03, 0.0003), which translates to about 137 (95% CI: -27, 258) fewer preterm births in this cohort. PM2.5 in the 4-week window was not associated with preterm birth.

CONCLUSIONS: Using a causal survival approach, we found that higher cumulative PM2.5 exposure was associated with increased risk of preterm birth.

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Keywords: birth outcomes, methods, causal inference

Associations between ambient PM2.5 and markers of platelet activity in pregnant women in Puerto Rico

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BACKGROUND AND AIM:Pregnancy is associated with increased platelet activity, which is associated with hypercoagulability and the pathogenesis of preeclampsia. This platelet activity is partially mediated through elevated platelet thromboxane A2 (TXA2) formation in the pregnant state, which increases the production of superoxide and other reactive oxygen species (ROS). Whether and to what extent exposure to ambient PM2.5 in pregnant women, which also has been associated with disorders of platelet aggregation and ROS production, may impact thromboxane levels remains unclear. METHOD:We investigate associations between 30-day moving average PM2.5 and maternal thromboxane (TXB2, a proxy measure for serum TXA2) levels in a cohort of 1,117 pregnant women between the ages of 18 and 41 enrolled in the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) study. We calculated PM2.5 estimates using EPA Air Quality System data from 13 island monitors, ascribing individual exposure estimates using inverse distance weighting. TXB2 samples were taken during the third trimester visit, and ordinary least squares regression was used for statistical analysis. All models were adjusted for fetal gestational age, parity, history of adverse pregnancy outcomes, maternal demographics (i.e., age, race) socioeconomic status, exercise, BMI, and seasonality.

RESULTS:Mean 30-day PM2.5 exposure was 8.7 ug/m3, and mean TXB2 level was 6.6 nmol/L. A 10 ug/m3 increase in the 30-day moving average PM2.5 increased TXB2 level by 55.5% (95% CI: 6.2, 127.7, p = 0.0233). Examination of quintiles of exposure demonstrated a non-linear dose-response relationship (p-trend <0.001).

CONCLUSIONS: Particulate matter air pollution may impact platelet activity, and thus hypercoagulability and risk for adverse pregnancy outcomes, by increasing TXA2 production in pregnant women.

Keywords: PM2.5, pregnant women, thromboxane, platelet activity

Associations between ambient PM2.5 and placental Corticotropin Releasing Hormone (CRH) in pregnant women in Puerto Rico

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BACKGROUND AND AIM:Corticotropin releasing hormone (CRH) is an important placental product during pregnancy which is thought to have neuroprotective and metabolic regulatory effects in the fetus and mother. Previous studies suggest that perturbations in CRH can adversely affect pregnancy outcomes, however no prior study has examined the impact of particulate matter (PM) on CRH despite a growing body of literature linking PM to placental health.

METHOD: We used generalized estimating equations to investigate associations between PM2.5 and maternal CRH in a cohort of 1,117 pregnant women (aged 18-41) enrolled in the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) study. Exposure estimates were derived from EPA Air Quality System (AQS) data, and individual 30-day moving average exposure estimates were assigned using inverse distance weighting from 13 island monitors spanning 2010-2020. Blood CRH levels were analyzed over two visits for each participant. All models were adjusted for fetal gestational age at the time of the blood draw, number of prior pregnancies, history of adverse pregnancy outcomes, maternal demographics (i.e., age, race) socioeconomic status (i.e., education, employment status, income, marital status), maternal exercise habits, pre-pregnancy BMI, and seasonality. RESULTS: Mean PM2.5 exposure was 8.7ug/m3 and mean CRH levels were 54.0ng/mL and 54.1ng/mL for visits 1 and 3, respectively. A 10ug/m3 increase in the 30-day moving average PM2.5 exposure was associated with a decrease in CRH of 77.2% (95% CI:-72.4,-81.1). A statistically significant and monotonic dose response relationship was also observed in guintile analyses, with the highest guintile of exposure associated with an 89.8% lower CRH (95% CI:-84.1,-93.5, p-trend <0.001). CONCLUSIONS: In the first examination of the association between ambient PM2.5 exposure and placental CRH levels, we identify significant and large magnitude associations. This may indicate that perturbations in placental endocrine physiology is an important and understudied pathway by which PM may adversely impact fetal and maternal health.

OP-141[Birth and pregnancy outcomes » Birth outcomes]

Maternal Metabolomics Linking Prenatal Exposure to Fine Particulate Matter and Birth Weight

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BACKGROUND AND AIM:Prenatal exposure to fine particulate matter (PM_{2.5}), especially during second trimester, has been associated with lower birth weight in Maternal and Developmental Risks from Environmental and Social Stressors (MADRES) study. This study aims to investigate potential maternal metabolic pathways in third trimester mediating the association between second-trimester PM_{2.5} exposure and lower birth weight.

METHOD: Based on the ongoing MADRES study in Los Angeles, 421 maternal serum samples collected at third trimester were analyzed for untargeted metabolomics using LC-MS. Daily estimates of PM_{2.5} concentrations were assigned to each participant's residential address using inverse-distance-squared weighted spatial interpolation and calculated as second-trimester averages. Birth weight and covariates were retrieved from electronic medical records or questionnaires. Metabolome-wide association studies were conducted using linear regression to identify metabolomic features associated with second-trimester PM_{2.5} exposure and birth weight Z-score, respectively. Metabolic pathways common to prenatal PM_{2.5} exposure and birth weight were identified using Mummichog pathway analysis.

RESULTS:Numbers of metabolomic features associated with second-trimester PM_{2.5} exposure and birth weight Z-score were 692 and 356 for HILIC positive mode, and 779 and 495 for C-18 negative mode, respectively (p<0.05). 35 positive-mode and 40 negative-mode metabolomic features were found to be associated with both PM_{2.5} exposure and birth weight. The most significant pathways associated with second-trimester PM_{2.5} exposure were ascorbate (vitamin C) and aldarate metabolism (p=0.01) and C21-steroid hormone biosynthesis and metabolism (p<0.01). Dysregulated metabolism of glycerophospholipid (p=0.01) and vitamin D3 (cholecalciferol) (p<0.01) was associated with birth weight Z-score. Ascorbate (vitamin C) and aldarate metabolism was a common metabolic pathway associated with both PM_{2.5} exposure and birth weight Z-score.

CONCLUSIONS: Metabolomics analysis suggested a potential mediating role of maternal oxidative stress during pregnancy in the association between prenatal PM2.5 exposure and lower birth weight.

Keywords: Air pollution, Birth outcomes, Metabolomics, Particulate matter

OP-142[Air pollution » General]

The NASA TEMPO Mission: Hourly Observations of Major Air Pollutants from Space for Advancing Air Quality and Health Applications

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BACKGROUND AND AIM:NASA is launching the Tropospheric Emissions: Monitoring of POllution (TEMPO) instrument, an ultraviolet and visible grating spectrometer, into Geostationary Earth Orbit (GEO) in April 2023. TEMPO will observe trace gases and aerosols, including nitrogen dioxide (NO2), sulfur dioxide (SO2), formaldehyde (HCHO), ozone (O3), and aerosol optical depth (AOD), at high spatial resolution (e.g., ~2 km x 4.75 km) every daylight hour over a Field of Regard (FoR) covering greater North America. TEMPO is part of a GEO air quality constellation, together with the Geostationary Environment Monitoring Spectrometer (GEMS; launched February 2020) covering Asia and the Sentinel-4 instrument (planned for launch in 2024) covering Europe.

METHOD:TEMPO will observe major air pollutants with high accuracy and detail at hourly and subhourly frequency throughout the daytime, which will enable new and improved health studies at suburban scales. TEMPO will provide the first-ever O3 profile product from space for diagnosing O3 concentrations in the 0-2 km layer where people live and breathe.

RESULTS:During the pre-launch era of the TEMPO mission, a large diversity of end users and stakeholders have participated in workshops, data tutorials, and focus sessions hosted by the TEMPO Early Adopters Program, supported by the NASA Applied Sciences Program (ASP), which aims to maximize the societal benefit of the mission data after launch. These user engagement activities have led to a better understanding of the unprecedented health applications that could be achieved through application of the high-resolution air quality products from TEMPO.

CONCLUSIONS: The TEMPO mission will provide multi-pollutant data at high spatiotemporal resolution for enabling more robust and accurate public health studies, including assessment model results for acute and chronic exposures to different pollutants. Altogether, the GEO air quality constellation will lead to improved health studies across highly populated areas across the globe.

Electromechanical Control of Metal Oxide Thin Films deposition in Successive Ionic Layer Adsorption and Reaction for gas sensors devlopement

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BACKGROUND AND AIM: The control of air quality and exposure to hazardous chemical agents requires the development of efficient gas sensors. Gas sensors based on thin film technology have gained a special interest as this technology allows developing robust and low cost efficient detection systems. METHOD: We describe the device developed to control the deposition parameters to manage, the adsorption and reaction process of metal oxide thin films for different applications such as gas sensors. The growth of nanostuctures thin films using SILAR technique is affected by two types of factors: chemical parameters (pH, concentration of precursor solutions, immersion time), and mechanical parameters (number of cycles, immersion angle and speed). Mechanical parameters are the most difficult parameters to control because they can affect the properties of the film (thickness, uniformity, adhesion to the substrate). The control of these mechanical parameters is not at all possible by the manual process. Therefore, the developed electromechanical system allows controlling all these parameters during deposition. The design of our electromechanical system is based on 1.8-degree-of-freedom motorized moving platform equipped with multiple substrate supports, a control board to regulate horizontal and vertical velocity, and an enhanced graphical interface to control and monitor key parameters. RESULTS: The system's performance is evaluated by depositing crystalline zinc oxide film. X-ray diffraction, ultraviolet/visible spectroscopy, and Scanning electron microscopy showed a good correlation between the evolution of number of deposition cycles, precursor solution concentration, pH, crystallite/grain size, crystallinity, and film thickness. In addition, the control of the instrument results in thin films with good adhesion and homogeneity. The developed thin films were tested towards detection of ethanol vapour, a hazardous chemical with high flammability risk. CONCLUSIONS: The automated SILAR system developed in this work has shown good capability for producing gas sensing films with good homogeneity and fair sensing capability towards the detection of hazardous vapours.

Keywords: Hazardous chemical, gas sensors, metal oxides, Thin film, Automated SILAR technique

Design and characterization of micro-tubes based on SnO2 for toxic gas detection applications: Experimental and theoretical study

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BACKGROUND AND AIM:SnO2 is among the most suitable materials for detection of toxics gases, because of its excellent morphological and electrical properties. SnO2 is also a chemo-resistive material and its gas sensing it mainly controlled by the change in resistance of the sensor as gas molecules react on its surface.

METHOD:In this work, SnO2 micro-tubes have been fabricated by a simple forcespining method. The prepared material are analyzed using XRD and SEM techniques. The sensory properties of the synthesized material were also studied under exposure to different toxic organic volatile compounds (ethanol, benzene and acetone). Calculations based on the Density Functional Theory (DFT) according to the Ultra-Soft Pseudo-Potentials (USPP) method implemented in the Quantum ESPRESSO code were carried out in order to reveal the mechanism of SnO2 detection.

RESULTS: The synthesized SnO2 micro-tubes show a good morphological (fig. a, b and c) and structural properties (fig.d). The characterization results of our sensor under ethanol, acetone and benzene at 180°C suggested a high sensitivity to ethanol (fig.e). In addition, DFT results showed that SnO2 has a higher adsorption effect towards ethanol than other target gases (fig. f) in good agreement with experimental results.

CONCLUSIONS: By analyzing the rate of change in the electrical conductivity in the presence of gas molecules, we observe that the conductivity of SnO2 (110) surface changes significantly when exposed to ethanol vapour (fig. g), which is in accordance with experimental results.

Keywords: SnO2 micro-tubes, organic volatile compounds, DFT, Adsorption, sensitivity.

Application of a Mobile Apparatus for Ultrafine Particle Exposure in Urban Communities

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BACKGROUND AND AIM:Ultrafine Particles (UFPs) in the urban community have been, and continue to be, an essential public health concern. Thus, it is significant to investigate urban UFP exposure. This research carried out a series of field measurements to study urban UFP exposure in Great Houston Area (GHA) through UFP respiratory deposition experiments.

METHOD: The newly developed Mobile Aerosol Lung Deposition Apparatus (MALDA) was employed to estimate size-dependent UFP respiratory deposition. MALDA consists of a human airway system and an aerosol measurement system. MALDA has the feature of carrying out aerosol respiratory deposition experiments in real-life settings outside the laboratory. The human airway system contains 3D-printed realistic human airway replicas covering head airways, TB airways, and the alveolar region. The aerosol measurement system includes two particle sizers to simultaneously measure UFP particle size distributions at the inlet and outlet of a human airway region to estimate UFP deposition fractions. In this research, MALDA was deployed in representative locations around the GHA throughout one year to measure UFP respiratory depositions. Data acquired was applied to calculate UFP respiratory deposited mass and then estimate the associated UFP average daily dose for the population in urban communities.

RESULTS:Results obtained showed that the UFP hourly deposited mass in the human airways ranged from 2.36 µg/hr (rush hour), 1.76 µg/hr (noon), to 2.09 µg/hr (afternoon) in the industrial area. In contrast, the UFP hourly deposited mass around the medical center was from 1.38 µg/hr (rush hour), 0.94 µg/hr (noon), to 1.14 µg/hr (afternoon). Based on these results, the highest UFP average daily dose estimated was 0.13 µg/kg-day.

CONCLUSIONS:UFP respiratory deposited mass and average daily dose can be reasonably estimated using the MALDA approach. When chemical analysis data on UFP composition are available, health risks caused by U

FP-contained harmful substances through prolonged UFP exposure could be further assessed.

Keywords: Ultrafine particle, Exposure, Respiratory deposition, Average daily dose

OP-147[Air pollution » Particulate matter]

Association of air pollution, temperature and relative humidity with emphysema severity in COPD

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BACKGROUND AND AIM: Air pollution has been associated with chronic obstructive pulmonary disease (COPD); nonetheless, the associations of air pollution with emphysema severity are limited. Our study aim was to examine the association of air pollution, temperature, relative humidity with emphysema severity in COPD.

METHOD:A cross-sectional study was conducted on 111 COPD patients obtained from a hospital in Taiwan. A spatial-temporal model was used to estimate the personal exposure to air pollution, temperature, and relative humidity. Ordinal regression models were performed to investigate the associations of air pollution, temperature, and relative humidity with emphysema severity. Two-pollutant models were conducted to investigate the associations of air pollution with severity of emphysema. The models were adjusted for age, sex, body mass index (BMI), and smoking pack years.

RESULTS:We found that exposure to particulate matter with an aerodynamic diameter of <10 μ m (PM10) and ozone (O3) was associated with emphysema severity. We observed that a 1 μ g/m3 increase in PM10 was associated with an increased risk of emphysema severity (OR = 1.070 and 95% CI = 1.008–1.136). A 1 μ g/m3 increase in PM10 and O3 was associated with increased risk of emphysema severity (OR = 1.092 and 95% CI = 1.021-1.167).

CONCLUSIONS: Exposure to PM10 was associated with increasing emphysema severity in COPD. Improving air quality can reduce the impact of air pollution on respiratory health, particularly for individuals with COPD.

Keywords: Emphysema, PM10, relative humidity, temperature.

Resilience to air pollution and coronary heart disease: a UK Biobank study

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BACKGROUND AND AIM: Air pollution (AP) is associated with increased risk of coronary heart disease (CHD). However, not everyone exposed to AP develops CHD. We hypothesized that the resilience to AP varies with individuals, which modifies the risk of CHD. The aim was to identify contributing factors to resilience to AP and CHD.

METHOD:Data were from 436,346 CHD-free participants at recruitment/baseline (2006-2010), with the mean age 56.3 years (SD=8.1) and a mean follow-up of 12.6 years (SD=0.8). The residential annual average estimates for PM2.5 in 2010 was used to identify participants highly exposed to AP (high PM2.5: \geq 11.3 mg/m3, 90th percentile of PM2.5). Baseline sociodemographics and lifestyle factors plus disease-associated biomarkers and CHD comorbidities, one at a time, were tested for interactions with high PM2.5 on incident CHD using logistic regression models. Significant interactions at the Bonferron-corrected level were characterized by odds ratios (ORs) associated with the factors in the high and non-high PM2.5 groups

RESULTS:The interaction between sex and high PM2.5 was statistically significant (p=0.003). The OR comparing males to females was 2.23 (95% CI 2.17-2.29) in the high PM2.5 group (n=44,026; CHD incidence 75 per 1000) versus 1.94 (95% CI 1.80-2.08) in the non-high PM2.5 group (n=392,320; CHD incidence 70 per 1000). Other contributing factors to resilience to AP and CHD included biomarkers associated with type 2 diabetes (glucose and HbA1c: OR=1.54 per SD [high] versus OR=1.45 per SD [non-high], p=0.001), inflammation biomarkers (lymphocyte count and CRP: OR=1.42 per SD [high] versus OR=1.34 per SD [non-high], p=0.001), and the liver biomarker alkaline phosphatase (OR=1.28 per SD [high] versus OR=1.21 per SD [non-high], p=0.003). CONCLUSIONS:Individuals who are male and have higher levels of biomarkers with indications for type 2 diabetes, inflammation, or decreasing liver function are at higher risk for CHD and the risk is further elevated by high exposure of AP.

Keywords: PM2.5, interaction, biomarkers

Long-term exposure to air pollution and coronary atherosclerosis, calcification, and noncalcified plaques – results from the Swedish SCAPIS study

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BACKGROUND AND AIM:Despite firm evidence for an association between long-term air pollution exposure and cardiovascular events also at low exposure levels, previous epidemiological studies on the association with atherosclerosis have been inconsistent. The aim of this study was to investigate associations between long-term low-level air pollutant exposure and coronary atherosclerosis. METHOD:We performed a cross-sectional analysis in the large Swedish CardioPulmonary bioImaging Study (SCAPIS, n = 30 154). Men and women 50–64 years old were recruited from the general population of six Swedish cities 2013–2018. Outcomes were coronary atherosclerosis (segment involvement score, SIS), coronary artery calcium score (CACS), and non-calcified coronary plaque (NCP) prevalence. Hourly total and source-specific residential PM2.5, PM10, and NOx were modelled in dispersion models with high spatial resolution and averaged over 10 years before recruitment. Prevalence odds ratios (POR) were estimated with ordinal logistic regression models adjusted for site and known risk factors, based on a directed acyclical graph.

RESULTS:Median PM2.5 exposure was 6.2 μ g/m3; 44% of participants had detectable coronary atherosclerosis. PM2.5 was not associated with SIS or CACS, but with a higher NCP prevalence (POR 1.65, 95% CI 1.18, 2.31, per interquartile range [2.05 μ g/m3] higher PM2.5) with a dose-response pattern (p = 0.034 for linear trend). Other pollutants and source-specific exposures did not demonstrate consistent positive associations with any of the outcomes.

CONCLUSIONS: In this large, middle-aged general population sample at low exposure levels, PM2.5 exposure was not associated with estimates of general coronary atherosclerosis or calcification, yet appeared to be associated with non-calcified plaques, which may reflect an association with the early phase of atherosclerosis or more vulnerable forms of atherosclerosis.

The main funder of SCAPIS is the Swedish Heart and Lung Foundation. Funding for this study was provided by the Swedish Research Council for Health, Working Life and Welfare (FORTE).

Keywords: cardiovascular diseases, particulate matter, environmental epidemiology

The association of particulate matter components with heart rate variability

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BACKGROUND AND AIM: The effect of particles having aerodynamic diameter less than 2.5 microns (PM2.5) on cardiovascular health has been well established in the literature, however, the total PM2.5 mass constitutes a complex mixture of organic and inorganic species. The differential impact of these species on health is still poorly understood but is imperative to policy formulations especially in highly polluted regions like India.

METHOD:In this research study, we assessed the impact of PM2.5 components on the heart rate variability (HRV) indices in a panel of health subjects situated near the entrance gate of college campus in a traffic micro-environment. 35 male security guards were monitored during their duty period (exposure period) during which they wore an ECG holter device to record both time and frequency domain parameters of HRV at 5-min interval. The Aerosol Chemical Speciation Monitor (ACSM) was used with a cyclone of 1-micron diameter cut-size to determine the concentrations of the PM1 components (chloride, ammonium, nitrate, organics and sulfate) and the concentrations were extrapolated for PM2.5 mass assuming homogeneity in the contributing sources. We used mixed-effect models to quantify the effect of per inter-quartile (IQR) change in pollutants on the HRV parameters (SDNN- standard deviation of normal-to-normal; pNN50- percent normal-to-normal intervals > 50ms; rMSSD- root mean square of successive differences between normal heart beats; HF- high frequency; LF- low frequency and LF/HF ratio).

RESULTS: We observed a significant decline of more than 10% in the pNN50 per IQR increase in all PM2.5 components. Similar associations were also seen for other HRV parameters.

CONCLUSIONS: The results of the study are indicative of the fact that exposure to PM2.5 components adversely affects the cardiac autonomic functioning of the body and suggests the need to study the associations with other PM components.

Keywords: Traffic-related, Particulate matter, Short-term exposure, Cardiovascular diseases, Envrionmental Epidemiology

Prenatal Air Pollution Exposure and Blood Pressure during Childhood and Adolescence: findings from Project Viva

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BACKGROUND AND AIM: To examine the associations of prenatal air pollution exposures with blood pressure (BP) from childhood to adolescence.

METHOD:Using residential addresses and a satellite-based spatiotemporal model, we estimated prenatal exposure to PM2.5, black carbon (BC), ozone, and nitrogen dioxide (NO₂) for participants of the Boston-area pre-birth cohort, Project Viva. We modeled associations of trimester-specific air pollution exposures with age-, sex- and height-standardized BP z-scores at early-childhood (mean age 3.2y), mid-childhood (7.7y), early-adolescence (12.9y), and late-adolescence (17.5y) using linear regression models. We adjusted for maternal age, pre-pregnancy BMI, race and ethnicity, education, smoking status, and household income.

RESULTS: We included 1446 children (49% female) in the analysis. Participants' mothers were mostly White, non-smokers, were college-educated, and had annual household income >USD\$70,000/year. The mean (interquartile range) prenatal exposure was 11.30 (10.28, 12.19) μ g/m3 for PM2.5 and 0.72 (0.57, 0.84) μ g/m³ for BC. After covariate adjustment, 3rd trimester PM2.5 and BC were positively associated with BP at early-childhood [e.g. 0.04 (95% CI: 0.02-0.07) higher systolic BP z-score per μ g/m³ increment in PM2.5; 0.38 (0.14-0.62) and 0.39 (0.20-0.57) higher systolic and diastolic BP z-scores, respectively, per μ g/m³ increment in BC]. Prenatal BC was also associated with higher BP in mid-childhood and late-adolescence. NO₂ was associated with higher systolic BP in early-childhood, but lower systolic BP in mid-childhood. The associations between ozone and BP were also inconclusive; 2nd trimester ozone was associated with higher systolic BP in early-childhood while 3rd trimester ozone was associated with lower diastolic BP in early-childhood.

CONCLUSIONS: Third-trimester PM2.5 and BC exposures were associated with higher BP in early childhood. Next, we will model BP trajectories across the four time points and evaluate mixture effects of co-exposure to multiple air pollutants during critical windows in early life.

Keywords: air pollution, children's environmental health, environmental epidemiology, cardiovascular diseases, blood pressure

Relationships between Short-term Exposure to Ambient PM2.5 and Incident Cases of Cardiovascular Disease

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BACKGROUND AND AIM: There are limited studies investigating the association between short-term exposure to PM2.5 and incident cardiovascular disease (CVD) cases in China. This study aims to examine the short-term effects of PM2.5 on the incidence of cardiovascular diseases. METHOD: Daily air pollutant concentrations including PM2.5 derived from continuous daily monitored data obtained from 12 monitoring sites in Yantai Environmental Monitoring Center from 2014 to 2019. Daily counts of incident CVD cases (International Classification of Diseases, 10th revision- ICD10) were collected from the Disease Control and Prevention Center Disease Registry System of Yantai. Combination of Poisson-distribution generalized linear model and distributed lag non-linear model were used to examine the association between short-term exposure to PM2.5 and incident cases of CVD.

RESULTS:The results revealed that per 10 μ g/m3 increment of PM2.5 increased the incident CVD cases by 0.147% (Relative Risk: 1.00147, 95% Confidence Interval: 1.00008-1.00286) at a lag of 2 days. The stratified analyses showed higher effects of CVD risk due to PM2.5 exposure in females, older residents (aged 60-75 years) and acute myocardial infarction group (p-value for difference < 0.05).

CONCLUSIONS: This study indicates that short-term exposure to PM2.5 may increase the risk of CVD and highlights the necessity for a higher air quality standard in Yantai and eastern China.

Keywords: Air pollution, Cardiovascular disease, Incident cases, PM2.5, Generalized linear model

Investigation of semen quality among Thai male tobacco farmers over harvest season

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BACKGROUND AND AIM: Semen quality is affected by a variety of factors that include tobacco use. Tobacco exposure are avoidable factors which may affect male fertility that reduces semen quality. Thailand is one of the most famous tobacco-growing zones. The farmers have been exposed to the nicotine in tobacco leaves and might be at risks to its health effects. This study aimed to evaluate the semen quality different between the season periods among male tobacco farmers.

METHOD:A cross-sectional study was performed to describe the semen quality over harvesting season period among 62 participants who were between 20-40 years of age in Sukhothai Province, Thailand. Sperm motility, sperm morphology and sperm count were evaluated for semen quality. Semen samples were collected two times during processing of cultivation tobacco growing. Paired t-test was used for data analysis.

RESULTS: In the 62 participants, the mean of sperm motility, sperm morphology and sperm count in the male tobacco farmers at the picking top of tobacco plants and dry curing of tobacco plants were significantly lower than those in the picking first of tobacco plants (p < 0.05).

CONCLUSIONS: The result of this study suggested that the effects of nicotine reducing semen quality. Tobacco exposure over harvesting season period leads to reduce potential semen quality. Therefore, education and prevention programs should be directly towards specific risk group. In addition, male tobacco farmers should be advised about the potential adverse effects of their work on sperm quality.

Keywords: Occupational exposures, tobacco exposure, semen quality

Prevalence of Chronic Respiratory Symptoms among Workers Exposed to Cement Dust in Gauteng Province, South Africa

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BACKGROUND AND AIM:Cement workers are exposed to various kinds of occupational hazards, dust being the most hazardous. Despite certain exposure limits on the emission of air pollutants in place, several people die each year due to complications from respiratory disease. This study aimed to assess the prevalence of chronic respiratory symptoms among workers exposed to cement dust. We conducted the study to identify the prevalence of respiratory symptoms among cement workers, evaluate workers' practices regarding the use of respiratory protection gear and to determine factors associated with respiratory symptoms.

METHOD:A quantitative, descriptive cross-sectional design was employed among 81 workers from two cement production companies. A self-administered questionnaire, anthropometric measurements and a spirometry test were used as data collection tools. Data were analyzed using Wilcoxon rank sum, binary logistic regression, Pearson's chi-squared and Fischer's exact tests.

RESULTS:Respiratory symptoms such as wheezing, recurring blocked nose, sneezing/stuffy nose, fatigue/tiredness, rapid breathing, soreness/watery eyes and breathlessness were significantly prevalent among participants from both facilities. Being a driver or an administrator and an operator was significantly associated with blocked nose, wheezing, phlegm and breathlessness, with a p-value of 0.018, 0.006, 0.037 and 0.018 respectively. Workers who smoked were more likely to experience any respiratory symptoms (95 percent CI=1.69-23.73, p=0.006).

CONCLUSIONS: Engineering and housekeeping control measures such as the use of a High-Efficiency Particulate Air (HEPA) vacuums to clean up dust and proper use of Personal Protective Equipment (PPE) where workers are exposed to dust particles should be implemented. This control will help in reducing silica exposure during production.

Keywords: chemical exposures, exposures, occupational exposures, respiratory outcomes

Improving environmental, occupational health and safety for small and micro-small enterprises in a mechanical craft village, outside of Hanoi, Vietnam

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BACKGROUND AND AIM: The small and micro-small sized enterprises (SMEs) have a vital role in creating jobs, increasing local income, and reducing poverty in rural areas in Vietnam, they also pose challenges to the environment, the local economies, and to public health. This study was carried out to 1) enhance understanding and skills in applying ergonomic solutions to improve environmental, occupational health and safety (EOHS) in mechanical SMEs; and 2) applying Work Improvement in Small Enterprises (WISE) method to improve EOHS conditions at the studied SMEs.

METHOD: Ergonomic intervention design was applied in this study. Training and communication were provided for employers and workers in a total of 40 mechanical SMEs, and general population living in the craft village. WISE developed by the International Labour Organization was used for improvement of EOHS conditions at 9 mechanical SMEs.

RESULTS:A significant difference in the knowledge on the applicability of ergonomic interventions before and after training was found (37.5% vs 79.5%, p < 0.01). All enterprises have evaluated the WISE method as very suitable (69.2%) and suitable (30.8%) with their production conditions and 89.7% of enterprises wish to apply this method to improve EOSH conditions. Some intervention activities were carried out at 9 mechanical SMEs include: providing earplugs and earmuffs for workers; supplementing essential medicine cabinets for first aid; increasing the number of bulbs and adjusting the lighting direction to improve the lighting intensity in the workshop; equipping fire prevention and fighting means; improving the seat size to be more suitable for each working position; reducing heavy loads by using self-designed trolleys in the workshop, and increasing industrial aesthetics by adding green plants to the workshop.

CONCLUSIONS: These results emphasized the need to have a further intervention program to promote SMEs applying WISE method to improve their EOHS towards enhancement of productivity and workers health at the workplace

Keywords: Ergonomic intervention, WISE, EOHS conditions, SMEs, mechanical craft village

Occupational exposure to pesticides and symptoms of depression in agricultural workers. A systematic review

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BACKGROUND AND AIM: BACKGROUND: Pesticides cause damage to the environment and human health. In the area of occupational health, there is concern about the effects on the mental health of agricultural workers.

OBJECTIVES: The objective of this review was to systematize the scientific evidence of the last ten years on the effects of occupational exposure to pesticides on the development of depression symptoms in agricultural workers.

METHOD:A search was conducted in PubMed and Scopus databases including articles in Spanish, English, and Portuguese from 2011 to September 2022 that evaluated the relationship of occupational exposure to pesticides with mental health, specifically symptoms of depression in agricultural workers. For the search, recommendations required by the PRISMA statement and the PICO strategy (Patient/participant, intervention, comparison, and outcomes) were followed.

RESULTS:Of 24 articles selected, 75% found an association between exposure to pesticides and the development of depressive symptoms. The most frequently reported pesticides were organophosphates (17 studies), herbicides (12 studies), and pyrethroids (11 studies). The quality of the studies oscillates between intermediate (46%) and high intermediate (46%). The study designs correspond mainly to cross-sectional (75%). Just one 20% of the studies measured with biological biomarkers and only one investigation measured with specific pesticide biomarkers. Depression symptomatology was measured in 10 studies with validated scales or inventories. Only one study measured levels of neurotransmitters and physiological markers associated with depression. CONCLUSIONS:The review is conclusive about the association between exposure to pesticides and the development of depressive symptoms. More longitudinal research with biomarkers of urine exposure is required, controlling for sociocultural variables. However, due to the increased use of these pesticides and the health risk that depression implies, it would be advisable to apply stricter measures in the surveillance of agricultural companies that apply pesticides and monitoring the mental health of exposed agricultural workers frequently

Keywords: pesticides, mental health, occupational health, depression, farmers

Exposure to hydrocarbons and risk of bladder cancer in petroleum workers

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BACKGROUND AND AIM: Increased risk of urinary bladder cancer has been observed in the petroleum industry, and studies based on validated exposure data have been asked for to explain the observations.

METHOD:Data were organised for case-cohort analyses of 189 identified bladder cancer cases diagnosed 1999–2017 and 2,065 randomly drawn non-cases from the Norwegian Offshore Petroleum Workers cohort. Cancers were recorded by the national Cancer Registry of Norway, and information on work histories, and on demographic and lifestyle factors was collected by questionnaires at baseline in 1998. Linkage was performed by unique personal identity numbers. Exposure data at offshore petroleum platforms on the Norwegian continental shelf were evaluated and organized in job-exposure matrices by experts in offshore industrial hygiene. Weighted Cox regressions were used to derive hazard ratios (and 95% confidence intervals (CI)), adjusted for age (as the time scale), tobacco smoking, education, and year of first employment, using lagged or unlagged exposures. Missing data were added with multiple imputation for 20 data sets.

RESULTS: Exposure to benzene was associated with increased risk of bladder cancer modelled as duration of exposure or cumulative exposure, compared with workers considered unexposed. The risks at the highest levels were, for duration (\geq 18.8 years), HR=1.91, 95% CI: 1.15–3.16; P-trend=0.041; and for cumulative exposure, HR=1.60, 95% CI: 0.97–2.63; P-trend=0.065. Associations persisted with 20-year exposure lag (disregarding most recent exposures). No association was found for crude oil (skin or inhalation exposure), mineral oil (for lubrication, hydraulics, or drilling), or for exposure to diesel exhaust.

CONCLUSIONS: The results suggested that exposure to benzene, or to compounds following the benzene fraction of the petroleum, is associated with increased risk of bladder cancer.

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Keywords: Cancer and cancer precursors, Occupational epidemiology, Occupational exposures

OP-159[Chemical exposures » Pesticides]

Glyphosate use and mosaic loss of chromosome Y among male farmers in the Agricultural Health Study

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BACKGROUND AND AIM:Glyphosate, the most commonly used herbicide worldwide, has been implicated in the development of certain hematologic cancers. While mechanistic studies in human cells and animals support the genotoxic effects of glyphosate, evidence in human populations is scarce. We evaluated the association between lifetime occupational glyphosate use and mosaic loss of chromosome Y (mLOY) as a marker of genotoxicity among male farmers.

METHOD: We analyzed blood-derived DNA from 1,606 farmers \geq 50 years of age in the Biomarkers of Exposure and Effect in Agriculture study, a subcohort of the Agricultural Health Study. mLOY was detected using genotyping array intensity data in the pseudoautosomal region of the sex chromosomes. Cumulative lifetime glyphosate use was assessed using self-reported pesticide exposure histories. Using multivariable logistic regression, we estimated odds ratios (ORs) and 95% confidence intervals (CIs) for the associations between glyphosate use and any detectable mLOY (overall mLOY) or mLOY affecting \geq 10% of cells (expanded mLOY).

RESULTS:Overall, mLOY was detected in 21.4% of farmers, and 9.8% of all farmers had expanded mLOY. Increasing total lifetime days of glyphosate use was associated with expanded mLOY (highest vs. lowest quartile, OR = 1.75, 95% CI: 1.00-3.07, *p*-trend = 0.03) but not with overall mLOY; the associations with expanded mLOY were most apparent among older (age \geq 70 years) individuals (2.30, 1.13-4.67, *p*-trend = 0.01), never smokers (2.32, 1.04-5.21, *p*-trend = 0.04), and non-obese

individuals (2.04, 0.99-4.19, p-trend = 0.03). Similar patterns of associations were observed for intensity-weighted lifetime days of glyphosate use.

CONCLUSIONS: High lifetime glyphosate use could be associated with mLOY affecting a larger fraction of cells, suggesting glyphosate could confer genotoxic or selective effects relevant for clonal expansion. As the first study to investigate this association, our findings contribute novel evidence regarding the carcinogenic potential of glyphosate and require replication in future studies.

Keywords: Cancer and cancer precursors, Male, Molecular epidemiology, Long-term exposure, Occupational epidemiology

Personal care product use and perfluoroalkyl substances in pregnant and postpartum women and adolescents in the United States and Canada

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BACKGROUND AND AIM:Perfluoroalkyl substances (PFAS) are ubiquitous chemicals routinely detected in personal care products (PCPs), associated with numerous adverse health outcomes. Few studies have quantified the contribution of PCPs on PFAS concentrations. This study evaluates PCP use and PFAS in maternal-plasma, human-milk, and adolescent-serum.

METHOD:We used 2 pregnancy cohorts; MIREC (2008-2011) and HOME (2003-2006) enrolled people from 10 Canadian cities and Cincinnati, Ohio, respectively. Participants reported frequency of PCP use in MIREC and past 24-hour in HOME. In MIREC, we quantified perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and perfluorohexanoic acid (PFHxS) in maternal-plasma (N=1,940) and PFOA, PFOS, PFHxS, and perfluorononanoic acid (PFNA) in human-milk (N=664). In HOME, we measured PFOS, PFOA, PFHxS, and PFNA in the serum of 11–14-year-old adolescents (N=193). Using linear regression, we estimated percent differences in PFAS concentrations with PCP use, adjusting for covariates.

RESULTS: In MIREC, higher use of several PCPs was associated with higher maternal-plasma and human-milk PFOA and PFOS concentrations. For example, people using hair spray or gel daily had 11.7% (95%CI: 4.9%-18.8%) higher maternal-plasma PFOA concentrations than people not using hair spray or gel. In human-milk, higher use of several PCPs was also related to higher PFNA and PFHxS concentrations, with people who wore makeup daily having human-milk PFHxS levels 32.6%

(95%CI: 6.4%-65.2%) higher those who never wore makeup. In HOME, use of several PCPs was associated with lower PFOA, PFOS, and PFHxS in adolescents.

CONCLUSIONS:Our results suggest some PCPs contribute to higher maternal-plasma and human-milk PFAS concentrations. PCP use was not associated with higher PFAS levels in adolescents. Future studies could examine if associations between PCP use and PFAS depend on country, child age, timing and frequency of PCP use, or product formulation.

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Keywords: PFAS, Pregnancy outcomes, Endocrine disrupting chemicals, Children's environment and health, Chemical exposures

Maternal arsenic exposure, folic acid use during early pregnancy and spina bifida risk: A casecontrol study in Bangladesh

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BACKGROUND AND AIM: Spina bifida is a common neural tube defect that can have lifelong health consequences. Few human studies have tested the association between arsenic exposure and spina bifida, and whether arsenic exposure could modify the protective effects of folic acid supplementation on spina bifida risk. This study aims to examine the associations between 1) prenatal arsenic exposure and spina bifida and 2) folic acid use during early pregnancy and spina bifida under different maternal arsenic exposure levels.

METHOD: The study recruited families and children with spina bifida visiting the National Institute of Neurosciences & Hospital (NINS&H) and Dhaka Shishu Hospital (DSH), two major referral centers for pediatric neurologic diseases in Bangladesh, between December 2016 and August 2022. Infants who visited the study sites for other diseases during the corresponding period were included in the control group. Spina bifida was evaluated by neurosurgeons at the study sites through clinical evaluations. The study team obtained maternal folic acid use information with questionnaires and tested arsenic concentrations from toenails and primary water sources.

RESULTS: There were 282 children with spina bifida and 163 controls in the study. Water and toenail arsenic concentrations were not associated with spina bifida in the study population. We observed a protective association between maternal folic acid use during early pregnancy and spina bifida among mothers with concentrations lower than or equal to the median toenail arsenic concentration (adjusted odds ratio [aOR]: 0.49, 95% confidence interval [CI]: 0.24-0.99, p=0.046) but not among those with concentrations higher than the median (aOR: 0.98, 95% CI: 0.47-2.03, p=0.949).

CONCLUSIONS: Maternal folic acid use during early pregnancy was associated with lower odds of spina bifida among mothers with toenail arsenic concentrations lower and equal to the median, but not among mothers with higher than the median arsenic concentrations in Bangladesh. Funded: National Institutes of Environmental Health Sciences.

Keywords: Birth outcomes, children's environmental health, environmental epidemiology, heavy metals.

Gestational blood levels of PFAS mixtures and associations with global DNA methylation in pregnant women and their infants

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BACKGROUND AND AIM:Pregnant women and their foetuses are exposed to multiple perfluoroalkyl substances (PFAS) that may alter epigenetic regulation, such as DNA methylation, which may negatively affect health and development in childhood and later in life. The aim of the study was to investigate the associations between gestational levels of PFAS, and their mixtures, with global DNA methylation levels in pregnant women and their newborn children.

METHOD:Seven PFAS and markers of global DNA methylation status [5-methylcytocine (5mC) and 5hydroxymethylcytosine (5hmC)] were measured in blood of 634 pregnant women (gestation week ~18) from the Norwegian Mother, Father, and Child Cohort Study (MoBa). Blood levels of 5mC and 5hmC were also measured in their newborn children (cord blood). Multivariable adjusted elastic net regression was used to identify the most important PFAS-global methylation relationships as well as two-way interactions (PFAS and covariates). Potential non-linear associations were also assessed. The joint effects of PFAS mixtures on DNA methylation markers were investigated using a quantile gcomputation approach.

RESULTS:In both pregnant women and their infants, PFHxS was the most important PFAS in relation to 5mC. For mothers, this relationship varied with levels of seafood intake and PFDA concentrations, whereas for newborns, it varied with maternal education level, maternal seafood intake and smoking during pregnancy. In pregnant mothers, PFHxS and PFOS (both non-linear) were identified as the most important PFAS in relation to 5hmC. No joint effect was observed of the PFAS mixtures on DNA methylation markers.

CONCLUSIONS: The results show that some specific PFAS may alter the DNA methylation status in pregnant women and/or their child. As DNA methylation dysregulation might be a key mechanism in disease development and thus of high importance for public health, future studies should be aimed at replicating these findings, as well as investigating the potential health consequences of such dysregulation.

Keywords: PFAS; DNA methylation; Neonates; Pregnant women; The Norwegian Mother, Father and Child Cohort study (MoBa)
Exposure to organophosphate ester flame retardants and plasticizers (OPEs) during pregnancy and autism-related outcomes

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BACKGROUND AND AIM: Growing evidence suggests that organophosphate esters (OPEs), chemicals widely used as plasticizers and replacements for PBDE flame retardants, may be developmental neurotoxicants. We investigated whether urinary concentrations of OPEs during pregnancy were associated with child autism-related outcomes in a large and diverse US sample. METHOD: We included 3,246 mother-child pairs born between 2006-2020 from 15 cohorts in the NIH Environmental influences on Child Health Outcomes (ECHO) Program. Nine OPE analytes were measured in spot urine samples collected during mid- to late- pregnancy. We assessed child autism-related traits via a) parent report on the Social Responsiveness Scale (SRS) and b) clinical autism diagnosis from parent report and medical records. We examined relations of OPEs with SRS T-scores and autism diagnosis in multivariable linear and logistic regression models, respectively, using generalized estimating equations to account for clustering by cohort. OPEs were modeled continuously (log2-transformed), categorically (high [> median], low [\leq median], non-detect), or as detect/non-detect depending on the proportion of values above the limit of detection.

RESULTS:The mean SRS T-score was 47.7 (SD=8.5) and 94 children had an autism diagnosis. Bis(1chloro-2-propyl) phosphate (BCPP), bis(butoxyethyl) phosphate (BBOEP), and bis(2-methylphenyl) phosphate (BMPP) were each associated with modest increases in autistic traits (BCPP adj- β for low vs. non-detect: 1.08, 95% CI: 0.16, 2.01; BBOEP adj- β for high vs. non-detect: 1.08, 95% CI: 0.69, 1.47; and BMPP adj- β for detect vs. non-detect: 0.94, 95% CI: 0.31, 1.57). These analytes were also associated with greater odds of autism diagnosis (BCPP adj-OR: 1.25, 95% CI:1.03, 1.51; BBOEP adj-OR 1.33 [1.03, 1.73]), though the estimate for BMPP was imprecise (adj-OR: 1.30, 95% CI: 0.92, 1.81). Other OPE analytes were not associated with autism-related outcomes.

CONCLUSIONS: Pregnancy exposures to OPEs, specifically BCPP, BBOEP, and BMPP, may be associated with slightly greater likelihood of traits and diagnosis of autism in childhood.

Keywords: Environmental epidemiology, Endocrine disrupting chemicals, Children's environmental health

Pregnancy and early infancy exposure to endocrine disruptors and post-natal growth in a cohort relying on repeated urine collection

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BACKGROUND AND AIM: Endocrine disrupting chemicals (EDCs) may play a role in adiposity growth during infancy. Literature in this scope suffers from limitations in exposure assessment: only one or few urine samples used or exposure only assessed during pregnancy and not in early infancy, another critical period. We investigated associations between early-life exposure to short half-life EDCs and post-natal growth, relying on repeated within-subject urine collections over pregnancy and early infancy.

METHOD:In SEPAGES cohort, we studied exposure to 4 phenols, 4 parabens, 7 phthalates and 1 nonphthalate plasticizer from weekly pooled urine sample collected from 364 mother during pregnancy (median 18 and 34 gestational weeks) and from their infant (at 2 and 12 months of age). Infant weight, height, body mass index (BMI) and head circumference were estimated at 3 and 36 months of age by modeling of repeated measures obtained from study visits and children's health record booklet. We assessed associations between these parameters and either individual chemicals using adjusted linear regression or their mixture using a Bayesian Kernel Machine Regression model.

RESULTS: The uni-pollutant analyses revealed few associations. Bisphenol-S at second trimester of pregnancy was positively associated with all infant growth parameters at 3 and 36 months. Mono-nbutyl phthalate (MnBP) at 12 months was positively associated with BMI, weight and head circumference at 36 months. Mixture analysis revealed positive associations between exposure at 12 months and BMI and weight at 36 months, with MnBP showing the highest effect size within the mixture.

CONCLUSIONS: This study suggests that exposure to a mixture of EDCs in early infancy may be associated with increased weight and BMI in early childhood, a risk factor of obesity in later-life. Furthermore, this study highlighted a potential impact of prenatal bisphenol-S exposure, a new compound that had never been studied in this context.

Keywords: Phthalates, Phenols, Children's environmental health, Obesity and metabolic disorders, Mixtures analysis

Assessment of environmental sources of arsenic, lead, and cadmium exposure among pregnant women in rural, Bangladesh

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BACKGROUND AND AIM: Exposure to heavy metals during pregnancy has been associated with an increased risk of adverse birth outcomes, including stillbirth. Our study aims to investigate the sources of exposure to select metals (arsenic, lead, and cadmium) during pregnancy among women residing Faridpur and adjacent districts, namely Madaripur, Rajbari, Jhenaida, Magura, Gopalganj, Kushtia and Dhaka, Bangladesh.

METHOD: We have enrolled women who experience stillbirths (N=31) and live births (N=33) at Bangabandhu Sheikh Mujib Medical College Hospital, Faridpur in Bangladesh, with 64 participants enrolled to date. Samples of drinking and cooking water, rice, courtyard and agricultural soil, and turmeric were collected from homes where participants resided for at least two trimesters of pregnancy. Concentrations of lead, cadmium, and arsenic in turmeric and soil were measured using a handheld X-ray fluorescence analyzer.

RESULTS:Turmeric lead concentrations exceeded the Bangladesh standard (2.5 μ g/g.) in approximately 10% of turmeric samples, with a maximum concentration of 46 μ g/g. Arsenic was not detected in these samples. Out of 64 participant households, 27 had agricultural land and provided agrarian soil samples. None of the courtyard or agricultural soil samples had lead concentrations exceeding the threshold of 400 μ g/g set by the US EPA. Only one courtyard was found to have soil arsenic concentrations exceeding the threshold level for arsenic (20 μ g/g); however, over 40% of agricultural soil samples had arsenic concentrations above 20 μ g/g, with an average concentration of 16.8 μ g/g (±12.1 μ g/g). Cadmium was not detected in the courtyard or agricultural soil samples. CONCLUSIONS:Pregnant women residing in Faridpur and adjacent districts of Bangladesh may face a potential risk of exposure to high concentrations of lead in turmeric as well as arsenic in agricultural soil or output. Our continued research will evaluate associations between heavy metal exposure and stillbirth in this community. **Keywords:** stillbirth, heavy metals, environmental exposure

A Multi-Country Effort to Understand Temperature Associations with Stroke-Specific Mortality

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BACKGROUND AND AIM:Globally, extreme temperatures contribute to millions of deaths each year, including stroke-related deaths. However, existing environmental evidence has overlooked the distinct causes and mechanisms of different stroke outcomes. Stroke-specific studies have been limited to single-city or single-country analyses, that are limited by publication bias and generalizability.

Within the Multi-country Multi-City (MCC) Network, we built a new mortality database for ischemic and hemorrhagic stroke to conduct a multi-national, multi-decade analysis on the relationship between extreme temperatures and the two most common causes of stroke.

METHOD: We used a two-stage protocol to analyze stroke-specific deaths. In the first stage, we fitted conditional quasipoisson regression for daily mortality counts with distributed lag non-linear models for the temperature exposure in each city. In the second stage, the cumulative risk from each city was pooled using mixed effects meta-analysis, accounting for potential higher-level effect modification and clustering of cities with similar features. We compared temperature-stroke associations across country-level gross domestic product (GDP) per capita. We computed excess deaths in each city that are attributable to the hottest and coldest 2.5% of days.

RESULTS: We collected a total of 3,443,969 ischemic stroke and 2,454,267 hemorrhagic stroke deaths from 522 cities in 25 countries. For every 1000 ischemic stroke deaths, we found that extreme cold and hot days contributed 9.1 (95% eCI:8.6,9.4) and 2.2 (95% eCI:1.9,2.4) excess deaths,

respectively. For every 1000 hemorrhagic stroke deaths, extreme cold and hot days contributed 11.2 (95% eCI:10.9,11.4) and 0.7 (95% eCI:0.5,0.8) excess deaths, respectively. The study found that countries with low GDP per capita were at higher risk of heat-related hemorrhagic stroke mortality than countries with high GDP per capita (p=0.02).

CONCLUSIONS: As climate change is driving more extreme temperatures and weather events, urgent

attention to meaningful clinical outcomes can help identify and minimize the risk of death from stroke, especially in low-income countries.

Keywords: ischemic stroke, hemorrhagic stroke, pathophysiology, extreme temperature, climate change

Geographical variation in the impact of extreme heat events on respiratory hospitalizations among older adults in 120 U.S. metropolitan areas

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BACKGROUND AND AIM: Extreme heat exposure is a well-known cause of mortality, particularly among older adults. However, evidence of the effect of extreme heat on morbidity is inconsistent. We applied a uniform modeling approach across 120 of the largest US metropolitan areas to assess heatrelated hospitalizations for respiratory disease among older adults.

METHOD: We obtained ZIP code-level daily counts of respiratory disease hospitalizations using Medicare billing claims from short-stay, inpatient hospitalizations. We estimated ambient heat exposure using spatially interpolated, population weighted weather station data. To estimate heathealth impacts during the warm season (June-Sept), we explored lag days 0-6, and used conditional Poisson with a distributed lag non-linear model, matched on ZIP code of residence, month, and day of hospitalization. We fit separate models for three heat exposure metrics; all models were adjusted for temporal trends and meteorology.

RESULTS: From 2000 to 2017, we identified 9,141,138 respiratory disease hospitalizations during the warm season. Associations between respiratory hospitalizations and extreme heat days - defined as the 95th percentile of the city-specific warm season temperature - exhibited substantial geographic variation. When comparing the 95th percentile to the 50th percentile of temperature, cumulative odds ratios ranged from 1.09 (95% CI: 1.03, 1.15) in Palm Bay, Florida to 0.95 (95% CI: 0.89, 1.00) in Boise City, Idaho. Geographical variation was not explained by U.S. region/division or Köppen classification of climate zones. Associations were generally larger on lag days 0-2 compared to later lag periods.

CONCLUSIONS: Considerable geographical variation in the magnitude and direction of odds ratios suggest that drivers of heat-health impacts are occurring at the local level. Future work should investigate area-level factors that modify risk. This work was supported by a cooperative agreement between the U.S. EPA and University of North Carolina-Chapel Hill. The abstract does not necessarily reflect the views and policies of the U.S. EPA.

Keywords: Built environment, Temperature extremes, Respiratory outcomes, Environmental epidemiology

Excess mortality of heat waves: comparison of the periods, the worst heat waves in the history of South Korea

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BACKGROUND AND AIM:Climate change has been causing extreme weather, including frequent summer heat waves. We examined how the effects of high air temperatures on mortality in South Korea have changed in the past and recently.

METHOD:Temperature data from the Korea Meteorological Administration and mortality data from Statistics Korea were used. Time series analysis was performed for each of the five years (1991–1995 and 2015–2019), including 1994 and 2018, the worst heat wave years since the meteorological history of South Korea. The maximum daily temperatures observed at all stations in 1994 and 2018 were 39.4°C and 40.1°C, respectively. We used distributed lag nonlinear models to estimate cumulative relative risks (CRRs) to determine the association between daily maximum temperature in summer (June to September) and mortality. CRRs were estimated for each province, and CRRs for all provinces were pooled using random-effects meta-analysis.

RESULTS:The CRR of the daily maximum summer temperature on mortality for the entire 10-year period (1991–1995 and 2015–2019) was 1.04 (1.02, 1.06), 1.07 (1.04, 1.09), and 1.14 (1.08, 1.21) at the 90th, 95th, and 99th percentile, respectively, based on the temperature of 30°C. The slope of the CRR for mortality increases along with increasing temperature and has been steeper in the past than in the recent and steeper in older than in younger people. Excess mortality has recently declined compared with that in the past.

CONCLUSIONS: The impact of high summer temperatures on mortality has changed over the past 25 years, suggesting improved population resilience.

Keywords: high air temperature, heat waves, mortality, distributed lag nonlinear model

Tracking climate change and health in Europe

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BACKGROUND AND AIM: Climate change impacts health through complex multidimensional pathways. However, whilst evidence and awareness of the health implications of climate change are increasing, there is a need for accessible information allowing effective communication of complex climate-health trends. Responding to this need in Europe, the Lancet Countdown in Europe (LCDE) developed indicators that monitor and quantify the health-climate change nexus since the 1950s. METHOD:33 indicators act as summary measures representing the heterogenous climate-health relationships across (1) impact, exposure, and vulnerability; (2) adaption, planning and resilience; (3) mitigation actions and health co-benefits; (4) economics and finance; and (5) politics and governance. RESULTS: Health risks (1) for almost all indicators have been increasing; clinically relevant pollen seasons are starting 10-20 days earlier each year (1981-2020), the climatic suitability for climatesensitive infectious diseases have been rapidly increasing (1951-2020), and heat exposure is estimated to have increased by 57% between the first and second half of the 21st century. Some encouraging trends for adaptation (2) could be observed. Yet, despite progress in the reduction of the carbon intensity of energy systems and phasing out coal for electricity generation, mitigation efforts remain inadequate to meet reduction targets (3); European energy systems should decarbonise five times the current pace to reach net-zero CO2 emissions by 2050. Likewise, 94% of the European population is still estimated to live at PM2.5 concentrations higher than the WHO guidelines. Furthermore, several substantial economic losses due to climate-related health impacts are reported (4), including losses to due extreme events or reduced labour supply. Lastly, whilst strengthening climate action requires key actors to engage with the health dimensions of climate change, political, corporate, scientific, and individual engagement remains low (5).

CONCLUSIONS: The LCDE highlights the accelerating trends in health-related hazards, exposures, vulnerabilities and risk from climate change, and the insufficient adaptation and mitigation actions in Europe.

Keywords: climate change, health, indicators

The influence of socio-economic factors on the association between temperature and dengue incidence in the Philippines, 2010-2019

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BACKGROUND AND AIM: This study sought to determine the association between dengue and temperature in multiple provinces in the Philippines and explore the extent of which socioeconomic factors influence this relationship.

METHOD:Nationwide dengue cases per province from 2010 to 2019 and data on temperature were obtained from the Philippines' Department of Health – Epidemiological Bureau and ERA5-land respectively. After examining the dengue-temperature association using a negative binomial regression coupled with a distributed lag non-linear model, we further implemented a meta-regression analysis in examining apparent heterogeneity in the province-specific associations.

RESULTS:Nationwide temperature-dengue risk function was noted to depict an inverted U-shaped pattern. Dengue risk increased linearly alongside increasing mean temperature from 23-25 degrees Celsius and peaking at 27 degrees Celsius before declining. However, province-specific analyses revealed significant heterogeneity (I2 =86.1%; p-value < 0.001). Population density, people living in urban areas, poverty incidence, average household size, and health expenditure significantly and substantially explained 85.30-86.30% of total heterogeneity.

CONCLUSIONS: The high levels of heterogeneity in the province-specific associations, in part, can be explained by the province-specific meta-predictors. From a programmatic standpoint, the high variability in dengue risk across provinces necessitates that risk management efforts must be tailor-fitted to each local context. Addressing the social determinants of health, boosting health system spending, and intensifying dengue prevention programs in such areas would help reduce dengue transmission nationwide. Understanding the likelihood of a dengue outbreak in the months given temperature trends would empower policy makers to deploy the most effective and agile interventions in resource-limited settings.

Keywords: Socio-economic factors, Vectors and vector-borne diseases, Modeling, Health inequalities

Association of prenatal solar activity with fertility and pregnancy loss in Eastern Massachusetts

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BACKGROUND AND AIM: Previous studies have linked solar activity to biological mechanisms that may be important to conceiving and sustaining a pregnancy, including folate and melatonin levels and inflammatory markers. We examined the association of prenatal solar activity with fertility (ability to conceive) and pregnancy loss.

METHOD:Our study included singleton births conceived in 2002-2016 at an academic medical center in Eastern Massachusetts. We considered several solar activity metrics, including sunspot number, Kp index, and ultraviolet radiation, from the NASA Goddard Space Flight Center and the European Centre for Medium-Range Weather Forecasts. We used a novel time series variation to infer associations with fertility and pregnancy loss based on the number of live birth-identified conceptions (LBICs) —the difference between the total number of conceptions and those that result in loss for each week—and fitted distributed lag models adjusted for time trends using a pair of harmonics. Effect heterogeneity by sex was also examined.

RESULTS:Higher solar activity was associated with fewer LBICs, which, given our analytic method, can be interpreted as more pregnancy losses for pregnancy exposures but as more pregnancy losses and/or lower fertility for pre-conception exposures. Out of approximately 95 conceptions per week, 14.5% (95% CI: 7.1%, 21.6%) would be lost for an interquartile range increase in sunspot number (78.8 sunspots) in the first 24 weeks of pregnancy. While Kp index and ultraviolet radiation during pregnancy were not associated with pregnancy loss, exposure prior to conception, particularly in the 1-2 months prior, was associated with fertility/pregnancy loss. These associations did not vary by sex. CONCLUSIONS:Our findings suggest that solar activity may be harmful to conceiving and sustaining a pregnancy. Solar activity is a complex phenomenon, and more studies are needed to clarify the underlying pathways and to develop interventions.

FUNDING: National Institutes of Health P30 ES000002 and U.S. Environmental Protection Agency RD-835872.

Keywords: solar activity, pregnancy outcomes, environmental epidemiology

Asian dust and daily mortality in East Asian cities: analysis using the European Union Reference Method for decomposing PM₁₀

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BACKGROUND AND AIM: The association between desert dust and daily mortality has been investigated previously in East Asia, but with a different analytical approach and methods for quantifying dust exposure, rendering it difficult to compare results with other regions. We conducted a study to examine the association using the European Union (EU) Reference Method (Directive 2008/50/EC) to identify desert dust events and quantify exposure as a continuous measurement of particulate matter with diameters of 10 micrometers or less (PM10).

METHOD: We collected data on daily mortality (total respiratory and cardiovascular), PM₁₀, and average temperature from four cities – Beijing, Seoul, Fukuoka, and Taipei – with a period of 4-6 years between 2011-2017. Desert dust days were identified using aerosol maps (NAAPS-NRL), back trajectories of air masses (HYSPLIT) and reanalysis product (MERRA-2). We estimated the background level of PM₁₀ and quantified PM₁₀ concentrations by desert and non-desert sources. City-specific Poisson regression models with distributed lags were used to estimate the associations between mortality and source-specific PM₁₀ (by 3 sources: desert and non-desert PM₁₀ on days with or without dust events).

RESULTS: Cities located closer to the desert areas had more dust events, ranging from 45% of the days in Beijing to 10% in Taipei. The exposure response curves tend to be more curvilinear for cities located closer to desert areas. We observed associations between mortality and PM₁₀ originating from desert dust notably in Beijing. The largest relative risks estimated for total, respiratory and cardiovascular mortality were 1.05 (95% confidence interval: 1.01, 1.10), 1.20 (1.06, 1.36), and 1.08

(1.02, 1.14), respectively, in comparison to the risk at the 1st percentile (3 microgram/m). Local PM₁₀ were also associated daily mortality but the association varied by cities.

CONCLUSIONS:PM10 from desert dusts is an independent risk factor for mortality in populations living near arid areas affected by desert dust.

Keywords: desert dust, particulate matter, air pollution, short-term exposure, mortality

Mortality burden due to PM composition and future projections from SLCP reduction scenarios: A regional comparison

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BACKGROUND AND AIM:Reducing emission of short-lived climate pollutants (SLCPs) is expected to prevent premature deaths from PM2.5 as well as to mitigate global warning. Although previous studies estimated the premature mortality using total PM2.5 mass concentration, PM2.5 toxicity may vary by its composition. Accounting for PM composition may be useful to consider the optimum mitigation path of SLCPs reduction. This study aims to estimate the PM composition-related mortality based on the various SLCPs reductions by region.

METHOD:Initially, we systematically reviewed the literature and pooled the mortality risk function for each PM composition (Black Carbon, Organic Carbon, Nitrate and Sulphate). Using the PM composition data obtained from atmospheric simulation, we projected the PM composition-related mortality with its population attributable fraction (PAF) from 2010 until 2050 for several scenarios which includes the "reference" scenario representing business as usual, as well as the combination of mitigation measures to reduce SLCPs emission ("end-of-pipe" scenario) and to limit global warming to < 2°C. RESULTS:Globally, the projected estimates in 2050 based on the "reference" and "end-of-pipe only" scenario showed an increased in premature mortality due to PM composition while the combination of "2°C target & end-of-pipe" scenario showed a reduction in the PM composition related mortality. Region wise, Eastern Asia, Southern Asia and Sub-Saharan Africa showed the biggest difference in mortality burden when comparing the "reference" scenario and the "2°C target & end-of-pipe" scenario.

CONCLUSIONS: A combination of "2°C target & end-of-pipe" for the mitigation scenario could potentially reduce PM composition related mortality in the world. The regions that could benefit most from these mortality burden reductions are Eastern Asia, Southern Asia, and Sub-Saharan Africa. This study was supported by Environment Research and Technology Development Fund S-20 (JPMEERF21S12020) of the Environmental Restoration and Conservation Agency Provided by the Ministry of Environment of Japan.

Keywords: climate, long-term exposure, mortality

Associations between fine particulate air pollution and cause specific mortality in 337 cities in Latin America from 2009 to 201

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BACKGROUND AND AIM:Air pollution has become a major problem in Latin America with its rapid and unplanned urbanization. Yet no studies have examined the association of mortality and air pollutants in the region across a wide range of cities. We aimed to evaluate whether ambient levels of PM2.5 from satellite measurements are associated with cardiovascular and respiratory mortality among adults in 337 cities from 9 Latin-American countries (Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Mexico, and Panama).

METHOD: We compiled mortality, PM2.5 and temperature data for all cities for the period 2009-2015. For each city, we evaluated the association between monthly changes in PM2.5 and cause-specific mortality for each sex using Poisson models, adjusted for seasonality, long-term trend, and temperature. To accommodate possible different associations between changes in mortality and PM2.5 by age, we included interaction terms between changes in PM2.5 and age (20-39, 40-59, and 60+ years) in the models. Then, we combined the city-specific estimates using a random effects meta-regression to obtain mortality relative risks (RR) for each sex and age group.

RESULTS:We analyzed 3,026,861 and 1,222,623 cardiovascular and respiratory deaths, respectively from a total population that represents 41% of the population of Latin America. We observed that increases in monthly PM2.5 were associated with increases in CVD and respiratory mortality in both sexes. After stratification by age, for CVD associations increased with age but were statistically significant only for males aged 60+ years (RR = 1.02, 95%CI 1.01,1.03). For respiratory mortality associations were larger in the middle aged (40-60) but mostly not significant, especially after adjustment for temperature.

CONCLUSIONS: Ambient air pollution is associated with CVD mortality in elderly population in Latin America, a region with different socioeconomic, environmental and health contexts than higher income cities from where most of the evidence so far comes from.

Keywords: air pollution; particulate matter; mortality; cardiovascular diseases; respiratory outcomes;

Propagation of annual PM2.5 concentration uncertainty into the association with mortality in the United States

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BACKGROUND AND AIM: Even at historically low air pollution concentrations in the US, pollutants are consistently associated with adverse health. To improve exposure assessment, spatio-temporal predictions are used, which possess inherent uncertainty. This uncertainty, however, is not commonly accounted for in health effects models. Uncertainty propagation is critical for comprehensively assessing air pollution impacts on health. We characterized the association between estimated annual PM2.5 concentrations and Medicare death rates in Washington State (WA) while fully propagating PM2.5 uncertainty.

METHOD: We leveraged WA-wide annual all-cause death records for people \geq 65 years (N=222,503) at the ZIP Code level from Medicare claims (2010–2015). We used the Bayesian Non-parametric Ensemble (BNE) to generate spatio-temporal PM2.5 concentrations and uncertainties, then used 500 random samples of annual ZIP Code-level PM2.5 concentrations from the BNE posterior distribution estimates. For each of the 500 WA-wide sample estimates, we fit a health model with a Bayesian formulation of the conditional Poisson model, adjusting for potential confounders. We then collected 2000 samples from each posterior health estimate (for 1,000,000 total samples) into a single pool for the final overall association incorporating uncertainty.

RESULTS:In a preliminary analysis assuming a linear exposure-response relationship, we estimated an overall increase in death rates of 0.68% [95%CrI: 0.08%, 1.44%; 98.8% posterior probability of positive association] per 1µg/m3 increase in PM2.5 concentrations. 474 of 500 (95%) estimates had a >95% posterior probability of a positive association.

CONCLUSIONS:During 2010–2015, when propagating the full spatio-temporal uncertainty in PM2.5 predicted concentrations in WA state, estimates of the positive association between PM2.5 concentrations and death rates were still positive indicating a consistently harmful association even at PM2.5 levels well below the newly proposed national standards.

Keywords: air pollution, PM2.5, mortality, health effects, uncertainty

Spatial and sector-specific emissions contribution to ambient air pollution and mortality in European cities

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BACKGROUND AND AIM: Ambient air pollution is a major cause of ill-health in European cities. We aimed to estimate spatial and sector-specific emissions contribution to ambient air pollution and mortality in European cities to promote targeted source-specific actions to tackle air pollution and protect population health.

METHOD: We estimated source contributions to annual PM2.5 and NO2 concentrations employing the Screening for High Emission Reduction Potentials for Air quality (SHERPA) model. We evaluated contributions from transport, industry, energy, residential, agriculture, shipping and aviation sectors and natural sources for 857 cities in Europe. For each city and sector, three spatial levels were considered: contributions from the same city, rest of country and transboundary. Mortality impacts were estimated for adult populations (\geq 20 years old) following standard comparative risk assessment methods to calculate the annual mortality preventable upon spatial and sector-specific reductions in PM2.5 and NO2.

RESULTS:We observed strong variability in spatial and sectoral contributions among European cities. For PM2.5, the main contributors to mortality were the residential (mean contribution of 22.1%) and agricultural (17.5%) sectors, followed by industry (13.5%), transport (13.2%), energy (9.7%) and shipping (5.3%). For NO2, the main contributor to mortality was transport (47.1%), with additional contributions from industry (14.6%), energy (14.4%), residential (10.0%) and shipping (9.4%). On average, the city contribution to its own air pollution mortality was 13.3% for PM2.5 and 33.6% for NO2 and increased among cities of largest area (22.0% for PM2.5 and 51.6% for NO2) and among European capitals (29.9% for PM2.5 and 62.7% for NO2).

CONCLUSIONS: We estimated city-level and source-specific air pollution health impacts and provide novel insights into actions that might be most effective to target air pollution and protect population health in European cities. Our results show strong variability, pointing out the need for local policies and coordinated actions that consider city-level specificities in source contributions.

Keywords: Health impact assessment, particulate matter, nitrogen dioxide, source contributions, European cities

OP-177[Neurologic and mental health outcomes » Mental health outcomes]

Influence of demographics and having chronic disease on worker mental health in food processing and agricultural industries in southern Thailand

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BACKGROUND AND AIM: Mental health disorders and chronic diseases often co-occur together, influencing the course and severity of the other. We investigated the influence of demographics and having a chronic disease on the mental health status of 434 workers at 5 different food processing and agricultural industry workplaces in southern Thailand. Findings will be used to design future workplace wellness programs using the total worker health framework.

METHOD: From January through February 2023, participants completed a survey about their demographic characteristics and health history, as well as the 66-item Thai Mental Health Indicators (TMHI-66) questionnaire. We used Chi-square analysis to examine the association of demographics with both chronic disease and mental health status. Controlling for sex, age, and body mass index, we employed multiple logistic regression to investigate the impact of having a chronic illness on the risk of poor mental health.

RESULTS: About 16% of participants reported having a chronic disease; while 9% of participants had poor mental health. Roughly 40% of our participants were either overweight or obese. We found associations between being male, over 45 years old, and overweight or obese with having chronic disease. Surprisingly, participants with higher monthly salary were more likely to have chronic disease. There were no associations between demographic characteristics with risk of having poor mental health. Nor did we observe any connections between having a chronic disease and increased risk of poor mental health in our study.

CONCLUSIONS:Our study results suggest that efforts to prevent chronic disease in workplaces should focus especially on males, the elderly, and those at risk for developing obesity. Future research should explore the potential link between rising incomes on changes in nutrition and physical activity. More investigation is needed to better identify what underlying factors are contributing to poor mental health in workers.

Keywords: community-engaged research, mental health outcomes, occupational epidemiology

OP-179[Air pollution » Particulate matter]

Absolute risk of PM2.5-attributable mortality differs by racial identity, income, and age

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BACKGROUND AND AIM:Long-term PM2.5 exposure likely causes premature mortality. In prior work, we reported that populations marginalized by both structural racism and poverty may be more susceptible to PM2.5 pollution than socially advantaged groups. Whether age further modifies these relationships remains understudied. Here, we extend our prior work to estimate PM2.5-mortality exposure-response curves reporting absolute mortality rates for subpopulations defined by multiple dimensions of identity (race, income, age).

METHOD: We analyzed Medicare data from 73 million persons age 65y and older from 2000-2016 in the United States to estimate associations between annual PM2.5 and mortality in subpopulations defined simultaneously by racial identity (Black / White), income level (Medicaid eligible / ineligible), and age (65-74, 75-84, 85-94, 95+). We tailored a causal inference method for continuous exposures to estimate exposure-response curves adjusted for 16 confounders. The method uses an outcome model and an inverse probability of exposure weight derived from the generalized propensity score, yielding a doubly robust estimator.

RESULTS:Each 1 µg/m³ increase in annual PM2.5 was associated with 7.08 (95% CI: 5.43, 8.73) additional deaths / 10,000 person-years for Black persons versus 3.96 (95% CI: 3.73-4.18) additional deaths / 10,000 person-years for white persons. However, this difference varied considerably when further stratifying by income and age. Among higher-income (Medicaid-ineligible) persons, the mortality risk was higher for Black vs. white persons aged 65-74 and 75-84 but lower for persons aged 85-94. For low-income (Medicaid-eligible) persons of all ages, mortality risk was higher for white vs. Black persons.

CONCLUSIONS:Overall, the Black vs. white PM2.5-attributable mortality rate was higher, but in some strata (low-income, older), mortality rates were lower, underscoring the importance of studying how multiple dimensions of identity alter susceptibility. Selective survival may explain some variation in relative mortality rates.

Keywords: air pollution, mortality, causal inference, environmental justice

OP-180[Built environment » Noise]

Interplay of Traffic Flow, Noise, and Air Pollutants on Mental Illness in the REVEAL-HBV Cohort Study

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BACKGROUND AND AIM: Exposure to traffic-related pollution (e.g. noise, air pollutants) is known to increase risk of mental illness, but little is known about which compartment contributes more disease risks. Therefore, we aimed to explore the relationship between long-term traffic exposure and mental illness using in Taiwanese cohort.

METHOD: We recruited 7,908 eligible subjects who were participated in REVEAL-HBV, a cohort study established in 1991-1992. The annual traffic flow data (e.g. passenger cars unit [PCU]) (2005 -2007) was retrieved from the Taiwan Ministry of Transportation and Communications. We obtained annual noise and air pollution (e.g. NO₂) information (2003-2017) from the Taiwan EPA. Participants' residential exposure to noise and air pollutants were based on land-use regression models. The diagnosis of mental illness (i.e. insomnia, anxiety, and depression) was based on participants' medical claim data linking with the Taiwan National Health Insurance Research Database. Cox regression hazards models were utilized to assess the association between traffic flow exposure and mental illness. Causal mediation models were applied to quantify mediation effects of NO₂ and noise on traffic-mental illness association.

RESULTS:A total of 1,537 participants were diagnosed with incident mental illness during follow-up period (2008-2017) with a mean follow-up of 7.1 years. Mental illness was positively associated with exposure to PCU (adjusted hazard ratio [HR] = 1.20; 95% confidence interval [CI] = 1.08 - 1.33; p-value < 0.001) and NO₂ [HR = 1.29; 95% CI = 1.17 - 1.44; p-value < 0.001] in a dichotomous exposure fashion (above median vs. below median). In causal mediate analyses, NO₂ contributed a significant mediation effect (i.e. natural indirect effect) on PCU-mental illness association (HR = 1.16; 95% CI = 1.09 - 1.25).

CONCLUSIONS:Long-term exposure to traffic flow increased the risk of mental illness, and this finding was partly mediated through traffic-related air pollutant (i.e. NO₂).

Keywords: Mental health outcomes, Environmental epidemiology, Traffic-related, Long-term exposure

Systematic evaluation of the environmental effect on depressive symptoms: exposome-wide association study and twin modeling

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BACKGROUND AND AIM: The prevalence of depressive symptoms leads to a severe public health burden. The exposome represents the totality of environmental exposures, but systematic evaluation in relation to depressive symptoms is seldom undertaken. We sought to identify the association of multiple domains of the exposome with depressive symptoms in late adolescence and early adulthood. Then we estimated to what degree the association is due to environmental vs. genetic effects based on a twin analysis.

METHOD: The participants were selected from the FinnTwin12 cohort (3025 in young adulthood and 4127 at age 17). Exposures were from multiple sources and grouped into 12 domains. At first, the exposome-wide association study (ExWAS) was used to identify the significant exposures associated with General Behavior Inventory (GBI) scores in young adulthood and at age 17. Based on these significant exposures, exposome scores were generated by confirmatory factor analysis. Then, bivariate Cholesky twin models, estimating additive genetic and environmental variance components, were fitted to the exposome score and depressive symptoms.

RESULTS:In ExWASes, 29 and 46 exposures were significantly associated with depressive symptoms in young adulthood and late adolescence, respectively, belonging to the domains of family and parents, friend and romantic relationships, school and teachers, and stressful life events. The physical, built, and social environments did not show significant associations with GBI at either age point. Twin models indicated that both genetic and unique environmental factors contributed to the covariance between the exposome and depressive symptoms. Additionally, we identified substantial sex differences in those two factors.

CONCLUSIONS: In summary, family- and parents-related environments substantially affect depressive symptoms in late adolescence and young adulthood. With the two-stage method, our findings underscore the systematic approach of the exposome and recommend the consideration of genetic effects when studying the role of environmental exposures.

Keywords: Built environment, Environmental epidemiology, Exposome, Mental health outcomes, Socio-economic factors

OP-182[Neurologic and mental health outcomes » Neurodevelopmental outcomes]

Longitudinal associations between prenatal paraben exposure with children's intelligence quotient development- TMICS-pilot Study

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BACKGROUND AND AIM:Parabens (PB) is an antimicrobial agent and has been widely used as preservatives. Maternal PB exposures may alter offspring's neurodevelopment in animal studies. Therefore, this study aimed to investigate the longitudinal effect of prenatal PB exposure on children's intelligence quotient (IQ).

METHOD:In the Taiwan Maternal and Infant Cohort Study-pilot, we recruited pregnant women in their third trimester in 2001. The mother-infant pairs were followed as the children aged 2-3, 5-6, 8-9, 11-12, 14-15, and 17-18 years. The concentration of methyl-paraben (MP), ethyl-paraben (EP), propyl-paraben (PP), and butyl-paraben (BP) in maternal urine were determined by on-line coupling with solid-phase extraction (SPE) with liquid chromatography-electrospray ionization tandem mass spectrometry (LC-ESI-MS/MS). The Σ PB was molar sum of the four PBs levels. Multiple linear regression model with generalized estimating equation were applied to investigate the associations across different ages.

RESULTS:In this study, the mothers were averagely aged 29.11 years. MP levels was the highest among the four PB. Data analyses included 62–110 valid mother-child pairs at different follow-ups. After adjustment for confounders, we found maternal urinary MP, PP and Σ PB concentrations were significantly positively associated with 2-3-year-old children's Mental Development Index (β =2.56, β =1.35, β =2.35). We also observed positive associations of maternal urinary MP, PP or Σ PB concentrations with 5-9-year-old girls' Verbal IQ (VIQ) (β =3.10, β =0.55, β =3.20) and Performance IQ (PIQ) (β =2.43, β =1.39, β =2.22), as well as with 11-18-year-old boys' Verbal Comprehension Index (VCI) (β =2.09, β =1.46, β =2.29) and Working Memory Index (WMI) (β =1.24, β =0.55, β =1.37) and girls' WMI (β =0.54, β =0.47, β =0.65). CONCLUSIONS: In this longitudinal study, we observed positive associations between prenatal PB exposure and children's IQ in different life stages. However, residual confounding including parental IQ, parenting style, and child's growing environment may not be fully adjusted. Further studies with large sample size and comprehensive information of children's genetic and socioeconomic status were needed.

Keywords: Endocrine disrupting chemicals, Epidemiology, Neurodevelopmental outcomes

OP-183[Air pollution » Particulate matter]

Association between fine particle matter (PM2.5) and hypothyroidism during prenatal and postnatal periods: A birth cohort study in Taiwan

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BACKGROUND AND AIM: Thyroid function is a critical part of the immune system for the human body. The evidence of PM2.5 on the risk of childhood hypothyroidism is still limited. We investigated the association between exposure to PM2.5 during pregnancy and infancy period and hypothyroidism, and identified sensitive key periods.

METHOD: We conducted a birth cohort study of 2,374,257 children born in Taiwan during 2004-2017 from the Taiwan Maternity and Childhood Database and follow- up until 2018. The exposure assessment of PM2.5 was satellite-based with 1 km resolution using the XGboost model corresponding to their residential address. We performed a Cox proportional hazard model to estimate the effect of PM2.5 on the risk of hypothyroidism and used a distributed lag nonlinear model (DLNM) to evaluate the relationship between PM2.5 and hypothyroidism during pregnancy and infancy period. The results were expressed as hazard ratio (HR) and 95% confidence interval (CI).

RESULTS:Our results showed 3.32 people per 10,000 person-years developed hypothyroidism during the study period. In the Cox proportional hazard model, the HR of hypothyroidism increased by 1.67% (95% CI: 1.01-1.03) with a 10 μ g/m3 PM2.5 during the infancy period. The sensitive key period was during 7-34 weeks after birth.

CONCLUSIONS:Our finding suggests that exposure to PM2.5 during infancy period may increase the risk of hypothyroidism.

Keywords: Children's environmental health, Pregnancy outcomes

Exposure to Perfluoroalkyl Substances and Longitudinal Changes in Bone Mineral Density in Adolescents and Young Adults: A Multi-Cohort Study

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) may impair bone accrual. No previous studies have examined prospective associations of PFAS with changes in bone mineral density (BMD) in Hispanic young persons, a population at high risk of osteoporosis and bone fracture in adulthood. We aimed to examine associations of PFAS exposure with longitudinal changes in BMD in an adolescent Hispanic cohort and examine generalizability of findings in a mixed-ethnicity young adult cohort.

METHOD:We included overweight/obese adolescents from the Study of Latino Adolescents at Risk of Type 2 Diabetes (SOLAR; n=304; mean follow-up=1.39 years) and a subset of young adults from the Southern California Children's Health Study (CHS; n=137; mean follow-up=4.07 years) in this analysis. Plasma PFAS levels were measured at baseline and dual x-ray absorptiometry scans were performed at baseline and follow-up to measure BMD. We estimated associations between five PFAS and BMD outcomes using linear mixed effects models adjusted for covariates.

RESULTS: In Hispanic youth from SOLAR, plasma perfluorooctanesulfonic acid (PFOS) levels at baseline were associated with the development of BMD during adolescence. Specifically, at the end of follow-up, participants with high PFOS concentrations (90th percentile) had 0.043 g/cm² lower trunk BMD than those with low concentrations (10th percentile; p=0.0415). In young adults from CHS, high PFOS was associated with lower BMD, suggesting that effects observed in adolescence persist into adulthood. Participants with high PFOS demonstrated 0.051 g/cm² lower baseline total BMD than those with low PFOS (p=0.0426) and similar differences were observed at follow-up. We did not find associations of other PFAS with BMD.

CONCLUSIONS:PFOS exposure was associated with lower BMD in Hispanic participants in adolescence, an important period for bone accrual. These effects persisted in mixed-ethnicity young adults. Low BMD in these time periods may increase risk of osteoporosis and fractures later in life.

Keywords: Children's environmental health, Environmental epidemiology

Multi-tissue DNA methylation analysis to identify an appropriate surrogate tissue for a unique tissue specific to spina bifida

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BACKGROUND AND AIM:Neural tube defects, including spina bifida, are severe birth defects that occur when the neural plate fails to close in early gestation, potentially causing lifelong health consequences in surviving children. Animal models suggests a role of epigenetic mechanisms, including DNA methylation, in neural tube closure; however, studies characterizing DNA methylation profiles in nervous system tissue from humans with spina bifida are limited. In this study, we assessed DNA methylation profiles in dural tissue collected at the time of surgical closure of the neural tube defect in infants diagnosed with spina bifida in a case-control study in Bangladesh and examined whether whole blood or buccal swab are appropriate surrogate tissues, as they are more practical to collect in largescale epidemiological studies and less invasive.

METHOD:Infant DNA methylation was measured in dural tissue, buccal swab, and whole blood samples collected from 27 infants with spina bifida using the Illumina Infinium MethylationEPIC BeadChip array. We used M-values in paired analyses to discover differentially methylated probes between the tissue types.

RESULTS: After accounting for multiple hypothesis testing, 34% of CpG sites assessed were not significantly differentially methylated between dural tissue and whole blood samples, compared to the 27% of sites not differentially methylated between dural tissue and buccal swab samples.

CONCLUSIONS: These preliminary results using DNA methylation profiles from a unique nervous system tissue, specifically dural tissue samples collected from infants with spina bifida, suggest whole blood samples may be a more appropriate surrogate tissue than buccal swab samples. The study warrants replication in larger groups to validate findings and may assist researchers restricted to more accessible biospecimens (i.e. blood) to further characterize epigenetic contributors to neural tube defect etiology.

Funding: NIEHS R01 ES026317, R21 ES030784, P30 ES000002; NIMH T32 MH112510; NICHD P50 HD105351 and R13 HD100191.

Keywords: pregnancy outcomes, neurodevelopmental outcomes

Gestational glyphosate exposure and early childhood neurodevelopment in a Puerto Rico birth cohort

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BACKGROUND AND AIM:N-(phosphonomethyl) glycine, or glyphosate, is a non-selective systemic herbicide that is widely used in agricultural, industrial, and residential settings. Early life exposure to glyphosate has been inconsistently linked to neurotoxic effects in animals, and studies of the neurodevelopmental effects of gestational glyphosate exposure among humans are scarce. Our study aimed to investigate the relationship between prenatal maternal urinary glyphosate metabolites and early childhood neurodevelopment.

METHOD: Mother-child pairs from the PROTECT-ECHO birth cohort in Puerto Rico with information for both maternal urinary glyphosate metabolites and early childhood measures of neurodevelopment were included for analysis (n=147). Spot urine samples were collected up to three times throughout pregnancy and analyzed for glyphosate and (aminomethyl)phosphonic acid (AMPA), a glyphosate degradation product, using gas chromatography tandem mass spectrometry. Child neurodevelopment was assessed at 6, 12, and 24 months using normalized scores from the Battelle Developmental Inventory, 2nd edition (BDI-2) in Spanish. The BDI-2 provides scores for adaptive, personal-social, communication, motor, and cognitive domains. We used multivariable linear regression to examine associations between the geometric mean of maternal urinary glyphosate metabolite across pregnancy and BDI-2 domain scores at each follow-up, adjusting for child's age, birthweight, and sex. RESULTS:At 24 months, all five BDI-2 domains were associated with maternal urinary AMPA: adaptive $(\beta = -5.43, 95\%CI: -9.51, -1.35)$, personal-social $(\beta = -7.86, 95\%CI: -6.23, -0.49)$, communication $(\beta = -7.86, -0.49)$, communication $(\beta = -$ 8.57, 95%CI:-15.40,-1.73), motor (β =-3.36, 95%CI:-6.23,-0.49), and cognitive (β =-6.04, 95%CI:-9.52, -2.55). Motor domain scores at 24 months were associated with maternal urinary glyphosate $(\beta = -3.13, 95\%$ CI:-6.16,-0.11). At 12 months, communication domain scores were associated with AMPA (β =-10.68, 95%CI:-17.99,-3.38). We found no significant associations with BDI-2 scores at 6 months

CONCLUSIONS:Our preliminary results suggest that gestational exposure to glyphosate is associated with adverse neurodevelopment across all domains, with more pronounced delays at older ages. Further investigation into the impact of gestational glyphosate exposure on neurodevelopment is warranted.

Keywords: pesticides, neurodevelopmental outcomes, children's environmental health, chemical exposures, environmental epidemiology

Epigenome-wide association study of urinary total nicotine equivalents in multiethnic current smokers from three prospective cohorts

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BACKGROUND AND AIM:Prior epidemiologic studies have observed that the influence of smoking on lung cancer risk varies by race/ethnicity. This disparity may be partially explained by interethnic differences in the mechanism in which smoking impacts blood DNA methylation. While many studies have investigated the associations between smoking status and DNA methylation, the effect of internal smoking dose on the epigenome has been less investigated, especially across racial/ethnic populations.

METHOD: We conducted a two-stage epigenome-wide association study (EWAS) of internal smoking dose, as measured by urinary total nicotine equivalents (TNE), in six racial/ethnic groups across three cohort studies. The discovery phase was performed in 1,994 smokers from five racial/ethnic groups (White, African American, Latino, Japanese American and Native Hawaiian) in the Multiethnic Cohort Study (MEC). We then externally replicated the findings in 171 Chinese smokers from the Singapore Chinese Health Study (SCHS) and 197 White and African American smokers from the Southern Community Cohort Study (SCCS).

RESULTS: In the discovery EWAS, TNE was associated with differential methylation in 408 CpG sites across >200 genes ($p=9x10^{-8}$). The top ten statistically significant probes were annotated to *AHRR*, *F2RL3*, *RARA*, *GPR15*, *PRSS23* and *2q37.1*, all of which had decreasing methylation with increasing TNE (average decrease ranging from 0.53%-4.44% per log-unit increase in TNE). We also identified 45 novel CpG sites, the most significant of which were

in 17q21.32, SLC28A1, CXXC5, MIR383; SGCZ and SPTBN1. Thirty-four of the 408 discovery CpG sites were replicated in the SCHS and SCCS (Bonferroni-corrected $p=1.23 \times 10^{-4}$). Moreover, significant heterogeneity by race/ethnicity was detected for CpG sites in MYO1G and CYTH1.

CONCLUSIONS:Our study illustrates the transethnic and ethnic-specific effects of TNE on DNA methylation across multiple racial/ethnic groups. Additional investigations in diverse populations are warranted to further clarify how epigenetics may contribute to the known racial/ethnic disparities in smoking-related lung cancer risk.

Keywords: Epigenomics, Epidemiology, Biomarkers of exposure, Omics technologies, Chemical exposures

Evaluation on the sex-related association between cigarette smoke exposure and inflammatory markers - C-reactive protein and white blood cell count

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BACKGROUND AND AIM:Smokers are exposed to hazardous particles and gases which induce inflammation. Accordingly, cigarette smoke exposure increases peripheral white blood cell (WBC) count. However, the association between cigarette smoking and C-reactive protein (CRP) which is one of the important inflammatory markers has been reported as inconsistent. Here, the associations were evaluated using both smoking questionnaires and urine cotinine as exposure markers. METHOD:The Korea National Health and Nutrition Examination Survey data were used for analyzing the associations. Data on age, sex, body mass index, smoking questionnaires, high-sensitivity CRP, WBC count, urine cotinine, blood pressure, cholesterol, glucose, alanine aminotransferase, and uric acid were obtained. The associations between cigarette smoke exposure, assessed by questionnaires and urine cotinine, and health effect, assessed by CRP and WBC, were examined using multiple regression analyses, controlling for relevant factors.

RESULTS: The exposure-response relationship represented a significant increase in CRP level in male smokers compared to male non-smokers, whereas no significant increase was found in female smokers. A significant dose-response relationship between urine cotinine and CRP was observed in male smokers, whereas no significant dose-response relationship was observed in female smokers. WBC count showed significant exposure-response and dose-response relationship consistently in both sexes.

CONCLUSIONS:WBC count was a consistent effect marker of cigarette smoke exposure, whereas CRP level showed an inconsistent association according to sex. CRP level was elevated in current male smokers, and a dose-response relationship was observed when assessed by urine cotinine. However, this association was not observed in women. The sex-related response to cigarette smoke exposure warrants further exploration in the future study.

Keywords: Cigarette smoke, C-reactive protein, White blood cell, cotinine, Tobacco

OP-190[Exposures » Water quality]

Assessing nitrate contamination in drinking water on indigenous Māori Reserves in the Ngāi Tahu takiwā, South Island New Zealand

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BACKGROUND AND AIM:Increasing epidemiological evidence suggests an association between elevated nitrate levels in drinking water and a number of poor health outcomes. Rural and private drinking water sources are particularly vulnerable to nitrate contamination due to neighbouring agricultural activity. Private water supplies, including many on indigenous land, are not routinely monitored for nitrate contamination. We aimed to systematically test drinking water supplies on Māori land in the Ngāi Tahu (an indigenous New Zealand tribe) takiwā (area) to identify areas of nitrate contamination.

METHOD: We implemented 18 marae (meeting house)-based testing sessions within the 18 subregions of the Ngāi Tahu Takiwā. Samples were obtained from all drinking water sources in the community including at the marae and within the community. Nitrate levels were determined onsite using a TriOS OPUS UV optical nitrate sensor.

RESULTS:A total of 18 marae-based testing sessions were carried out. At least two marae had nitrate levels that breached drinking water standards (11.3mg/L nitrate-nitrogen), while other areas had elevated levels (5.65mg/L nitrate-nitrogen). Areas of elevated nitrate in drinking water were adjacent to intense agricultrural activity.

CONCLUSIONS:Māori living on reserves are exposed to unsafe drinking water that breach the drinking water standards. Nitrate contamination on Māori land primarily comes from agricultural activity which is permitted by government policy and regulation. The potential disproportionate level of contamination on Māori land compared to non-Māori land may breach the Treaty of Waitangi, New Zealand's founding document. At the least, it may represent an another environmental injustice to indigenous communities. Future research should collate more monitoring data on Māori land to ensure the best policy and infrastructure is implemented to prevent and mitigate contamination of waterways. All sources of funding: University of Otago, Health Research Council of New Zealand and Ngāi Tahu freshwater entity.

Keywords: Community-engaged research, Environmental disparities, Exposures, Water quality
Insulin resistance and thyroid cancer in Korea: using the Korean National Health and Nutrition Examination Survey (KNHANES) 2016-2021

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BACKGROUND AND AIM: The association between insulin resistance and thyroid carcinoma is controversial. The purpose of this study is to examine the potential effects of insulin resistance on the risk of thyroid cancer among Korean adults.

METHOD: This cross-sectional study included a total of 1,782 adults (204 cases and 1,764 controls without chronic diseases) aged 19 to 59 years from the Korea National Health and Nutrition Examination Survey 2016-2021. Homeostasis Model Assessment for Insulin Resistance (HOMA-IR) and Quantitative Insulin Sensitivity Check Index (QUICKI) were used as insulin resistance indices. The multivariable conditional logistic regression analysis was applied to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS:HOMA-IR was positively associated with the risk of thyroid cancer in all models: compared to tertile 1 of HOMA-IR, ORs were 1.69 (95% CIs = 0.93-3.05) and 4.57 (2.56-8.16) for tertiles 2 and 3, respectively (p for trend <0.001) in multivariable model. Similarly, QUICKI was inversely associated with the risk of thyroid cancer in all models: compared to tertile 1 of HOMA-IR, ORs were 0.37 (95% CIs = 0.22-0.61) and 0.22 (0.12-0.39) for tertiles 2 and 3, respectively (p for trend <0.001) in multivariable models.

CONCLUSIONS: We found a significant association between higher levels of insulin resistance and a higher prevalence of thyroid cancer among Korean adults. In conclusion, our study suggests the importance of developing strategies for insulin management to prevent thyroid cancer in Korea, particularly through dietary intervention, which is known to be related to our findings.

Keywords: thyroid cancer, insulin resistance, HOMA-IR, QUIKI, metabolic health

Association of Alcohol Drinking and Polymorphisms of Alcohol Metabolism Genes with Cataract Risk

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BACKGROUND AND AIM:Cataract, the major cause of blindness worldwide, is caused by a partial or total opacification of the crystalline lens. In Taiwan, about 5.7% of the population has cataracts, mainly over the age of 65, and the prevalence of alcohol consumption among adults is about 43%. Cataract may be affected by alcohol and the genes involved in alcohol metabolism. However, there is a lack of relevant research of the association between alcohol metabolism genes and cataract risk. Therefore, we explore the association between alcohol drinking, alcohol metabolism genes (including *ADH1B* and *ALDH2*) and their interaction with the risk of cataract.

METHOD: We obtained 62,436 individuals over 45 years old from Taiwan Biobank and their genetic polymorphism data of *ADH1B* rs1229984 and *ALDH2* rs671 from Axiom Genome-Wide Array Plate. The logistic regression model was used to determine the alcohol drinking and genotypes associated risk of cataract. The synergistic interaction between the two factors was assessed using the synergy factor. All statistical analyses were performed using SAS version 9.4 software.

RESULTS:We found out alcohol drinking (OR=0.84, 95% CI=0.77-0.92, P<0.0001), compared to nondrinkers, and the *ALDH2* rs671 GA genotype (OR=0.95, 95% CI=0.90-0.99, P=0.0262) and GA+AA genotype (OR=0.95, 95% CI=0.91-1.00, P=0.0324), compared to the GG genotype, were significantly associated with lower risk of cataract. However, these associations were attenuated after adjusted for covariates. Also, the *ADH1B* rs1229984 was not significantly associated with cataract risk. Unfortunately, the interaction between alcohol consumption and alcohol metabolism genes was not discovered in this study.

CONCLUSIONS: Though we found that cataract risk was marginally associated with *ALDH2* rs671 genotype and not effected by the alcohol-gene interaction, we cannot exclude the possibility of residual confounding. Further studies with more alcohol metabolism genes and in other population are required to clarify the alcohol associated risk of cataract.

Keywords: Cataract, Alcohol drinking, Alcohol metabolism, Genetic polymorphism, Interaction

Transgenerational effects of maternal exposure to ambient PM2.5 on sperm functions and DNA methylation in mouse offspring

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BACKGROUND AND AIM: Fine atmospheric particles, which are particulate matter (PM) with a diameter \leq 2.5 µm in total suspended atmospheric particles, can enter the terminal alveoli and even blood circulation along with human respiratory movement; insoluble PM2.5 particles can attach to various toxic entities and could threaten human health, and result in a variety of human dysfunctions and diseases. Knowledge about the effects of prenatal insoluble PM2.5 particle particles on male reproduction and whether transgenerational effects occur in subsequent generations are scant. METHOD: Therefore, in this study, we tested the hypothesis that prenatal exposure to insoluble PM2.5 particles disrupted sperm function in the F1, F2, and F3 generations of male mice. Pregnant Balb/c mice were treated by intratracheal instillation in gestation day 7, 11, and 15 with 10 mg insoluble PM2.5 particles/kg/day. On postnatal day 105 for all generations, epididymal sperm counts, motility, morphology, mitochondrial membrane potential (MMP), reactive oxygen species (ROS) generation, sperm chromatin DNA structure integrity, testicular DNA content in spermatogenesis, serum testosterone, and testicular DNA methyltransferases (Dnmts) levels were assessed. RESULTS: In the F1 generation, prenatal exposure to insoluble PM2.5 particles decreased anogenital distance (AGD) and normal sperm morphology, disrupted body weight, testis, and caput epididymal weight, and significant differences in ROS generation, MMP, and Dnmt1. In the F2 generation, insoluble PM2.5 particles decreased AGD, sperm motility, and normal sperm morphology, with significant differences in ROS generation and MMP. In the F3 generation, disrupted body weight, testis weight, and normal sperm morphology showed significant differences in ROS generation. CONCLUSIONS: Prenatal exposure to insoluble PM2.5 particles might induce the transgenerational effects on male reproductive toxicity in F3.

Keywords: Water soluble PM2.5, Insoluble PM2.5 particles, Intratracheally instillation, Male reproductive toxicity, Transgenerational effects

A quality assessment framework for evaluating study quality and risk of bias of studies of air pollution and preterm birth

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BACKGROUND AND AIM: Recent guidance by GRADE recommended the development of tailored guality assessment framework for reviews of observational studies. There is currently no tailored quality assessment framework available for epidemiological studies of air pollution and preterm birth (PTB), thus there is a clear need to develop one to critique the increasing volume of evidence. METHOD: Our previous work identified 23 SR/MAs in this area, from which information regarding quality assessment tools used and confounders considered was extracted and compared. In particular, studies that conducted stepwise adjustment of confounders to observe their effect on the observed association have been examined. Experts in air pollution exposure and preterm birth were also consulted, and direct acyclic graphs were produced. The WHO Air Quality Guideline Risk of Bias Evaluation (AQG RoB) tool was used as the basis for a framework for studies of air pollution exposure. The framework was then modified to include specific considerations for birth outcome studies. RESULTS: Several changes to the WHO AOG RoB tool have been proposed. In the 'confounding' domain, a key confounder to be added is parity. Alcohol consumption, time-activity pattern and season of conception are confounders highlighted in past literature. In the domain of 'outcome measurement', an additional guestion is recommended to evaluate if the authors have considered how interacting or effect modifying variables may impact the observed association, namely methods of delivery, conception, the type of PTB, or the method of gestational dating. Studies that satisfied these changes would be classified to have a low risk of bias in the subdomains.

CONCLUSIONS: The modified WHO AQG RoB tool is not finalised and further changes will be suggested subject to further discussions with experts and examination of the literature. It will be piloted in a subgroup of studies in an upcoming SR/MA on air pollution exposure during pregnancy and PTB.

Keywords: Epidemiology, Methodological study design, Pregnancy outcomes, Reproductive Outcomes, Female

The Effects of Air Pollution on Children's Educational Attainment at Schools in England

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BACKGROUND AND AIM: Evidence suggests air pollution exposure may impact children's health, including cognitive development. This study examines the effects of PM2.5 and NO2 on children's performance on standardised tests throughout school, while considering the methodological challenges posed by relationships among environmental and socioeconomic characteristics. METHOD: The exposure of children born between 2000-2002 attending schools in England to annual average PM2.5 and NO2 was determined in a 1km radius around their home and school postcodes from their first year of life to age 17 years old using government modelled background pollution data. Related environmental covariates - greenspace exposure from Copernicus' Normalised Difference Vegetation Index and National Strategic Noise Mapping of road and rail noise - were also assessed at children's home and school postcodes. Children's total achievement on standardised English and mathematics tests at ages 6, 8, 12 and 17 years old were obtained from the National Pupil Database. Pupil-level factors - relative age, gender, language, ethnicity and socio-economic status - were also included. Linear mixed-effects models of life-time average PM2.5 and NO2, separately, on performance on standardised tests at school at ages 6, 8, 12 and 17 years old, respectively, were conducted while accounting for potential confounders and geographic clustering by local authority district and school. RESULTS: In fully adjusted models, cross-sectional analyses indicate no observable associations between either air pollutant and total attainment at age 6 or 12 years old; PM2.5 exposure was associated with lower total attainment at ages 8 and 17 years old, while NO₂ showed evidence of borderline associations with lower total attainment at ages 8 and 17 years old. Longitudinal and sensitivity analyses are planned to investigate these relationships further. CONCLUSIONS: This study utilises comprehensive environmental data and powerful, country-wide

administrative data to demonstrate some negative impacts of air pollution exposure on children's cognitive development.

Keywords: Air pollution, Children's environmental health, Environmental epidemiology, Green space, Noise

Susceptible windows of exposure to fine particulate matter and behavioral symptoms related to attention-deficit hyperactivity disorder

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BACKGROUND AND AIM: Few studies have explored temporally refined susceptible windows of exposure to fine particulate matter (PM2.5) and child behavior. We utilized distributed lag non-linear

models (DLNMs) to identify susceptible windows of pre- and postnatal PM2.5 exposures on attentiondeficit hyperactivity disorder (ADHD) symptoms in school-aged children.

METHOD: We included 1,475 mothers recruited in early pregnancy (2003–2008) from the Spanish INMA (INfancia y Medio Ambiente) Project; mother-child pairs were followed through early childhood. ADHD-related symptoms and behaviors were assessed around ages 4-5 and 6-8, using the ADHD Diagnostic and Statistical Manual of Mental Disorders (ADHD-DSM-IV) and Conner's Parent Rating Scales (CPRS), respectively. PM2.5 exposures in 4-week windows from conception to age 6 were estimated using a two-stage random forest model with temporal back-extrapolation. We applied DLNMs within the Bayesian hierarchical model framework to identify susceptible windows of exposure to pre- and postnatal PM2.5 (per 5-µg/m³) on (a) age- and sex-standardized T-scores for CPRS subscales (ADHD index, cognitive problems/inattention, hyperactivity, and oppositional), using the identity link and (b) number of inattention or hyperactivity/impulsivity symptoms from ADHD-DSM-IV, using the log link. Models were adjusted for covariates identified from a directed acyclic graph. Cumulative effects were calculated by aggregating estimates across individual susceptible windows identified in adjacent periods.

RESULTS:No associations of prenatal PM2.5 with ADHD symptoms or behaviors were observed. Postnatal PM2.5 exposure during 1.4-2.7 years and 1.0-2.6 years of age was associated with increased risk of hyperactivity/impulsivity symptoms on the ADHD-DSM-IV [Cumulative risk ratio (RRcum) = 2.72, 95% credible interval (CrI) = 1.98, 3.74] and higher T-scores on the CPRS hyperactivity subscale (β cum = 3.70, 95% CrI = 2.36, 5.03), respectively. Associations were not observed between postnatal PM2.5 exposures and other ADHD-related symptoms or behaviors. CONCLUSIONS:Our study suggests early toddlerhood as a susceptible period of exposure to PM2.5 on hyperactivity symptoms in school children.

Keywords: Air pollution, Particulate matter, Neurodevelopmental outcomes, Children's environmental health.

Impact of exposure to PM2.5 in household air pollution on child neurocognitive development at seven years of age

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BACKGROUND AND AIM:93% of the world's children under age 15 breathe polluted air that harms their health and development. Fine-grained particulate matter (PM2.5) in household air pollution is a particular threat. A significant source of PM2.5 is use of polluting cookstoves in the home. Mothers and children suffer the highest exposures, with risks to children beginning in-utero, potentially impairing their later neurocognitive development. We examine the association between PM2.5 exposures and neurocognitive development in children at age seven.

METHOD: This study follows up on a randomized controlled trial that compared effects, on Nigerian pregnant women, of cooking with polluting fuels versus ethanol. We have followed the children born to these women and measured their personal and indoor PM2.5 exposures at age seven. We assessed their neurocognitive development using the Kaufman Assessment Battery for Children, 2nd Edition (KABC-II) and the Vineland Adaptive Behavior Scales (VABS). Multiple linear regression was used to examine the association between PM2.5 exposures and neurocognitive ability, adjusting for child's age, family assets, and mother's education.

RESULTS: Our sample of 198 children (mean age 7.2 years, SD 0.2) included 132 children from

households using clean cookstoves (liquefied petroleum gas, ethanol) and 66 children from households using polluting cookstoves (firewood, charcoal). Indoor peak PM2.5 levels were higher in households with polluting stoves (geometric mean, 276 μ g/m3) than those with clean stoves (192 μ g/m3). Children's PM2.5 exposure levels were inversely associated with their KABC-II and VABS scores. A 2-fold increase in child's peak personal PM2.5 exposure was associated with a 3.9-unit reduction in KABC-II score (p<0.001); a 2-fold increase in peak indoor PM2.5 exposure with a 2.0-unit reduction in VABS score (p=0.03). Clean stove use was associated with higher KABC-II scores (coef. 4.1, p=0.04). CONCLUSIONS:Household use of polluting cookstoves contributes to children's PM2.5 exposure levels, potentially impairing their neurocognitive development.

Keywords: Air pollution, exposures, particulate matter

Associations of socioeconomic factors and perand polyfluoroalkyl substance exposure profiles in The Norwegian Mother, Father, and Child Cohort Study

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BACKGROUND AND AIM: Socioeconomic status (SES) is an important determinant of exposure to a number of environmental toxicants, including among pregnant women and their developing foetuses. As a combined measure of a person's social and economic position, socioeconomic status is in addition to income, education, and occupation, also related to many lifestyle factors which in turn are linked to health outcomes in children. The purpose of this study is to investigate whether socioeconomic status is associated with levels of per- and polyfluoroalkyl substances (PFAS) in the mother's blood during pregnancy.

METHOD: The present study utilizes data from 3271 pregnant women in The Norwegian Mother and Child Cohort Study (MoBa) with available blood measurements of seven PFAS. Latent Profile Analysis (LPA) was used to identify latent subpopulations characterised by common PFAS exposure profiles. We examined the associations between these profiles and education, household income, and fish intake using linear regression models.

RESULTS: The LPA detected four profiles of PFAS exposures. The relative probabilities of belonging to the first two profiles (characterised by lower overall exposure, one with slightly higher perfluorooctanesulfonate) showed negative association with higher income, education and dietary fish intake (p.adj < 0.0001).

CONCLUSIONS: These preliminary results indicate that different PFAS exposure profiles are differently associated with socioeconomic status. The negative association between income, education, fish intake and with lower PFAS exposure profiles is consistent with previous findings. Future development of this study will integrate data from Statistics Norway to get a more precise picture of SES of the parents and grandparents, will use latent class analysis to identify subgroups with similar socioeconomic status, and then evaluate their link to profiles of prenatal PFAS and other toxicant exposures using latent transition analysis, as well as analysing associations with child neurodevelopmental disorders.

Keywords: PFAS, Mixtures analysis, Socio-economic factors

Per/poly fluoroalkyl substances induce lipid accumulation via the serotonergic signaling pathway in *Caenorhabditis elegans*

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BACKGROUND AND AIM: Per/polyfluoroalkyl substance (PFASs) are persistent chemicals that contaminate the environment worldwide. Previous studies have found PFASs could disrupt lipid homeostasis *in vivo*; however, the possible underlying mechanism is still unclear. METHOD: In this study, Caenorhabditis elegans (C. elegans) was used as a model organism to investigate the toxic effects of perfluorononanoic acid (PFNA), perfluorooctanesulfonamide (PFOSA), and perfluorooctane sulfonate (PFOS) on lipid accumulation and evaluate the mechanism involved. RESULTS: The results showed that exposure to 1 µM PFNA, PFOSA, and PFOS did not affect the development but significantly increase the lipid accumulation in C. elegans by both bodipy 493/503 and nile red staining methods. Among them, PFNA showed a higher level of lipid accumulation than PFOS, followed by PFOSA. In addition, PFNA, PFOSA, and PFOS did not increase the food intake based on the results of decreased pharyngeal pumping rate. Since serotonin plays a crucial role in maintaining the energy balance and regulating lipid metabolism, we further evaluated the serotonin pathway-related gene expression. The results showed that exposure to 1 µM PFNA, PFOSA, and PFOS significantly downregulated the expression of tph-1, mod-1, and nhr-76 genes. Additionally, PFNA and PFOSA significantly downregulated the expression of adipose triglyceride lipase, *atgl-1*. These suggest PFNA, PFOSA, and PFOS may reduce serotonin production and then affect beta-oxidation. Meanwhile, exposure to 1 µM PFNA, PFOSA, and PFOS upregulated the expression of dgat-2, which is involved in triacylglycerol synthesis.

CONCLUSIONS: This study demonstrates that PFNA, PFOSA, and PFOS promote fat accumulation, which is mediated by the serotonin-involved pathway and lipogenesis, to induce the obesogenic effect.

Keywords: Chemical exposures, PFAS, Toxicology, Obesity and metabolic disorders

Prenatal and early postnatal exposure to perfluoroalkyl substances and intelligence quotient score in 7-year-old children

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BACKGROUND AND AIM:Perfluoroalkyl substances (PFAS) are persistent chemicals capable of crossing the placenta and passing into breastmilk. Evidence suggests that PFAS exposure may affect brain development. We investigated whether prenatal or early postnatal PFAS exposure was associated with intelligence quotient (IQ) scores in 7-year-old schoolchildren.

METHOD: We studied 967 mother-child pairs enrolled in the Odense Child Cohort, Denmark from 2010 to 2012. We assessed perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA),

perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA) and perfluorodecanoic acid (PFDA) concentrations in maternal serum collected in the 1st trimester of pregnancy and in child serum at age 18 months. At 7 years of age children completed an abbreviated version of Wechsler Intelligence Scale for Children version-V (WISC-V) from which Full Scale Intelligence Quotient (FSIQ) and Verbal Comprehension Index (VCI) were estimated. We applied multiple linear regressions and elaborated the complex associations by use of structural equation modeling (SEM).

RESULTS:A doubling in maternal PFOS and PFNA concentrations was associated with a 1.5 (95% Confidence Interval (CI) 0.3;2.6) and 1.4 (0.2;2.6) point lower FSIQ, respectively, while no significant associations were observed for PFOA, PFHxS or PFDA. Strong correlations were observed between duration of breastfeeding and PFAS concentrations at 18 months. Despite application of SEM, it was

not possible to isolate potential adverse associations between early-life PFAS exposure and FSIQ from the beneficial association between duration of breastfeeding and FSIQ.

CONCLUSIONS:As PFAS exposure is ubiquitous, even a small reduction in cognitive development is of public health importance, as many children exposed to a small risk may have greater societal impact compared to a few children exposed to a large risk. This work was funded by the Novo Nordic Foundation; the Danish Council for Independent Research, medical sciences; HBM4EU, EU Horizon 2020; the Odense University Hospital PhD Fund.

Keywords: neurodevelopmental outcomes, children's environmental health, environmental epidemiology

Perfluoroalkyl Substances and Metabolic Dysregulations over the Life-course: A Longitudinal Metabolome Investigation using Causal Inference Framework

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BACKGROUND AND AIM:Studying the human metabolome could unravel metabolic dysregulations caused by per-and poly-fluoroalkyl substances (PFAS). However, limitations of observational designs and lack of longitudinal metabolomics measures make it challenging to infer causal associations. Using causal inference methods, we estimated associations between PFAS and metabolomics across the life course.

METHOD: We studied 125 Faroese individuals followed from birth (1986–1987) to mid-childhood (age 7), adolescence (age 14), and adulthood (ages 22 and 28). PFAS were measured in cord whole blood at birth and serum at later ages. In addition, serum untargeted metabolomics was measured at ages 7–28 by liquid chromatography with high-resolution mass spectrometry. We used the Rubin causal model to reconstruct hypothetical randomized experiments that investigate the causal question 'Does increasing PFAS exposure alter the human metabolome?' and evaluated the long-term effects of PFAS at each exposure window on the metabolome using linear regression models with a randomization-based multiple comparison error correction. Metabolites altered by PFAS exposure were enriched into pathways using Reactome.

RESULTS:Prenatal PFOS was associated with increased pantothenic acid over the life course and decreased DL-glutamate from adolescence to adulthood. We found effects by other PFAS for postnatal exposures only when exposures were higher. Mid-childhood PFOA and PFHxS were associated with increased dimethyl-arginine and N-acetylneuraminic acid in adolescence and adulthood. Adolescence, PFHxS, and PFNA were associated with decreased iminodiacetic and 8,11,14–eicosatrienoic acid, respectively, in adulthood. Smaller effect sizes were found for adulthood PFAS compared to developmental exposures. All reported significant associations had adjusted p-value<0.2. Metabolites altered by developmental PFAS exposures are involved in the cellular response to chemical stress, transport of small molecules, SLC-mediated transmembrane transport, ABC transporters in lipid homeostasis, and free fatty acid receptors, among other pathways.

CONCLUSIONS: Using hypothetical PFAS interventions, we found that developmental PFAS exposures may have long-term and persistent effects on the human metabolome through adulthood.

Keywords: Metabolomics, Causal inference,

PFAS Exposure in a Community with a Former Paper Mill: Source Apportionment and Relative Exposure via Drinking Water and Diet

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BACKGROUND AND AIM: Drinking water is an important exposure pathway when PFAS concentrations are elevated whereas for the general population diet is believed to contribute the most exposure. Local and homegrown foods may also be an important exposure pathway for some communities. Therefore, we conducted a detailed biomonitoring study for a Midwestern community with historic (pre-2018) PFAS drinking water contamination (1600 ppt). We enrolled 129 participants from 92 homes, administered dietary surveys, collected samples of serum and drinking water, and collected data on historic drinking water concentrations. We investigated 48 PFASs in water from private wells and found elevated concentrations of nine more not previously identified. Serum concentrations were elevated compared to the general population for PFOS, PFOA, PFHxS, PFHpS and NMeFOSAA. METHOD: We utilized source apportionment methods(Principle Component Analysis-Multiple Linear Regression and Postive Matrix Factorization) to identify predominant PFAS mixtures in the serum samples. We also determined relative contributions of serum PFASs from the drinking water and dietary exposure pathways.

RESULTS: For source apportionment methods that adopting receptor models, we identified 3 to 4 major contamination sources. And all of them were able to identify historical drinking water as a major contamination source.

CONCLUSIONS: The findings indicate that these three methods can successfully identify sources in high-exposure populations. Future research on PFAS exposure should concentrate on analyzing serum for an expanded PFAS panel, identifying cohorts with other distinct point source exposures, and combining biological and environmental data to better understand source apportionment results in the context of PFAS toxicokinetic behavior.

Keywords: PFAS, Source apportionment, human exposure, Drinking water and Diet, receptor models

Differences in association of PM2.5 and PM10 with respiratory hospitalization in Korea from 2006 to 2019

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BACKGROUND AND AIM: The health effects of air pollution do not act equally on the entire population. Even if exposed to the same level of air pollution, the magnitude of the association of air pollution on health may appear differently depending on time, spatial factors, and populations with specific characteristics. This study examined the association of PM2.5 and PM10 with hospitalization due to respiratory diseases according to the variation of spatiotemporal and socioeconomic levels. METHOD: Time series study was conducted using data from 2006-2019 for daily average of PM2.5 and PM10 (grid 9 km), daily average temperature, daily average humidity, and the number of respiratory hospitalizations (ICD code: J00-J46; upper and lower respiratory infections, influenza, chronic obstructive pulmonary disease, and allergic asthma) in South Korea. Spatial variation was subdivided into 16 cities and provinces, and temporal variation was subdivided into 5-year moving intervals. A Poisson distribution was assumed, and the relative risk was calculated through a generalized additive model.

RESULTS:Increase of 10 μ g/m3 concentrations of PM2.5 and PM10 was significantly associated with all respiratory hospitalization. The magnitude of association of hospitalization and PM2.5 was greater than the that of PM10. In a meta-analysis according to the income level, 10 μ g/m3 increase in concentrations of PM2.5 and PM10 were associated with different amount of excess hospitalization according to income level. The range of excess hospitalization according to income level was 1.23% (95% CI: 0.80; 1.66) to 1.37% (95% CI: 0.77; 1.98) for PM2.5 and 0.67% (95% CI: 0.47; 0.87) to 0.84% (95% CI: 0.62; 1.06) for PM10. In addition, spatial and temporal heterogeneity was observed. CONCLUSIONS:Groups with low or high socioeconomic status were evaluated to be more affected by the increase in PM2.5 and PM10. Further research is needed to elucidate the causes of temporal and spatial heterogeneity.

Keywords: Air Pollutant, Particulate Matter, Hospitalizations, Respiratory disease

OP-204[Air pollution » Wildfires]

Association between wildfire, respiratory and cardiovascular disease admission: Mediating effect of air pollutants in Korea

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BACKGROUND AND AIM: Although the impact of wildfires on health is diverse, few studies quantitatively estimate this impact. This study aimed to evaluate the effects of wildfires on respiratory and cardiovascular disease hospitalizations and to estimate the direct and indirect effects through air pollution on these admissions.

METHOD: We used data from the Korea National Health Insurance Service, AirKorea, and the Korea Meteorological Administration. We compared the relative risk of admission in Kangwon province before and after wildfire with those of other regions using a difference-in-differences approach. We conducted mediation analysis to estimate the mediating effects of air pollutants.

RESULTS:We observed increased risks of respiratory and cardiovascular diseases admission during 1 week after the wildfire, and the relative risk was 1.01 [95% Confidence Intervals (CI):0.97, 1.04] and 1.07 (95% CI: 0.95, 1.21) for respiratory and cardiovascular diseases, respectively. Mediation effects were observed for all air pollutants in respiratory [RR (95% CI): Indirect effect 7.78(3.92, 13.56); Direct effect 0.00(0.00, 4.91)] and cardiovascular [RR (95% CI): Indirect effect 1.67(0.01, 3.41); Direct effect 2.01(0.41, 6.18)].

CONCLUSIONS: The study provides evidence on the health effects of wildfire and mediation effect of air pollution.

Keywords: Wildfire, Respiratory disease, Cardiovascular disease, Difference-in difference, Mediation

Long-term exposure to air pollution and risk of acute lower respiratory infections: The Danish Nurse Cohort

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BACKGROUND AND AIM: Air pollution is major risk factor for chronic cardiorespiratory diseases, while the evidence on respiratory infections remains sparse. We examined the association between longterm exposure to air pollution and incidence and episodes of acute lower respiratory infections (ALRIs).

METHOD: We followed 23,912 female nurses in Danish Nurse Cohort (aged > 44) from baseline (1993 or 1999) to 2018. Using primary diagnosis, we defined ALRIs incidence as the first-ever hospital contact and ALRIs episodes as all hospital contacts after baseline. The residential annual mean concentrations of particulate matter with diameters $\leq 2.5 \ \mu m$ (PM2.5), nitrogen dioxide (NO2) and black carbon (BC), since 1979 were modelled by the Danish DEHM/UBM/AirGIS modeling system. Marginal Cox models with time-varying exposures were used to assess the association between 3-year mean air pollution and ALRIs incidence and episodes. Concentration-response functions (CRF) were assessed using natural cubic splines with 3 degrees of freedom, and effect modifications were assessed by adding interaction terms and likelihood ratio test.

RESULTS:During mean 21.3 years' follow-up, 4,746 ALRIs were observed, of which 2,553 were incident (first-ever) events. We observed strong associations of all three pollutants with ALRIs incidence, with hazard ratios and 95% confidence intervals of 1.19 (1.08-1.31) per 2.5 μ g/m3 for PM2.5, 1.17 (1.11-1.24) per 8.0 μ g/m3 for NO2, and 1.09 (1.05-1.12) per 0.3 μ g/m3 for BC. We detected even stronger associations with ALRIs episodes. We found supra-linear CRFs for all pollutants, indicating a stronger association at lower concentrations. We identified people with baseline chronic respiratory diseases, or low physical activities were more susceptible to the adverse effect of air pollution.

CONCLUSIONS:Long-term exposure to air pollution, even at low levels, was associated with risk of both new and subsequent ALRIs.

Keywords: Respiratory outcomes, Infectious diseases, Air pollution, Long-term exposure, Incidence

Constituents of fine particle air pollution and oxidative stress, quality of life of patient with allergic rhinitis: A panel study

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BACKGROUND AND AIM:Allergic rhinitis (AR) is significant global public health issue that affects individuals worldwide, with environmental exposure exacerbating the condition. However, the effects of particulate matter (PM) on AR patients remain inconsistent, with limited studies exploring the relationship between PM2.5 constituents and AR, especially in developing countries with severe pollution.

METHOD: We conducted a panel study to investigate the association between 17 PM2.5 constituents and 49 AR patients, diagnosed >1 year in Taiyuan, China. From June 2017 to January 2018, a face-toface interview and nasal lavage were conducted to assess their health status, life quality, and oxidative parameters for four times in both heating and non-heating seasons. The timemicroenvironment-activity pattern was applied in this study to assess individual PM2.5 exposure, and the constituent-specific concentration of the nearest fixed sampling point was used to proxy individual exposure. Spearman's rank correlation coefficients were used to assess PM2.5 constituent correlations, while mixed-effects regression models were used to investigate short-term exposure effects.

RESULTS: The results showed that PM2.5 mass and constituents, including BaP, PAHs, SO2- 4, NH+ 4, V, Cr, Cu, As, Se, Cd, and Pb, were significantly associated with increased oxidative stress, as indicated by an increase in Malondialdehyde (MDA) index. Additionally, PM2.5 constituents, including V, Mn, Fe, Zn, As, and Se, were associated with decreased antioxidant activity, as indicated by a decrease in Superoxide Dismutase (SOD) index. PM2.5 and constituents were also associated with more severe subjective symptoms and a lower quality of life, as indicated by increased Visual

Analogue Scale (VAS) and rhinitis Related Quality of Life Scale (RQLQ) scores. CONCLUSIONS:Our findings suggest that persistent PM2.5 exposure, along with specific constituents, could exacerbate AR patients' inflammatory symptoms and adversely affect their quality of life in heavy-industrial city of Taiyuan, China. These findings may have potential biological and policy implications.

Keywords: Particulate matter, Chemical components, Air pollution, Allergic rhinitis,

Antagonistic interactions between aging genetic variants and air pollution exposure on chronic respiratory conditions in elderly women

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BACKGROUND AND AIM: Aging is described as the accumulation of modifiable risk factors for chronic diseases. Evidence supports that aging and related diseases are regulated by both the individual genetic make-up and environmental factors such as air pollution. We aimed to investigate their interplay on chronic respiratory conditions in elderly women using an aging genetic risk score (GRS). METHOD: We used data from 834 women (67-80 years) enrolled in the German cohort study on the influence of air pollution on lung function, inflammation and aging (SALIA) between baseline (years 1984–94) and first follow-up (2007–10). Chronic respiratory conditions were defined as any of the following conditions at a mean age of 74 years (SD=3) including asthma, chronic bronchitis, cough, cough with sputum, or chronic obstructive pulmonary disease (n=248). Out of 77 aging candidate single nucleotide polymorphisms, we constructed and evaluated a GRS utilizing bagging and random forests as the statistical learning procedures. Main and interaction effects between GRS and chronic NO2, NOx, PM2.5, PM10, PMcoarse, and PM2.5 absorbance exposure over observation time were investigated on chronic respiratory conditions by adjusted logistic regression models. RESULTS: Higher exposures to air pollutants increased the odds of chronic respiratory conditions by 34% (NOx: IQR=32.1 μ g/m³, p-value=0.007) to 43% (NO2: IQR=11.6 μ g/m³, p value=0.001). Additionally, antagonistic gene-environment interaction effects were identified (GRSxNO2: p-value interaction=0.030, GRSxPM2.5: p-value interaction=0.016, GRSxPM10: p-value interaction=0.023, GRSxPM2.5 absorbance: p-value interaction=0.014, GRSxPMcoarse: p-value interaction=0.042). In individuals exposed to air pollution exceeding the EU thresholds, the GRS suppressed the effect on chronic respiratory conditions.

CONCLUSIONS: In elderly German women, chronic respiratory conditions as an indicator of aging were associated with air pollution exposure, while the individual aging genetic make-up reduced this effect.

Keywords: air pollution, big data, environmental epidemiology, respiratory outcomes

Occurrence of Cryptosporidium species in Wastewater Treatment Plants in Gaza Strip: Environmental health problem

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BACKGROUND AND AIM:Sewage is a common problem in developing and developed countries, where there are many pathogens in wastewater, but they are relatively few. Cryptosporidium spp. Which may contaminate the environment. This study aimed to detect Cryptosporidium spp. in the two wastewater treatment plants (WWTPs) (North Gaza and Sheikh Ejleen WWTPs). METHOD:Over the course of 5 months 85 wastewater samples were collected from the North Gaza and from Sheikh Ejleen WWTPs. The collection process was carried out through the use of a plastic container designated for collection with a capacity of 1 liter. All samples were screened using wet mount, flotation method, acid-fast stain (AFS) and polymerase chain reaction (PCR). RESULTS:The results showed that Cryptosporidium spp. oocyst detected only in 4/85(8%) of sewage samples using the PCR, and these samples had previously were tested positive using the Acid-fast stain. Those samples were from the Sheikh Ejleen WWTP, while the NGWWTP did not record any positive sample for Cryptosporidium spp. The prevalence of the parasite varied over the course of the examination months. It was in September and October 2.3%, while in December and July it was only 1.7%.

CONCLUSIONS:Our findings shed light on the presence of pathogenic parasites in wastewater treatment plants, especially Cryptosporidium spp., which can reach the environment especially Gaza shore where there is a partial treatment for sewage in Gaza, in addition the potential infection for humans.

Keywords: Gaza Strip, wastewater, Cryptosporidium, environment, nested PCR.

Climate variability and occurrence of vector borne diseases: evidence from National Capital Region of Delhi, India

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BACKGROUND AND AIM: The driver of climate variability in the form of unseasonable rain and rising temperatures in this scenario amplifies the risk of vector borne diseases (VBDs) such as malaria, dengue and Chikungunya. We aimed to develop the climate based prediction model for VBDs in National Capital Region - Delhi India

METHOD:A secondary data for eight years (2010–2017) of confirmed VBDs cases in all 10 districts of Delhi - NCR was obtained from local municipalities. District wise monthly data were segregated with respect to the reported residential address of the cases. Climate data, such as atmospheric temperature (AT), relative humidity (RH),rainfall were extracted from satellite, using modern ERA Retrospective analysis for research and Applications. The data were produced on a 0.5 * 0.66 degree grid with 72 layers at hourly scale and averaged for Delhi on a daily basis at district level. Information on Normalized Difference Vegetation Index (NDVI), socio-demographic characteristics were also obtained. The exposure-response was estimated at district level by multivariate generalized linear additive mixed effects model with Quasi-Poisson family.

RESULTS: Gradual increase in monthly average temperature and seasonal variation in occurrence of VBD were observed. RR of VBDs was estimated as 1.17 (95% CI: 1.12-1.23) for AT. There were 18% (95% CI: 12-23%) increase in Dengue cases and 7% (95% CI: 2-12%) increase in Malaria cases for unit increase in monthly average AT. Monthly VBD cases at district level increase monotonically with temperature, RH and NDVI. On interaction analysis AT was correlated with VBD cases if monthly rain fall is between 1-3cm. No impact of temperature on VBD was observed when relative humidity was above 40%

CONCLUSIONS: Temperature and associated climate variability drives the outbreaks of VBDs in Delhi - NCR region. Climate based prediction model could play important role in management of VBDs in India.

Keywords: Climate variability, Vector borne diseases, India

Airborne Avian Influenza Virus in Ambient Air in the Winter Habitats of Migratory Birds

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BACKGROUND AND AIM:Airborne avian influenza virus (AIV) has been evaluated in live poultry markets and case farms. However, no study has discussed airborne AIV in ambient air in the winter habitat of migratory birds. Therefore, this study aimed to evaluate airborne AIV, specifically H5, H7, and H9, in a critical winter habitat of migratory birds and assess the factors influencing airborne AIV transmission in ambient air.

METHOD:A total of 357 ambient air samples were collected in the Aogu Wetland, Taiwan, Republic of China, between October 2017 and December 2019, and analyzed using quantitative real-time polymerase chain reaction. The effects of environmental factors including air pollutants, meteorological factors, and the species of the observed migratory birds on the concentration of airborne AIV were also analyzed.

RESULTS:This is the first study to investigate the relationship between airborne AIV in ambient air and the influence factors in winter habitat of migratory birds, demonstrating the benefits of environmental sampling for infectious disease epidemiology. The positive rate of airborne H7 (12%) was higher than that of H5 (8%) and H9 (10%). The daily mean temperature and daily maximum temperature had a significant negative correlation with influenza A, H7, and H9. Cold air masses and bird migration were significantly associated with airborne H9 and H7, respectively. In addition, we observed a significant correlation between AIV and the number of pintails, common teals, Indian spot-billed duck, northern shovelers, Eurasian wigeon, tufted duck, pied avocets, black-faced spoonbill, and great cormorants. CONCLUSIONS:We illustrated the potential for alternative surveillance approaches (monitoring bird species) as an indicator of influenza-related risks and identified cold air masses and the presence of specific bird species as a potential driving factor for the presence of airborne AIV.

Keywords: H5, H7, H9, airborne avian influenza virus, cold air mass

Factors Influencing Mosquito Bed Net Ownership and Utilization in Eastern Uganda

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BACKGROUND AND AIM: Malaria remains a major global health problem. Although distribution of mosquito bed nets is a widely used approach for malaria prevention, data on how bet net use may be influenced by its source and other factors are still limited. We examined the factors associated with bed net ownership and the pattern of usage in an eastern region of Uganda.

METHOD: Home visits and participant interviews were conducted to collect data from 2540 households among 10 villages in Buwagi Parish, Uganda in 2019. Household- and individual-level data were collected, such as bed net ownership (at least one net versus none), acquirement source (governmental campaigns versus others), and sociodemographics. Net-level information including bed net quantity, conditions, materials used, as well as pattern of usage (e.g., whether nets were hung properly, alternative uses, etc.) were also collected. Multivariable-adjusted regression models were performed to identify the key determinants of bed net usage profiles.

RESULTS:Only 1438 (57%) households processed at least one bed net; households owning net(s) were more likely to have at least one child \leq 5 years of age, compared to households without a net (56.5% vs. 40.8%, p<0.01). Among households owning net(s), the odds of a bed net being correctly used (i.e., to sleep under) after adjusting for potential confounders were significantly lower for larger household size (OR=0.91, 95% CI: 0.83, 0.99, p<.001) and households owning more nets made of polyethylene (OR=0.58, 95% CI: 0.35, 0.94, p<.001), resulting in an alternative use of the net. Interestingly, a bed net obtained from the government for free was associated with lower odds of being correctly hung, compared to a net obtained or purchased from other sources (OR=0.24, 95% CI: 0.08, 0.80, p=0.02).

CONCLUSIONS: Identifying the factors influencing the patterns of bed net use may help provide information to more effectively plan for malaria control programmes.

Keywords: Malaria, prevention, insecticidal nets, sociodemographics, health behaviors

Examining the oxidative potential of residential outdoor PM2.5 through multiple assays and their potential chemical drivers

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BACKGROUND AND AIM: Several studies have shown that inhalation of PM2.5 constituents induces oxidative stress, which increases the risk of cardio-respiratory disorders, irrespective of age. This study examines the oxidative potential of fine particulate matter using multiple acellular assays at residential outdoor locations in urban India. Comparison against a novel cellular assay and its association with PM chemical constituents is also examined.

METHOD:As a part of the APEAL (Longitudinal Effect of Air Pollution Exposure on Adolescents' Lungs) study, a multi-centric cohort study, a pilot study was conducted in the summer of 2022 across Mumbai, Bangalore, Mysore, and Delhi, where daily outdoor PM2.5 was collected using low volume samplers outside 7-9 homes for a week. Water-extracted PM samples were subjected to two standard acellular assays, OPAA, OPDTT, and a very sensitive assay based on lipid-peroxidation, OPLPO. OP association was examined with various PM chemical constituents.

RESULTS:Delhi shows the maximum OP activity (mean \pm SD:1.30 \pm 0.37 nmol min-1m-3), which is 3%, 57%, and 63% higher than Mumbai, Bengaluru, and Mysuru, respectively. For OPAA and OPLPO, Mumbai shows the highest toxicity (0.3 \pm 0.2 and 23.86 \pm 14.78 nmol mi-1m-3). Both OPDTT and OPAA show association with different transition metals. For OPDTT, Cu and Se show a strong affinity in Delhi (p<0.05), while Co is positively correlated in Bengaluru. On the pother hand, As and Cd are strongly associated with OPAA and OPLPO, respectively in Mumbai (p<0.05)..In Mysuru nitrate is positively associated with OPDTT and OPLPO.

CONCLUSIONS: This study provides OP levels outside residential environments in different cities using multiple assays. Delhi and Mumbai exhibit the highest but similar toxicity, while having significant difference in PM2.5 levels. Thus, PM mass concentration, alone, may not be an appropriate metric for safeguarding the public health. Additional analyses including carbonaceous characterization is underway.

Keywords: chemical exposures, heavy metals, particle components, children's environmental health, long-term exposure

Inhalation health risk assessment of ambient PM2.5 and associated trace elements in Cape Town, South Africa

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BACKGROUND AND AIM: There is a lack of human health risk assessment studies on air pollution in Africa. A study was therefore conducted in Cape Town, South Africa, using the US EPA health risk framework.

METHOD: The study investigated the human health risks associated with inhaling ambient PM2.5 and some of its trace elements (Cl, Si, and Ti) over a period of 12 months (April 2017 to April 2018). PM2.5 samples were collected over 24 hours and every third day at an urban background site in Cape Town (n=121). X-ray fluorescence was used to determine the trace element concentrations. The other five trace elements (Ca, Fe, K, S, and Zn) do not have reference concentrations and were not investigated in the health risk assessment study. The safe average daily dose was determined using the yearly WHO guideline and South African ambient air quality standard for PM2.5, as well as the US EPA regional screening levels for trace elements.

RESULTS:The average yearly PM2.5 concentration was 13 mg/m3, which exceeded the yearly WHO guideline of 5 mg/m3, but was below the yearly South African standard of 20 mg/m3. Thirty-eight samples exceeded the daily WHO guideline (15 mg/m3), but not the daily South African standard (40 mg/m3). Si had the highest median concentration (380 ng/m3), followed by Cl (290 ng/m3) and Ti (33 ng/m3). The average yearly PM2.5 concentration posed a low risk to adults (Hazard Quotient of 0.66) but a higher risk to infants (HQ of 2.13) and children (HQ of 1.96). Additionally, Cl posed health risks to all age groups (HQ > 1).

CONCLUSIONS:PM2.5 and its trace element components have adverse health effects on all population age groups. Since the toxicity of PM2.5 depends on its composition, the study recommends a source apportionment study to quantify source contributions and inform appropriate abatement strategies.

Keywords: Human health risk assessment; inhalation exposure; PM2.5; trace elements

Association between Asian Dust and adverse health effects in Japan

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BACKGROUND AND AIM: This study aimed to assess the adverse health effects of Asian Dust (AD) among healthy individuals in Japan. AD storms occur seasonally, mostly in spring, affecting Japan and neighboring countries such as Mongolia, China, Taiwan, and Korea. Climate and westerly wind conditions determine which countries get affected. AD includes other components of air pollution. While health issues related to AD have been reported, the possibility of adverse effects remains unclear. This study addresses the above gap.

METHOD:We administered self-report questionnaires online to healthy volunteers residing in Yonago, Japan between 2013 and 2015. We followed 96 volunteers aged 19–65 years at baseline. We used visibility-judged data from Japan Meteorological Agency (JMA) and Light Detection and Ranging (LIDAR) data to assess AD exposure. Associations between AD and subjective symptoms were assessed using a linear mixed model, with climate, other air pollutants, pollen, disease history, and preventive behavior as possible covariates.

RESULTS: We classified the data into: AD (February to May) and non-AD (June to January) seasons. By comparing the JMA's judgment with corresponding LIDAR data, a dust coefficient of above 0.036/km was defined as an AD day. In the AD season, the score difference for nasal symptom on AD days compared to non-AD days was 0.05 (95% CI: 0.01-0.08, p < 0.05), indicating a significant association between nasal symptom and AD exposure. In the non-AD season, there was no significant relationship between nasal symptom and AD exposure.

CONCLUSIONS: We conducted a long-term survey to investigate the short-term effects of AD on nasal symptoms in healthy participants by adjusted possible confounding factors. Even healthy participants demonstrated elevated symptom scores during AD events in AD seasons. Future studies should attempt to provide more detailed component effects.

Keywords: Allergies, Heavy metals, Exposures

Emissions of Airborne Pollutants from Open Dumpsites and Perceived Health Effects among Residents in Ile-Ife, Osun State, Nigeria

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BACKGROUND AND AIM:Globally, wastes generated are poorly managed and encumbered by the increasing population, inadequate waste management infrastructure, personnel and logistics, especially in least developing countries like Nigeria. municipal waste is disposed by open dumping without environmentally friendly alternatives, compromising environmental quality. The study measured the diversity and air pollutants from open dumpsites and perceived health effects on populations.

METHOD: The study utilised a comparative cross-sectional design and measured atmospheric emissions from open dumpsites and health symptoms from exposed residents. The target population were high-exposed ($\leq 250m$) and low-exposed (251-500m) around open dumpsites residents. With non-response, the sample size for the household survey was a total of 183 respondents per group. A purposive sampling technique was used to select open dumpsites close to residential settlements, and simple random sampling identified streets and households that satisfied the inclusion criteria. The data collection instruments were Aeroqual 200 series, Wolf pack area monitor, Aerocet 831 series, and household questionnaire. The questionnaire was pretested and validated before use. Field data were analysed with IBM-SPSS version 20. The association among variables was determined by chi-square statistics at p-value <0.05.

RESULTS:53.5% of respondents were below 40 years. 42.9% respondents had at least a secondary level education, and 74.9% were traders, artisans, and masons. Measurement of gaseous pollutants revealed an increased level of SO2, H2S, NO, NO2, and PM10 as against their ambient thresholds. More than three-fifths of respondents (63.5%) had a poor perception of the health hazard of open dumping, though respondents from high- and low-exposure groups had experienced respiratory and gastrointestinal symptoms.

CONCLUSIONS: Dumpsites emit gaseous pollutants that may adversely affect the health of the resident population. Hence, population awareness of the health risks of open dumpsites and a system approach to waste management should be applied. Adequate monitoring of air quality and gaseous pollutants levels should be instituted.

Keywords: Air pollution, Exposure assessment-air pollution, Environmental epidemiology, Public Health

OP-218[Air pollution » Particulate matter]

Air Quality and Health Risk Assessment of Particulate Matter (PM2.5 and PM10) in Awotan and Aba-Eku Dump Sites, Ibadan, Nigeria

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BACKGROUND AND AIM:Report on air quality across dump sites in most Nigeria cities showed greater values for airborne particles than their acceptable limits. The study therefore assessed air quality and health risk of particulate matter (PM2.5 and PM10) in Awotan and Aba-eku dump sites, Ibadan, Nigeria.

METHOD: Ambient air at the dumpsites was sampled for particulate matter (PM2.5 and PM10) using particle counter twice per day (morning and afternoon). A total of 1080 samples were collected at both dump sites. Non-cancer risk of exposure to PM2.5 and PM10 was estimated using hazard quotient while cancer risk for exposure to PM2.5 through exposure routes was estimated using excess lifetime cancer risk (ELCR).

RESULTS: Average mean value of PM2.5 and PM10 in Awotan was $46.02\pm17.02 \ \mu g/m3$ and $58.19\pm21.15 \ \mu g/m3$ in the morning and $60.94\pm29.27 \ \mu g/m3$ and $75.45\pm34.46 \ \mu g/m3$ in the afternoon while PM2.5 and PM10 in Aba-eku was $81.62\pm68.46 \ \mu g/m3$ and $127.69\pm100.82 \ \mu g/m3$ in the morning and $86.11\pm56.32 \ \mu g/m3$ and $128.20\pm95.53 \ \mu g/m3$ in the afternoon. Air quality index at both dump sites ranges from no pollution (HRA \leq 50) to very hazardous pollution (HRA \geq 250). Average excess lifetime cancer risk values of exposure to PM2.5 for adult and children were found to exceed $1\times10-6$. Non-cancer risk of exposure to PM2.5 and PM10 via routes of exposure at both dump sites in children and adults presents low values below maximum acceptable levels of 1 except for children via ingestion route.

CONCLUSIONS: Exposure to PM2.5 and PM10 from both dump sites can result to health risks among residents living close. However, children are more likely to be affected compared to adults. Therefore, it is necessary to close and relocate both dump sites to prevent health risk of children living near dump sites.

Keywords: Particulate Matter, Exposure

Determinants of measurement error in surrogate exposures assigned as proxies of personal exposure to ambient air pollution: the MELONS study

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BACKGROUND AND AIM:Assignment of surrogate estimates of personal exposure to ambient air pollution to individuals in epidemiological studies introduces error and these estimates may not always be suitable proxies of "true" exposure. Investigation into quantification of the magnitude, type (classical/Berkson) and determinants of error in assigned surrogate estimates is limited. The aim of the present study was to investigate measurement error and identify its determinants. METHOD:In the MELONS study, personal exposure estimates of nitrogen dioxide (NO2) and particulate matter ≤2.5 micrometres in diameter (PM2.5) of ambient origin were available through a personal monitoring campaign (defined here as "true" exposure) of 76 older individuals. Surrogate measures of ambient exposure to the same pollutants, derived from spatio-temporal models and a fixed-site monitoring network, were also assigned per individual in addition to individual-level characteristics collected throughout the campaign. Linear regression models were constructed to estimate the influence of each covariate on the magnitude of error in each surrogate exposure estimate (the difference between the surrogate and "true" exposure).

RESULTS:The difference in "true" exposure and ambient residential estimates from a fixed-site monitor were most influenced by smoking and socioeconomic status; the error magnitude increased in current smokers (NO2: 20.7µg/m3 [4.10, 37.20] increase in disparity with "true" in comparison to former smokers) and for those living in areas of higher deprivation score (PM2.5: 0.10 [0.03, 0.17]). For modelled surrogate exposure, the largest determinants of error were residential building type (NO2: -15.30 [-25.60, -4.96] decrease in disparity for those living in detached or semi-detached housing in comparison to those living in a flat/apartment) and smoking status (NO2: -13.90 [-27.50, -0.21] decrease for non-smokers).

CONCLUSIONS: The magnitude of error observed in surrogate measures of ambient air pollution assigned as proxies of personal exposure is likely influenced by individual-level characteristics that may need to be adjusted for in epidemiological studies.

Keywords: Air pollution, Exposure assessment-air pollution, Environmental epidemiology

OP-220[Air pollution » Wildfires]

Characterization of Wildfire Particulate Emissions using Computer Controlled Scanning Electron Microscopy Techniques

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BACKGROUND AND AIM: Conditions related to global warming have resulted in more frequent and intense wildfires in the western United States and other parts of the world. Smoke produced during wildfires is comprised of a mixture of gas-phased and particle pollution, and there is a growing body of scientific evidence that links wildfire smoke exposure to various health effects. Thus, there is a need to gain a better understanding of particulate emissions generated during wildfire events.

METHOD: Studies incorporating the collection of samples during wildfire events using passive and active samplers and subsequent analysis of the samples using computer controlled scanning electron microscopy (CCSEM) have been performed to characterize particulate emissions on an individual particle basis. Data obtained from the CCSEM analysis was used to speciate the particulate matter into particle classes based on size, shape, elemental composition, and review of digital images collected during the CCSEM analysis.

RESULTS:Results indicate that wildfire emissions can be identified by the presence of spherical carbon particles ('tar balls'), and show that tar balls and soot concentrations were significantly higher during wildfires events. As an example, particles classified as tar balls accounted for 23.4 ug/m3 during a wildfire event compared to 1.1 ug/m3 during a non-wildfire event.

CONCLUSIONS: The ability to speciate particulate matter on an individual particle basis using CCSEM techniques provides greater specificity of wildfire emissions as compared to bulk analytical methods and demonstrates the benefit of using CCSEM to complement other analytical methods related to the characterization wildfire emissions.

Keywords: particulate matter, particle components, long-term exposure, short-term exposure

OP-221[Chemical exposures » General]

Spatiotemporal Characteristics and Changes in Hazard-Based Result Scores Using Pollutant Release and Transfer Register Data

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BACKGROUND AND AIM: The constant consumption of chemical products owing to expanding industrialization has led to an increase in public interest in chemical substances. As the production and disposal processes for these chemical products cause environmental problems, regional information on the hazard level of chemical substances is required considering their effects on humans and in order to ensure environmental safety.

This study aimed to identify hazard contribution and spatiotemporal characteristics by region and chemical by calculating a hazard-based result score using pollutant release and transfer register (PRTR) data.

METHOD: This study calculated the chemical discharge and hazard-based result score from the Risk-Screening Environmental Indicators (RSEI) model, analyzed their spatiotemporal patterns, and identified hot-spot areas where chemical discharges and high hazard-based scores were concentrated. The amount

of chemical discharge and hazard-based risk scores for 250 cities and counties across South Korea were calculated using PRTR data from 2011 to 2020.

RESULTS: The chemical discharge and hazard-based result scores showed varying spatial patterns. The chemical discharge and hazard-based result score hot-spots were identified. Additionally, identification of the hazard-based result scores revealed differences in the type of chemicals contributing to the discharge. Chromium accounted for >90% of the discharged chemicals in the hazard-based result score hot-spots.

CONCLUSIONS: The RSEI hazard-based result score is a quantitative indicator that considers the degree of impact on human health as a toxicity-weighted value. It can be used for the management of industries discharging chemical substances as well as local environmental health management.

Keywords: Risk-Screening Environmental Indicators, pollutant release and transfer register, hazard score

OP-222[Exposure assessment methods » Exposure assessment-air pollution]

Comparison of Performance in Removing Submicrometer Particles between Kitchen Hoods by Using a Systematic Measurement Test

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BACKGROUND AND AIM:Cooking emissions are an influential factor in indoor air quality, as they contribute up to 30% of human daily particle exposure and could have health effects. The use of kitchen hoods is an effective intervention strategy in maintaining indoor air quality. However, there is no standardized method to assess the performance of kitchen hoods in Taiwan. Previous studies used tracer gas to determine kitchen hood capture efficiency instead of particles, which makes it difficult to extrapolate the results. Additionally, differences in cooking style, kitchen hood types, and environmental conditions make it challenging to directly apply Western study findings to Taiwan. Therefore, the objective of this study is to apply a systematic and quantitative method to compare the performance of kitchen hoods under the kitchen-simulated condition.

METHOD:We conducted laboratory tests to evaluate the performance of 26 kitchen hoods. To simulate cooking scenarios, we generated artificial aerosols using an electric heating chamber. Particles within the range of 14.6 to 685.4 nm in size were measured using Scanning Mobility Particle Sizer[™] spectrometers (SMPS[™]). The capture efficiency (CE) was used as the index of kitchen hood performance. Additionally, air exchange rate (ACH) and particle deposition rate measurements were conducted, which helped to characterize the performance of kitchen hoods under controlled conditions. RESULTS:We successfully built a controllable simulated kitchen zone with ACH from 1.6 to 2.4. Fixed flow rate (6 and 16 m3/min) among 26 kinds of kitchen hoods provided comparable particle size-resolved CE results. The 3 times repeated results showed that the CE of kitchen hood varies with particle sizes, the design of hood geometry, and flow rate.

CONCLUSIONS:Overall, this study can be a baseline to provide a guideline to customers on how to select an effective kitchen hood in order to improve residential indoor air quality and reduce population exposure to cooking emissions.

Keywords: Particulate matter, Methodological study design, Air pollution

A Review and Quality Assessment of Systematic Reviews and Meta-Analyses of Traffic-Related Air Pollution Epidemiological Studies

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BACKGROUND AND AIM: Decision-making to prevent harmful exposures relies on high-quality scientific evidence. Our objective was to overview the state of systematic reviews on traffic-related air pollution (TRAP) and human health effects and evaluate whether systematic reviews are being conducted following best practices.

METHOD: We conducted a systematic search of the scientific literature until December 2022 in PubMed, Embase, and Web of Science. Two independent screeners identified studies that: 1) selfidentified as a systematic review; 2) investigated traffic related air pollution exposures; 3) reported on human health outcomes. Data were extracted to categorize included references by study design and characteristics. The Policy From Science's Literature Review Appraisal Toolkit (LRAT) was used to assess the credibility of each systematic review and provide an ultimate decision regarding the level of confidence in the overall conclusions of each review.

RESULTS:Our search retrieved over 2,000 studies and our screening identified 92 studies that met our inclusion criteria. These studies were published between 2010-2022; the majority were self-reported as being a systematic review (n=82), of which 43 also included a meta-analysis for quantitative synthesis of data. Studies were heterogeneous in terms of population, exposure (14 unique chemical components), health outcome (11 different categories), and review methodology (5 named tools or lack of a structured assessment tool). The LRAT tool revealed that the quality of included studies was generally poor. Almost all reviews performed unsatisfactorily on at least 5 of the 9 domains, in particular the use of protocol (n=85), directness (n=64), methodological quality (n=40), and synthesis of evidence (n=61).

CONCLUSIONS: Systematic reviews can contribute to understanding and improving scientific knowledge – however, all systematic reviews are not equal and does not automatically result in high quality reviews.

Keywords: Systematic review, quality assessment, air pollution, epidemiology
OP-224[Methods » Causal inference]

Implementation of the Negative Control Exposure Method in Environmental Epidemiology: A Simulation Study

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BACKGROUND AND AIM:Residual confounding is the primary barrier to causal inference in environmental epidemiology. Several methods have been developed to detect whether an observed association is biased by residual confounding. One of these methods uses negative control exposures (NCE): alternative exposures that, under certain assumptions, indicate residual confounding. While the NCE method has seen a growth in use in recent years, it is unclear how the method is affected by the relations among the different study variables and how to correctly select and implement an NCE that will have an optimal ability to detect residual confounding. This is a simulation study examining these issues.

METHOD: We constructed three possible causal scenarios in epidemiological settings, represented in directed acyclic graphs, with varying degrees of residual confounding, linear causal effects, and effect strengths among the main variables. We then applied the NCE method under varying conditions and tested its ability to detect residual confounding.

RESULTS: The ability of an NCE to detect residual confounding increases the stronger its association with the unobserved confounder is relative to the association of the unobserved confounder with the exposure. This ability is further improved when the association of the unobserved confounder with the outcome is also strong. In addition, a variable that is a common cause of the NCE and the exposure, but is not a confounder, can affect the performance of the NCE method due to a collider bias and due to its effect on statistical power, requiring researchers to consider this possibility during the planning stage of the study.

CONCLUSIONS: The performance of the NCE method highly depends on the causal relations among the variables and their relative strengths. Further research is needed to reveal the conditions in which NCEs can be safely used and the most appropriate statistical tests, and to expand the simulations to non-linear relations.

Keywords: Environmental epidemiology, Modeling

Co-production and evaluation of air pollution interventions with school-age citizen scientists

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BACKGROUND AND AIM:School children are exposed to high levels of pollution during the school journey but are typically not involved in the development of interventions to reduce their exposure. We assessed patterns of pollution exposure on the school journey with pupil citizen scientists and describe the co-production of interventions to reduce exposure, their implementation, and evaluation. METHOD:Two schools in urban areas were recruited at each study site (Bradford, United Kingdom; Barcelona, Spain). Pupils (n=40) aged 9-11 years carried mobile sensors collecting particulate matter (PM), nitrogen dioxide (NO₂) and GPS data. Co-production workshops with pupils, teachers, parents, and local stakeholders were carried out to develop acceptable and feasible interventions to reduce pollution. Interventions were implemented in June-July 2022 with pollution monitoring occurring one week before and one week after implementation. Change in exposure levels (PM2.5, PM10, NO₂) were examined using Generalized Linear Models separately for the morning and afternoon travel periods. Focus groups and interviews with parents, children and teachers gathered views on intervention acceptability and sustainability.

RESULTS:Personal monitoring found large variation in exposure between children with peaks during school journeys. Co-production workshops identified alternate routes to school, walking buses, informational campaigns, and additional monitoring as feasible interventions. No changes were observed in monitored pollutants from pre- to post-intervention in the morning (PM2.5 (μ g/m3) – Bradford: 1.7 (95% CI: -1.0, 4.4); Barcelona: -1.6 (-5.6, 2.4)) or afternoon travel periods (Bradford: 0.8 (-4.1, 5.7); Barcelona: -2.1 (-4.9, 0.7)). Focus groups and interviews revealed a preference for structural changes to reduce pollution rather than individual behaviors.

CONCLUSIONS: School communities are motivated to find ways to reduce exposures, but meaningful reductions may require structural, in addition to individual behavior, changes.

Keywords: community outreach, air pollution, built environment, exposure assessment, children's environmental health

Assessing the effect of the Akoben programme on the environmental performance of mining industries in Ghana: A case study Approach

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BACKGROUND AND AIM: The adverse impact of mining activities means human health could be at risk. In effect, Ghana Environmental Protection Agency (EPA) make serious attempts to improve the environmental performance of mining and manufacturing companies to mitigate environmental pollution, hence this study aim to evaluate the impact of Ghana's EPA Akoben programme, a rating and disclosure tool which seeks to promote better environmental performance in the mining and manufacturing industries by promoting transparency and accountability in Ghana.

METHOD:Using a case study approach, this study analysed the Akoben audit report card for a mining company in Ghana over a four-years year period (2009-2012) based on seven- criteria – legal requirements, hazardous on-site waste management, toxic emissions management, environmental monitoring and reporting, best practice environmental management, complaint management, and corporate social responsibility. Key stakeholders mainly the Ghana Chamber of Mines, EPA, and some mining companies' perceptions on the programme's appropriateness were solicited RESULTS:findings of the study revealed that the overall environmental performance for the four-year period between 2009 and 2012 (2009 – 56.6%; 2010 – 65.6%; 2011 – 59.1%; 2012 – 61.4%) under review was poor, with none criteria meeting the required minimum standards, except for legal requirements and corporate social responsibilities. With the company's toxic and Non-toxic waste emissions being significant concerns. Toxic parameters, such as Arsenic, and Cyanide, were exceeded. The weaknesses of the programme were identified by stakeholders as inadequate publicity, lack of legal support, insufficient incentives for outstanding performance and the stringent nature of the programme.

CONCLUSIONS:Notwithstanding, the stakeholders acknowledge the fact that the Akoben programme has improved the environmental performance of the mining companies because it puts their operations in check, although more can yet be achieved with regards to environmental sustainability with this programme if adequate measures including legal backing are put in place to ensure its continuity

Keywords: Environmental performance rating, Policy effectiveness, Mining

Management of waterborne diseases: an epidemiological approach for health policy analysis

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BACKGROUND AND AIM:Pakistan faces a high burden of waterborne diseases, particularly diarrhea, due to poor water quality and inadequate sanitation facilities. According to the World Health Organization (WHO), an estimated 16,500 children under the age of five die each year in Pakistan due to diarrhea alone. Other waterborne diseases, such as malaria, gastroenteritis typhoid fever and hepatitis A, also remain prevalent in many parts of the country.

METHOD: We analyzed national health management policy from 2015 to 2020 in the context of financial resource allocation, prevention of child exposure to unsafe drinking water, child mortality, increasing access to healthcare, and promoting better hygiene practices. Primary and secondary data were consulted to assess effectiveness of health policies.

RESULTS:Health sector's share of 0.42% in 2015 increased to 0.47% in 2020 of total federal budget of Pakistan which is lowest in Southeast Asia. Child mortality rates have improved during this period (76 to 66 deaths per 1,000 live births) but are still high than many other countries. Survey of school children from Abbottabad district reveals high Diarrheal incidence owing to drinking unpurified water (odds ratio= 2.3, 95% CI=1.28-3.89), using public tap water (odds ratio=3.16, 95% CI=1.82-5.48). Large family size with poor income group attributed to overall high prevalence of waterborne diseases. Local government in rural areas was unable to provide adequate sanitation facilities due to financial constraints hence exposure to environmental fecal contamination remained unprecedented. CONCLUSIONS:Policy implementation to raise public awareness is non-existent that promotes poor hygiene practices, which, in turn, contribute to the spread of diseases. Progress in health system management has been slow between 2015 and 2018 due to a variety of factors, including limited resources, political instability, and social and cultural barriers. However, in 2019 and 2020 there were still considerable differences in waterborne diseases from rural to urban context.

Keywords: Children's environmental health, Epidemiology, Waterborne diseases, Water quality

OP-229[Air pollution » Other (to be specified with keywords in the keywords section)]

What are the air pollution co-benefits of Net Zero in the UK?

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BACKGROUND AND AIM: The UK has committed to legally binding Net Zero (NZ) targets, setting up an independent advisor, the Climate Change Committee (CCC), to assess current progress towards NZ and to recommend future pathways to meet NZ by 2050.

The aim of this research was to combine UK Government 2030/40 emissions forecasts with the UK's CCC Balanced Net Zero and Widespread Innovation Pathways in 2030/40 and 50, and to understand the air pollution co-benefits of domestic and vehicle emissions changes on exposure outdoors and indoors.

METHOD: We used European, UK National and Imperial's vehicle emissions model forecasts between 2019 and 2030/40 and 50. The emissions were combined with the WRF met. and CMAQ-urban coupled model, providing outdoor hourly UK NOx, NO2, PM10, PM2.5 and O3 at 2km spatially, down to every 20m close to major roads as well as Imperial's indoor air pollution model providing NO2 exposure indoors.

RESULTS:PM2.5 concentrations in 2030 were below the WHO interim target of 10 ug m-3 for the vast majority of the UK with significant reductions occurring in NO2. The widespread adoption of electric vehicles, whilst beneficial for tailpipe emissions increased non-exhaust emissions for tyre wear, road surface wear and resuspension, limiting future benefits for PM from these vehicles. Widespread changes to domestic heating and the removal of gas cookers in 2040 led to important reductions in PM2.5 and NO2 exposure indoors and outdoors.

CONCLUSIONS: We have shown the combined benefits of UK air quality policies and Net Zero pathways for PM2.5 and NO2 control. We identified important but uncertain emissions sources, such as non-exhaust electric vehicle emissions, NOx from gas cooking and domestic wood burning.

Keywords: Particulate matter, Oxides of Nitrogen, Policy, Traffic-related, Built environment

Effect of home energy efficiency retrofit on indoor temperature and self-reported health: evaluation of Dublin's 'Warmth & Wellbeing' scheme

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BACKGROUND AND AIM: The Irish Government's 'Warmth & Wellbeing' scheme, introduced in 2016, installed energy efficiency measures in the homes of people with chronic respiratory conditions living in parts of Dublin. We aimed to evaluate the impact of the scheme on health, wellbeing, social participation and other outcomes.

METHOD:955 participants were enrolled in the research study. Pre- and post-intervention data on general health, thermal comfort and aspects of psycho-social health were collected by Ireland's Health Service Executive (HSE) through a questionnaire and three survey instruments: EQ-5D, SGRQ and SF-36. Data on monthly drug prescriptions were acquired through the Primary Care Reimbursement Service (PCRS). A building survey was performed and, for a subset of homes, hourly internal temperatures were monitored. We treated each measure separately and analysed before-after differences using standard parametric methods.

RESULTS:545 participants (66.2% female, mean age 68.9 years) had pre-intervention data and at least one post-intervention follow-up. The mean increase in standardised indoor winter temperature was 1.29 °C. Participants reported improved thermal comfort, satisfaction with their ability to control home temperature, ability to pay fuel bills and comfort inviting visitors to their home. Self-reported health service contacts over the previous six months decreased for GP visits (before-after change: -1.10, 95%CI -0.75 to -1.44), respiratory emergency department visits (-0.13, -0.06 to -0.21) and respiratory hospital admissions (-0.12, -0.06 to -0.18). There were improvements in physical, mental and psycho-social health across most EQ-5D, SGRQ and SF-36 dimensions. For example, EQ-5D summary score decreased by 5.36 (-2.68 to -8.04) and SGRQ total score by 11.70 (-10.31 to -13.08). Monthly PCRS drug prescriptions also reduced.

CONCLUSIONS: Installation of home energy efficiency measures resulted in improvements in a range of measures of physical and mental health. Although the pathways to health cannot be elucidated, the benefits appear to be substantial, at least in the short-term.

Keywords: Built Environment, Housing, Temperature, Health co-benefits, Respiratory outcomes

Examining the utility of the Singapore Housing Index in a Singaporean cross-sectional, population-based elderly cohort

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BACKGROUND AND AIM:To determine the utility of the Singapore Housing Index (SHI) as a proxy of socioeconomic status (SES) in a multi-ethnic population of elderly Singaporeans. The SHI was developed as an areal-level SES indicator, with advantages of overcoming limitations in collecting and handling individual-level SES data.

METHOD:A SHI dataset, containing the SHI value for every residential postcode in Singapore, was assembled using an open-data query procedure previously developed. We included individuals from The PopulatION HEalth and Eye Disease PRofilE in Elderly Singaporeans (PIONEER), a population-based study of Singaporean Chinese, Malays, and Indians adults aged 60 years or older in Singapore. Participants were deeply phenotyped on sociodemographic characteristics including: age, gender, income, education, and housing. A merged dataset containing the SHI value for each participant was analysed with spearman correlation against traditional markers of SES (income, education, occupation, type of housing) as a monotonic relationship was assumed.

RESULTS:In 2,522 participants (mean age±SD 73.5±8.5; 55% female), the mode of SES variables including income<S\$1,000, completed secondary education, retiree and living in a 4-room public housing was 40%, 37%, 60% and 30%, respectively. Mean SHI assigned to all participants was 4.10±1.23. Spearman's rho [95% confidence interval] between variables showed SHI demonstrated stronger monotonic relationship with income 0.40[0.35,0.44] than *Education–Income* 0.31[0.25,0.35] or *Occupation–Income* 0.31[0.26,0.35], while matching the strength of *Housing–*

Income 0.42[0.38,0.47]. Similarly, associations were found in *SHI–Education* 0.35[0.31,0.39] and *Housing–Education* 0.38[0.34,0.41]. All coefficients were statistically significant (p<0.05). CONCLUSIONS:The SHI can serve as a straight-forward and reliable proxy for SES in Singapore simply by obtaining a participant's residential postcode. Understanding this association allows us to use the SHI to account for SES in health studies and guide policy beyond medical and public health programs. Future studies to explore the use of the SHI in a younger adult population will certainly be valuable.

Funding:Singapore National Medical Research Council((NMRC-CSA-SI#JRNMRR140601)

Keywords: socio-economic factors, epidemiology, policy, policy and practice

OP-233[Built environment » Other (to be specified with keywords in the keywords section)]

Identification of key predictors of severe annoyance caused by railway induced vibrations using machine learning: an external exposome study

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BACKGROUND AND AIM:Rail transport is considered to be a sustainable mode of transport. However, people living near a railway line are also exposed to noise and vibrations. While there is limited knowledge about the effects of train noise, the health effects of exposure to train vibrations are largely unknown. In addition, few studies have investigated what external factors influence these health effects. We performed an untargeted analysis using machine learning (ML) techniques to identify key determinants of severe annoyance caused by train vibrations within an external exposome dataset METHOD:In 2021, we administered a questionnaire among people aged 16 years and older living within 300 meters of a railway track in The Netherlands. The questionnaire included questions about annoyance caused by railway induced vibrations and possible co-determinants of annoyance. The survey was enriched with various assessments of railway vibration levels (using the Dutch railway vibration calculation model)), noise levels and other environmental exposures such as NO2 and urban green. The final dataset contained information on 5,611 persons and 70 different variables. Least absolute shrinkage and selection operator (LASSO) regression and random forest (RF) were used to identify key predictors of annoyance. Individual contributions of vibration and noise were examined using accumulated local effect (ALE) plots.

RESULTS: In both LASSO and RF, annoyance by railway noise, concerns regarding structural damage caused by railway vibrations and attitude towards rail transport were the strongest predictors of annoyance. Factors related to vibration exposure were less predictive compared to these personal predictors. The ALE plots show a non-linear relationship between vibration exposure and annoyance, and suggest interaction between distance, vibrations and noise levels.

CONCLUSIONS: This study shows that both personal factors and, to a lesser extent, environmental stressors contribute to railway vibration annoyance. Furthermore, the novel application of LASSO and RF techniques demonstrates the potential of ML in environmental studies.

Keywords: External exposome, Noise, Traffic-related

East vs. West, The Decibel Duel. A Comparative Systematic Review of Noise Pollution Research

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BACKGROUND AND AIM: Environmental noise is a growing concern in urban areas across the globe, impacting the health of millions of people. This systematic literature review aims to compare researches conducted on environmental noise exposure in the East and West.

METHOD: The review followed PRISMA guidelines for selection of all research articles published in the year 2022. Separate searches were conducted for the East and West using keywords for each region. The search was conducted using Google Scholar, Web of Science, and PubMed databases. The articles obtained from PubMed search were further evaluated for quality.

RESULTS: The systematic search resulted in 1200 and 1960 studies on Google Scholar, 18,908 and 14,114 studies on Web of Science, and 126 and 174 studies on PubMed for East and West respectively with majority of studies from China, Japan, and South Korea in the East, and the United States and various European countries in the West. Studies conducted in the West generally had higher quality with larger sample sizes, intricate methodologies, and meticulous findings as compared to the East. Moreover, studies in the East primarily focused on community noise, while those in the West focused on individual-specific noise.

CONCLUSIONS: These differences in the number and quality of studies between the East and West can be attributed to differences in research funding, institutional support, and cultural attitudes towards noise. The high number of studies from China may be due to the country's rapidly growing urbanization, resulting in increased noise pollution. However, the lower quality of studies from the East is concerning due to the region's large population and the significant public health concern of environmental noise exposure. There is an urgent need for more high-quality research on noise exposure in Asia to understand its effects and help policymakers take action to mitigate its negative impact and improve public health outcomes.

Keywords: Environmental disparities, Public health, Environmental epidemiology

Household analysis of health-related indoor temperature exposure: comparison between thermal comfort and health conditions in English dwellings

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BACKGROUND AND AIM: Excess deaths during winter and heatwaves have been observed in England and Wales. There were 13,400 additional deaths in winter 2021, and 3,271 extra deaths in summer 2022. Household temperature significantly impacts vulnerable individuals who spend extended periods indoors. Previous research has identified housing factors that affect thermal comfort. This study aims to investigate the differences in housing factors that impact thermal comfort and health conditions due to exposure to high/low indoor temperature.

METHOD: This study focused on potentially vulnerable populations, particularly older adults. Two sources were analysed: (1) 2011 Energy Follow Up Survey (EFUS) collecting information on energy use, indoor temperature and self-rated thermal comfort for 823 English households; (2) English Longitudinal Study of Ageing (ELSA) providing information on health, social, wellbeing and economic circumstances, and indoor temperature for 11,578 households of the English population aged 50 and older. Linear regression and chi-square automatic interaction detection were used to explore the relationships between outdoor/indoor temperature, housing factors, and occupant thermal comfort/health.

RESULTS:Energy performance determinants (e.g., building envelope, efficiency improvements, Energy Performance Certificate) and household characteristics (e.g., age, income, tenure) affected indoor temperatures. Under a similar location- and time-matched outdoor temperature, there was no significant difference between the mean household indoor temperatures in EFUS (automatically measured by temperature loggers) and in ELSA (manually measured by a trained nurse using a consistent protocol and equipment). A link between high/low indoor temperature (above 24.6°C/under 18°C) and self-rated thermal discomfort was found. However, thermal comfort was not significantly associated with indicators of physical health, including self-rated general health and physician-diagnosed conditions.

CONCLUSIONS: This research highlights energy efficiency improvements and fuel payment eligibility may affect indoor temperature and occupant health. It is crucial to consider energy use practices and household characteristics in housing energy policies to reduce energy use and improve the health of older occupants.

Keywords: English dwellings, Indoor temperature, Thermal comfort, Physical health, Older adults

Europe-wide road traffic noise modelling using a harmonized methodological framework (CNOSSOS-EU)

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BACKGROUND AND AIM:Road traffic is the most pervasive source of noise in urban environments. Strategic noise mapping in Europe only covers populations in large urban areas. The limited coverage of harmonised noise exposure data prevents us from studying the health effect of road traffic noise in larger populations across Europe. Therefore, this study aims to develop models capturing variations in road traffic noise exposures across Europe to facilitate pan-European multi-cohort studies. To estimate noise, we used a simplified version of CNOSSOS-EU (Common NOise aSSessment MethOdS) framework. The major challenge was to obtain all the input data required in the model at a European scale.

METHOD: Firstly, we estimated Europe-wide annual average daily traffic (AADT) counts at the OpenStreetMap (OSM) road network. We trained random forest models with traffic count observations collected in six central and western European countries. The models were built separately for four road types (highway, primary, secondary/tertiary and residential). Predictor variables included road-related variables, LULC and population within different circular buffer (ranging 100m to 200km). A 5-fold cross-validation showed relative RMSE of 0.43, 0.5, 0.57, 0.87 and 0.92 (AADTs) for respectively highway, primary, secondary, tertiary, and residential roads. Secondly, we approximated traffic speed with the speed limit from OSM and legal speed limits for missing data. With these input data and building geometries with an assigned default building height of 10m, road traffic noise was estimated at noisiest building façades (i.e., points nearest to nearby roads) using CNOSSOS-EU.

RESULTS: Plausible noise levels were obtained in test runs (range 52.17 dB to 72.54 dB at 500 points in Bristol, UK). We will compare our Europe-wide noise estimates with national noise model estimates in the Netherlands, Switzerland, and Barcelona.

CONCLUSIONS: In conclusion, we developed the Europe-wide input data required for noise modelling. Modelled noise will be used to study Europe-wide health effects of noise.

Keywords: Modeling, Traffic-related

Increasing exposures to compound wildfire smoke and extreme heat hazards in California, 2011-2020

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BACKGROUND AND AIM: Wildfire smoke and extreme heat hazards are inherently linked, yet the frequency and distribution of exposure to compound events, i.e., co-occurring wildfire smoke and extreme heat, is not well understood. Shared climatic drivers are worsening these hazards and the threat they pose to public health and safety; thus, there is a critical need to investigate exposure risks. We examine compound hazard exposures to wildfire smoke and extreme heat from 2011-2020 in California to characterize populations at greater risk.

METHOD: We calculate population-weighted estimates of compound exposures within ZIP Code Tabulation Areas (ZCTA) using (a) fine-resolution population estimates (1-km resolution), (b) daily wildfire smoke-influenced fine particulate matter (wf-PM2.5; 3-km resolution) and, (c) maximum temperature (4-km resolution), which were resampled to 1-km resolution to create populationweights, then aggregated to the ZCTA-level. We apply dichotomous exposure definitions for wf-PM2.5 (presence/absence) and temperature (ZCTA and month-specific 95th percentile threshold) to count annual exposure days to wildfire smoke only, heat only, and compound wildfire smoke and heat (CH days). CH days were classified if both exposures occurred within a 3-day exposure lag window, i.e., each may occur up to three days prior to the measured day. The distribution of CH days was then examined statewide and by ZCTA community characteristics: income, education, race/ethnicity, urbanicity, housing.

RESULTS:Results are presented in maps to illustrate the distribution of compound hazard exposure changes across 10 years. ZCTAs experienced differing degrees of exposure in each year, highlighting both Northern and Southern regions. Nonetheless, recent years (2017 and 2020) showed increasing exposures with the highest annual CH days. Additionally, we show community-level risk factors relate to differential exposure to compound hazards.

CONCLUSIONS: This research presents a robust method to assess exposure risk to compound hazards, as well as characterizing the worsening, yet unequal, threat of wildfire smoke and extreme heat events.

Keywords: Wildfires, Temperature extremes, Exposure assessment methods, Environmental disparities, Public Health

Extreme Heat and Fertility Outcomes in Nigeria

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BACKGROUND AND AIM:Nigeria has experienced an exponential growth in extreme humid-heat exposure. Nigeria also has one of the highest fertility rates in the world. While nascent research has explored the heat-fertility nexus, this relationship has yet to be studied with longitudinal, high-resolution data across a country as geographically diverse as Nigeria. To fill this gap, we examine the heat-fertility nexus in Nigeria from 1983 – 2016 using a new, high-resolution daily climate record and six waves of the Demographic and Health Survey (DHS).

METHOD: We spatially integrate six DHS waves with a new, high-resolution (5-km) dataset of daily humid-heat extremes, defined as the number of days per year wet bulb globe temperatures exceed 30°C from 1983 – 2016. We map the effect of extreme humid-heat exposure on three individual-level fertility outcomes – conception, termination, live birth. Next, we use a fixed-effect probit model to compare extreme humid-heat effects across the three fertility outcomes.

RESULTS:On average, households experienced a 3-fold increase in annual extreme humid-heat exposure from 1983 to 2016. Extreme humid-heat is correlated with average parity and exhibits a heterogenous geographic pattern across Nigeria's strong climate gradient. While descriptive results suggest that fertility outcomes vary by demographic characteristics, model results indicate that extreme humid-heat exposure has a negligible effect on conceptions and births. In contrast, extreme humid-heat exposure is significantly associated with a 0.01 percentage point increase in the probability of experiencing a pregnancy termination. This effect implies a 16.1% increase in terminations across the entire 30-year period.

CONCLUSIONS: Extreme humid-heat exposure has increased across Nigeria, but the effects may not be impacting conceptions and births. However, it may be influencing terminations, suggesting that as we continue to warm the climate, increased extreme humid-heat exposure may impact key aspects of fertility patterns in Nigeria.

Keywords: extreme heat, climate change, fertility, maternal and child health, Africa

Exploring the Link Between Temperature and Sick Leave in Norway

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BACKGROUND AND AIM: In this study, we aim to gauge the impact of temperature fluctuations on productivity loss in Norway by examining the relationship between past temperature and sick leave. METHOD: We conduct our analysis using a panel dataset in the year of 2018 for individual-location-specific daily temperatures and sick leave records from a national registry in Norway based on the Cohort of Norway (CONOR). A logistic regression model is utilized to estimate the relationship for winter and summer periods.

RESULTS:Our findings suggest that temperature fluctuations had significant impacts on health and productivity, and these effects varied depending on the season and personal characteristics. We find that immediate temperature during the summer season did not have a statistically significant effect on sick leave, while a 14-day lagged temperature was found to have a small but significant positive impact on sick leave likelihood. This finding reveals that heat temperature fluctuations have a delayed impact on health and productivity. In contrast, short-term temperatures had significant and negative effects on the probability of sick leave during the winter. Moreover, our analysis indicates that higher education levels were associated with a lower probability of sick leave, possibly reflecting better access to healthcare and healthier lifestyle choices among those with higher education levels. Additionally, females had a higher probability of taking sick leave than males in both seasons of the year, indicating gender differences in the perceptions or needs of sick leave. In this paper, we also conducted sensitivity analyses to examine the robustness of the estimates.

CONCLUSIONS: Due to climate change, extreme temperatures are observed on a more frequent basis. This paper provides insight into the potential productivity loss and economic impacts of more temperature variability.

Keywords: temperature variability, temperature extremes, female

Attribution of extreme heat and heat-related mortality events to climate change in Europe: an integrated age- and sex-specific continental analysis

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BACKGROUND AND AIM: Extreme Event Attribution (EEA) aims to answer the question of whether and to what extent the intensity and likelihood of an observed extreme weather event have changed due to climate change. In this study, we apply the EEA framework to estimate how the the probability of different extreme temperature and heat-related mortality events has changed from a pre-industrial climate to present-day climate conditions (+1.2°C warmer globally).

METHOD:In the first step, we apply a distributed lag non-linear model to estimate the association between temperature and mortality counts. We use ERA5-Land temperature data and a mortality database including 92.612.620 death counts from 823 contiguous regions spanning 35 European countries and over 534 million people. We then separately fit a conditional extreme value distribution to the annual maxima of temperatures and heat-related mortality counts. By shifting the location of the distributions proportional to the global mean surface temperature, we calculate how the likelihood of events with different return periods has changed under climate change.

RESULTS: We see a strong climate change signal in both the increased probabilities of extreme temperature and heat-related mortality events. We find that the probability ratios differ between temperature and heat-related mortality, highlighting the non-linear relation between heat and mortality, but also showing how health risks largely depend on socio-demographic factors. Among them, we analyse gender differences by stratifying by age and sex, and find a higher risk not only with age but also for women. The probability ratios differ largely among societies with the strongest climate change contributions to heat-realated mortality detected in the Mediterranean.

CONCLUSIONS: This study demonstrates the use of epidemiological models in EEA studies, and opens the door for further work, including rapid attribution studies, studies of other health impacts and extreme weather events, and the extension of the EEA framework to analyse sociodemographic inequalities in adaptation.

Keywords: Climate, Environmental epidemiology, Mortality, Socio-Economic Factors, Temperature Extremes

Effect modification of greenness on PM2.5associated mortality in a multidrug-resistant tuberculosis cohort

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BACKGROUND AND AIM: Evidence for the association between fine particulate matter (PM2.5) and mortality among patients with tuberculosis (TB) is limited. Whether greenness protects air pollution-related mortality among patients with multidrug-resistant tuberculosis (MDR-TB) is completely unknown.

METHOD:2,305 patients reported in Zhejiang and Ningxia were followed up from MDR-TB diagnosis until death, loss to follow-up or end of the study (31 December 2019), with an average follow-up of 1724 days per patient. 16-day averages of contemporaneous Normalised Difference Vegetation Index (NDVI) in the 500 m buffer of patient's residence, annual average PM2.5 and estimated oxidant capacity Ox were assigned to patients regarding their geocoded home addresses. Cox proportional hazards regression models were used to estimate HRs per 10 µg/m3 exposure to PM2.5 and all-cause mortality among the cohort and individuals across the three tertiles, adjusting for potential covariates. RESULTS: HRs of 1.702 (95% CI 1.680 to 1.725) and 1.169 (1.162 to 1.175) were observed for PM2.5 associated with mortality for the full cohort and individuals with the greatest tertile of NDVI. Exposures to PM2.5 were stronger in association with mortality for younger patients (HR 2.434 (2.432 to 2.435)), female (2.209 (1.874 to 2.845)), patients in rural (1.780 (1.731 to 1.829)) and from Ningxia (1.221 (1.078 to 1.385)). Cumulative exposures increased the HRs of PM2.5-related mortality, while greater greenness flattened the risk with HRs reduced in 0.188-0.194 on average. CONCLUSIONS: Individuals with MDR-TB could benefit from greenness by having attenuated associations between PM2.5 and mortality. Improving greener space and air quality may contribute to lower the risk of mortality from TB/MDR-TB and other diseases.

Keywords: Air pollution, Green space, Environmental epidemiology, Long-term exposure, Mortality

OP-243[Built environment » Green space]

Health Impact Assessment of Greenness Promotion on All-cause Mortality in 37 Chinese Cities

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BACKGROUND AND AIM: Urban green space has the potential to improve population health in cities. This health impact assessment study aimed to estimate the number of preventable deaths in 37 major Chinese cities by implementing a targeted urban planning policy. METHOD: The health impact of green spaces was assessed using two matrices as policy inputs: the Normalized Difference Vegetation Index (NDVI) and the percentage of Green Area (%GA). The relationship between %GA (tree, shrub, and grass) and NDVI was assessed in the urban built-up areas (250m x 250m grids) of each city using generalized models. The health effect (preventable deaths) of NDVI increase was calculated based on a meta-analysis, as well as the city's population size and mortality rate. Further, The Chinese government's policy target of %GA at 42% was translated into a targeted NDVI for each city, and preventable deaths were calculated correspondingly under this policy. RESULTS: In the 37 major Chinese cities, an increase of 0.1 in NDVI could have prevented 68,330 deaths (approximately 878 fewer deaths per 100,000 residents). Trees and grass are the main groups of green space in built-up areas, and the proportion of vegetation species varies significantly depending on the geographical location. 26 out of the 37 cities were able to establish a good correlation between %GA and NDVI (adjusted R-squared > 0.2). A targeted 42% %GA could prevent 20,322 deaths (approximately 378 fewer deaths per 100,000 residents) in these cities. CONCLUSIONS: This study provides a quantitative assessment of the benefits of green space, bridging the gap between public health studies and urban planning matrices. The findings provide evidencebased support for policy makers to promote healthy and sustainable urban development.

Keywords: Policy, Mortality

Urban greenness space and parental positive and negative affect during pregnancy

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BACKGROUND AND AIM: Maternal mental illnesses during pregnancy have been found to influence child health. Although studies evidences suggested greenness space may beneficial to mental illnesses, little is known about whether it is to enhance subject well-being to maintain mental health, especially for pregnant couples in urban area. The study aims to examine the association between urban greenness and parental positive and negative affect at each trimester.

METHOD:Participants were selected from an ongoing cohort study: Longitudinal Examination across Prenatal and Postpartum Health in Taiwan. We analyzed the data between June 2017 and March 2020.Six items of self-report questions, three of positive (higher the score, the worse positive affect) and three of negative affect (higher the score, the higher the negative affect), during each trimester were assessed using the guidelines of the Joint Research Centre of the European Commission and the OECD. Urban greenness space was assessed using Normalized Difference Vegetation Index (NDVI) within a designated radius (250, 500, 750, 1000, 1500, and 2000m) surrounding participants' residences. Multiple regressions were used for examination the associations.

RESULTS:There were 330 pairs were enrolled in analysis. No matter positive and negative affect, average of parental level of each trimester was similar. In the univariate model, NDVI shows beneficial for parental positive and negative subject at midterm. After adjustment for other covariates, higher NDVI within a 2000m buffer (β =-1.65 95% C.I.= (-2.49, -0.80) were beneficial for maternal positive affect at the second trimester, while no other significant association were observed in other trimester. Besides, no significant association was observed in paternal positive or negative affect in the final model.

CONCLUSIONS: We found evidence that having more green space near the residence supported maternal positive affect, highlighting the important role of urban green spaces in promoting maternal mental health. This work was supported by National Science and Technology Council, Taiwan

Keywords: Green space, mental health, parents, subject well-being

Pollen exposure and the risk of respiratory emergency department visits among adults 65 and older in Michigan, Ohio, and Pennsylvania,

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BACKGROUND AND AIM:Climate change is increasing the length of intensity of seasonal patterns of various species of aeroallergenic pollens. These pollens have been shown to exacerbate respiratory disease symptoms of allergic rhinitis and asthma. However, the extent and nature of how short term lag exposures to pollens impact respiratory health events is not well understood. This research uses a database of respiratory related emergency department visits in Medicare recipients age 65+ (N= 5.1 million visits) in 30 counties each in Michigan, Ohio and Pennsylvania and a prognostic, model based raster of four classes of pollens to test and estimate associations of pollen exposure with symptomatic respiratory disease.

METHOD: We regressed daily ED visit count by ZIP code on cumulative seasonal pollen concentration counts for each evergreen, deciduous broadleaf, grass and ragweed pollen class including confounders for precipitation and temperature. Models were Poisson regression models with daily population-at-risk offsets within a distributed-lag-non-linear models with a 7-lag-day exposure history.

RESULTS:We found that one week cumulative exposure to >90th percentile of deciduous broadleaf pollens was positively associated with increases in ED visits (RR 1.09 95\% CI(1.02, 1.16)). However, we found no association for cumulative exposure to evergreen (RR 1.00 95\% CI(.95, 1.05)), grass pollens (RR 1.01 95\% CI(.95, 1.05)) and ragweed pollens (RR 1.03 95\% CI(.98, 1.08)) CONCLUSIONS:Cumulative exposure to deciduous broadleaf pollens, which appear in late Winter/early Spring may increase risk for serious respiratory symptoms in elderly adults.

Keywords: climate, Respiratory outcomes, Air pollution, Environmental epidemiology, Allergies

Impacts of greenspace on the relationship between particulate matter exposure and mental health related mortality in Detroit, Michigan, U.S.A

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BACKGROUND AND AIM:Anthropogenic climate change impacts humans through increased exposure to air pollutants, including particulate matter (PM2.5). Increased exposure to PM2.5 has been associated with increased risk for depression and other mental health outcomes. However, greenspace such as public parks and tree cover could mitigate the most serious impacts of air pollution on mental health. This research will explore how neighborhood greenspace can mitigate impacts of PM2.5 exposure and mental health related mortality using zip code level data from the post industrial Detroit, MI, USA.

METHOD:To measure greenspace, we use a dataset of latitude and longitude locations of trees collected from major cities in the United States. We count the number of trees within each zip code tabulation area (ZCTA) within the city limits of Detroit. From death records from the State of Michigan, we count up all mental health related deaths within each ZCTA between 2006 and 2016. Finally, we calculate mean PM2.5 exposure from a prognostic, model based raster of PM2.5 concentrations. We regress PM2.5 exposure and the number of trees on mortality counts using Poisson regression models, including the population of each ZCTA as an offset.

RESULTS: We found that tree cover varies by ZCTA, with tree count being positively associated with white race and ZCTA level median income. When controlling for median income, while we found a positive association of tree count with mental health related mortality, we also found that there were small but statistically significant protective effects of tree counts against PM2.5 on mental health related mortality.

CONCLUSIONS: Positive associations between greenspace and mental health related mortality could reflect underlying racial disparities in the recording of mental health in vital records, but might also reflect known disparities in the etiology of mental health between white and Black groups.

Keywords: Environmental justice, Air pollution, Particulate matter, Mental health outcomes, Green space

Spatial distribution of greenness in Bangkok, Thailand during 2018-2020: Ecological study

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BACKGROUND AND AIM: Greenness has become an essential element for urban residents because of its various contributions to citizens' health and quality of life. Previous studies have conducted greenness assessments; however, most were studied in developed countries. This study applied an ecological analysis aimed to reveal the spatial distribution of greenness in Bangkok, Thailand, during 2018–2020, using the district as a unit of analysis.

METHOD: Greenness data during 2018–2020 was provided by NASA, and it was measured by a Terra Moderate Resolution Imaging Spectroradiometer (Terra-MODIS) sensor with 250m x 250m spatial resolution. The Normalized Difference Vegetation Index is a satellite-image-based vegetation index that was used to estimate greenness in each district. MODIS NDVI images were collected with acquisition dates closer to the middle of the month. The ArcGIS program was used to extract NDVI values and generate a greenness map. Finally, monthly greenness values were calculated to estimate the annual average values of greenness in each district.

RESULTS:There are 50 districts in Bangkok, Thailand, and the results showed the greenness values in 2018, 2019, and 2020: the minimum was 0.14-0.22, 0.15-0.23, and 0.15-0.24; the maximum was 0.43-0.53, 0.45-0.56, and 0.45-0.55 respectively. From 2018 to 2020, the greenness values in Bangkok's East and West were higher; most are large districts that border other provinces, indicating that it is more rural than the urban area. Moreover, the greenness values were lower in the Central areas of Bangkok from 2018-2020, which are the urban, economic, and densely populated areas of Bangkok.

CONCLUSIONS: Greenness exposure may contribute to reducing health issues. It is recommended that policymakers and communities increase environmental greenness to moderate the health burden.

Keywords: Green space, Exposure assessment, Spatial statistics, Built environment

Association between long-term exposure to PM2.5 and mortality varied by serious underlying disease in South Korea: national health insurance cohort

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BACKGROUND AND AIM: The association between exposure to PM_{2.5} and mortality is well established, however, fewer studies have investigated the risk of PM_{2.5} considering underlying disease in large national cohorts due to the limitation of data. Therefore, this study aims to examine the association between PM_{2.5} and mortality by serious underlying diseases in beneficiaries of the national health insurance cohort in South Korea, in order to better understand the specific health risks associated with exposure to PM_{2.5}.

METHOD: We constructed a longitudinal cohort for 2002 to 2019, including beneficiaries aged 48 to 80 years enrolled in 2002. The cohort was based on the National Insurance Service – National Sample Cohort, which can be representative of the population in South Korea. Using the Charlson Comorbidity Index criteria, we defined beneficiaries who were diagnosed with seven serious underlying diseases in 2002 and 2003. We performed Cox proportional hazard models with time-varying exposures and confounders.

RESULTS: We identified 52,318 cases of death among 212,912 individuals aged 50 years or older. For each 5μ g/m³ increase in annual PM_{2.5} concentrations, the hazard ratio (HR) for patients without serious underlying disease was 1.023 [95% CI 1.017-1.029] and it was the lowest among other underlying diseases. The highest HR was observed in beneficiaries with liver disease (1.046 [1.031 to 1.062]), renal disease (1.043 [0.996 to 1.092]), and peripheral vascular disease (1.040 [1.016 to 1.065]).

CONCLUSIONS: We estimated the mortality risk of long-term exposure to PM_{2.5} for each underlying disease. Our results provide scientific evidence for the establishment of target-specific PM_{2.5} guidelines based on the medical histories of individuals.

Keywords: Particulate matter, Long-term exposure, Mortality

Interpretability – using causal modeling frameworks to investigate the association between long-term exposure to nitrogen dioxide and COVID-19 disease

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BACKGROUND AND AIM: The current evidence linking long-term exposure to air pollution and coronavirus (COVID-19) disease is still sparse and inconsistent. Moreover, to enhance communication with clinicians and policymakers, findings need to be more interpretable and related to potential policy intervention. We aimed to examine the association between long-term exposure to nitrogen dioxide (NO₂) and COVID-19 hospitalization and mortality risk, and estimate the preventable cases under policy intervention.

METHOD: We followed residents aged 30 years or older in Denmark from March 1, 2020 until March 1, 2021. Annual mean concentration of NO2 in 2019 were estimated at each residence address by the Danish DEHM/UBM model. Risks were modelled through binomial regression with inverse probability censoring weighting, to account for censoring. Then, risk differences were estimated under counterfactual scenarios for low/high NO₂ exposure, dichotomized by 10 μ g/m³ of World Health Organization Air Quality guideline (G-computation). In a further analysis, we estimated the excess risk under the hypothetical scenario where the guideline would be met comparing with the current exposure. The covariates and confounders, including sex, age, individual and area-level socioeconomic status were considered in the model.

RESULTS:During the first year of COVID-19 pandemic in Denmark, 10,187 were hospitalized and 2,442 died from COVID-19 out of 3,721,813 participants. During this period, we estimated an excess risk [95% confidence interval] of 769 [640-898] COVID-19 hospitalization and 224 [160-288] mortality per 1 million persons associated high NO₂ exposure. Furthermore, using counterfactual analysis with linear NO₂ exposure, we further estimated that reaching the WHO guideline for NO₂ could avoid 1025 [848-1202] COVID-19 hospitalizations and 289 [205-373] deaths.

CONCLUSIONS:Long-term exposure to NO₂ contributes to a significant increase in the risk of COVID-19 hospitalization and mortality in Denmark, and our results highlight a potential health benefit of air pollution reduction in reduced COVID-19 hospitalization and mortality.

Keywords: Air pollution, COVID-19, Causal inference, Policy, Risk assessment

Association between Long-Term Exposure to Air Pollution and COVID-19 Mortality: Investigation of potential collider bias

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BACKGROUND AND AIM: Studies examining the link between exposure to air pollution and COVID-19 mortality, only including COVID-19 infected or hospitalized patients, can be subject to collider bias. However, this potential bias has not been investigated in the recent literature on air pollution and COVID-19. We aimed to investigate the association between long-term exposure to air pollution and COVID-19 mortality among the general population, COVID-19 infected and hospitalized patients. METHOD: We followed Danish residents aged ≥ 30 years old from March 1st 2020 until COVID-19 death or April 26th 2021, whichever came first. We assigned annual mean concentration levels to all participants based on their residential addresses in 2019: particulate matter with diameter $\leq 2.5 \,\mu m$ (PM2.5) and nitrogen dioxide (NO2) estimated by the Danish DEHM/UBM model. The associations between exposure to air pollution and COVID-19 mortality were assessed in three baseline groups: general population (n=3,721,813), and COVID-19 infected (n=138,742) and hospitalized (n=11,270) patients. We used Cox regression models after adjusting for potential covariates. RESULTS: Mean levels of air pollution were higher in COVID-19 infected or hospitalized patients (11.4-11.5/7.5 μ g/m³ for NO2/PM2.5) compared to the general population (10.7/7.4 μ g/m³ for NO2/PM2.5). We detected greater associations of exposure to air pollution with COVID-19 mortality in the general population compared to the COVID-19 infected and hospitalized patients. Hazard ratios (95% confidence intervals) for the risk of COVID-19 mortality were 1.23 (1.04-1.44), 1.08 (0.93-1.26), and 1.04 (0.87-1.24) per 0.55 µg/m3 increase in PM2.5 based on the general population and COVID-19 infected and hospitalized patients, respectively. A similar declining pattern of the associations was also observed with exposure to NO2. CONCLUSIONS: Our findings suggest that associations between long-term exposure to air pollution and

CONCLUSIONS: Our findings suggest that associations between long-term exposure to air pollution and COVID-19 mortality is likely prone to be underestimated in patient-based cohorts due to potential collider bias.

Keywords: Environmental epidemiology, Methodological study design, COVID-19, Air pollution

Health economic loss of mortality attributable to wildfire-related PM2.5: a nationwide time series study in Brazil

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BACKGROUND AND AIM: Wildfire imposes a high mortality burden on Brazil. However, there is a limited assessment of the health economic losses attributable to wildfire-related fine particulate matter (PM2.5).

METHOD: We collected daily time-series data on all-cause, cardiovascular, and respiratory mortality from 510 immediate regions in Brazil during 2000–2016. The chemical transport model GEOS-Chem driven with Global Fire Emissions Database (GFED), in combination with ground monitored data and machine learning was used to estimate wildfire-related PM2.5 data at a resolution of 0.25° × 0.25°. A time-series design was applied in each immediate region to assess the association between economic losses due to mortality and wildfire-related PM2.5 and the estimates were pooled at the national level using a random-effect meta-analysis. We used a meta-regression model to explore the modification effect of GDP and its sectors (agriculture, industry, and service) on economic losses. RESULTS:During 2000–2016, a total of US\$81.08 billion economic losses (US\$5.07 billion per year) due to mortality were attributable to wildfire-related PM2.5 in Brazil, accounting for 0.68% of economic losses and equivalent to approximately 0.14% of Brazil's GDP. The attributable fraction (AF) of economic losses due to wildfire-related PM2.5 was positively associated with the proportion of GDP from agriculture, while negatively associated with the proportion of GDP from service. CONCLUSIONS: Substantial economic losses due to mortality were associated with wildfires, which could be influenced by the agriculture and services share of GDP per capita. Our estimates of the economic losses of mortality could be used to determine optimal levels of investment and resources to mitigate the adverse health impacts of wildfires.

Keywords: Mortality, Short-term exposure, Respiratory outcomes, Cardiovascular diseases.

Improving Health by Mitigating the Air Pollution? Mortality and Trends caused by PM2.5 in the heavy-industrial areas in southern Taiwan

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BACKGROUND AND AIM: Heavy industry produces many air pollutants during production, such as airborne particulate matter (PM10 and PM2.5). Although the exposure concentration of air pollution has decreased in recent years, it still exceeds the World Health Organization (WHO) standard. Especially in Linyuan, where heavy industries gather in southern Taiwan, the concentration of PM2.5 exposures is more than 4 times the 2021 WHO standard. This study attempts to analyze the effect of PM2.5 on mortality rates, and further compare areas with different levels of PM2.5 between heavy industrial areas and general areas.

METHOD:A retrospective study design used Taiwan National Health Insurance Research Database and the Taiwan Air Quality Monitoring Database from 2008 to 2019. The major outcome of interest was to compare age-adjusted mortality by area. Through literature review, five air pollution-related causes of death (all causes of death, malignant tumors, pneumonia, chronic lower respiratory diseases (CLRD), and lung cancer) were selected. In addition to estimating the trends of PM2.5 exposure and specific disease mortality, repeated measures were used to determine the time and regional impact of PM2.5 exposure and mortality.

RESULTS:Taiwan's PM2.5 exposure concentration has shown a downward trend since 2008. The mortality of all causes of death, malignant tumors, pneumonia, and CLRD in males, and the mortality of all causes of death, pneumonia, and CLRD in females decreased over time. Compared with Taiwan in general, the heavy industrial area (Linyuan) presents a higher risk of death for both genders. CONCLUSIONS:Our findings show that air pollution has indeed improved in Taiwan since 2008 and associated risk of death decreased. The standardized death rate is higher in areas with higher air pollution, especially in heavy industrial areas (Linyuan). Policy may need to continue improving air quality to positive benefit in public health.

Keywords: PM2.5, age-adjusted mortality, Taiwan National Health Insurance Research Database (NHIRD), Air pollution

Indoor particulate matter heavy metals and their potential health risks in low socio-economic communities

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BACKGROUND AND AIM: There is growing evidence that, pollutants such as particulate matter and heavy metals are associated with significant health impacts. The aim of this study was to identify the predictors and common sources of indoor PM2.5 heavy metals and evaluate the health risk to the children living in Durban.

METHOD: Thirty households belonging to mothers participating in the mother and child in the environment birth cohort study were selected for this study. Airmetrics MiniVol samplers loaded with Teflon membrane filters were used for sampling airborne indoor PM2.5. A wavelength-dispersive x-ray fluorescence technique was used to assess the amount of heavy metals in the filters. Contamination levels were evaluated using contamination factor (CF), enrichment factor (EF), and pollution load index (PLI). Multivariate linear regression models were used to identify the predictors of indoor PM2.5 heavy metals. The common sources of PM2.5 heavy metals were identified using Pearson correlation and principal component analysis. The measured concentrations of metals were used to estimate the health risk for children.

RESULTS:According to CF, EF and PLI contamination exist in the assessed homes. Proximity to industry, wall type, age of the house, presence of windows, and proximity to pollution generating activities were associated with an increase in the levels of some indoor PM2.5 heavy metals. Cross ventilation was associated with a reduction in indoor PM2.5 As and Cu levels. The use of Pearson correlation and principal component analysis point to the potential roles of household characteristics, traffic emissions, industries, and natural sources. The health index was >1, and the cancer risk values in PM2.5 As and Pb exceeded the maximum acceptable level of carcinogenic risk for humans. CONCLUSIONS:This study highlights the potential contribution of heavy metals to indoor PM2.5 toxicity. To protect vulnerable groups from exposure to heavy metals, it is necessary to prevent exposure to high-risk metals.

Keywords: Air pollution, Children's environmental health

Assessment and mitigation of cadmium exposure based on human bioavailability

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BACKGROUND AND AIM:Cadmium (Cd) is a ubiquitous environmental pollutant, posing a threat to human health. Health risks assessment of dietary Cd exposure is depended not only on total Cd concentration, but also on Cd relative bioavailability.

METHOD:Rice samples collected from contaminated areas were analyzed for Cd concentration and Cd relative bioavailability using an in vivo mouse bioassay. Measured urinary Cd for 119 nonsmokers with rice as the staple food was compared to predicted values from rice-Cd intake with and without considering Cd relative bioavailability. Furthermore, the effects of mineral nutrients (Zn, Fe, and Ca) on Cd relative bioavailability in rice based on an in vivo mouse bioassay model were evaluated. RESULTS:In rice, Cd relative bioavailability varied from 16.9% to 57.4%. Predicted human urinary Cd (geometric mean: 4.14 μ g/g creatinine) based on a toxicokinetic model using total Cd concentration in rice was 3.5-fold greater than the measured urinary Cd. While when rice Cd relative bioavailability was incorporated, predicted urinary Cd agreed well with the measured urinary Cd (1.07 vs 1.20 μ g/g creatinine), highlighting the importance of bioavailability in accurately estimating human Cd exposure and related health risks. Evidence based on mouse bioassay showed that increased dietary levels of Fe and Ca effectively reduced Cd exposure by decreasing Cd-RBA in rice, thereby reducing Cd accumulation in humans via rice intake.

CONCLUSIONS: This research will provide valuable information on accurately assessing the health risk in humans and developing effective dietary strategies to reduce Cd exposure and its associated health risks.

Keywords: Metals, risk assessment, food/nutrition, biomarkers of exposure

OP-255[Chemical exposures » Mixtures]

Urinary metal mixtures and their association with renal function: A cross-sectional study in Mexico

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BACKGROUND AND AIM: Epidemiological and experimental studies have established that individual metal exposure, such as arsenic, lead, mercury, and cadmium, can cause kidney damage, resulting in alterations at molecular, structural, and function levels. However, these exposures occur jointly in real contexts, and their effect on renal function has been incipiently studied. Tlaxcala is a Mexican entity that presents a high incidence of chronic kidney disease in the young population without traditional risk factors. Therefore, studying the possible environmental causes of kidney disease development is pertinent. This work aims to associate urinary metal mixtures with renal function markers in adolescents from Tlaxcala.

METHOD:A cross-sectional study was carried out, including 914 healthy adolescents. The urinary concentrations of aluminum (Al), vanadium(V), manganese (Mn), copper (Cu), zinc (Zn), arsenic (As), selenium (Se), strontium (Sr), molybdenum (Mo) tin (Sn), lead (Pb), lithium (Li), nickel (Ni), iodine (I), and barium (Ba), were determined by inductively coupled plasma mass spectrometry (ICP-MS) and corrected for urinary density. Renal function markers were glomerular filtration rate (eGFR mL/min/1.73m2) and albumin/creatinine ratio (ACR) with the following cut-off points: <30 and \geq 30 mg/g -creatinine. The mixtures' effect on renal function markers was evaluated using Weighted Quantile Sum regression (WQS) adjusted by confounders.

RESULTS:The average age of the study population was 13 ± 1.6 years, and 55% were women. The median eGFR was 103.7mL/min/1.73m2(p25-p75:92.04-121.52), and 18% of subjects presented proteinuria. Two urinary metal mixtures with opposite associations with log-eGFR were found: [V, I, Sn, Al, Pb, and Sr; β :0.037, p-value<0.001] and [Mn, Cu, Se, Ni; β :-0.026, p-value=0.036]. CONCLUSIONS:Our study provides evidence that the metal mixture's effects on renal function in apparently healthy adolescents were associated with increased and decreased glomerular filtration rates. Mixture analysis approximates exposure to multiple contaminants, their possible metabolic interactions, and possible mechanisms of kidney damage.

Keywords: Mixtures, biomarkers of exposure, Multi-pollutant, Heavy metals.

Exposure to uranium and its decay products is associated with plasma metabolome of people living near former uranium processing site

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BACKGROUND AND AIM: There is an urgent need for bioassays that provide biodosimetric assessment of low-dose radiation exposure and their associated health effects. In this study, we determined circulating metabolic features associated with low-dose radiation exposure, emitted from uranium and its decay product, radon, in people living in the vicinity of a former uranium processing site. METHOD: The Fernald Community Cohort (FCC) was created to study the effects of uranium and radon exposure among people who lived in the vicinity of a uranium processing site at Fernald (near Cincinnati), Ohio. The Fernald Dosimetry Reconstruction Project (FDRP) estimated exposure to uranium, released from the plant during production, and radon, from two large silos, using dosimetry algorithms. Untargeted plasma metabolomic profiles were generated using liquid chromatography coupled to a Thermo Orbitrap HFX mass spectrometer at the Columbia Exposomics Core. We studied the relationship between estimated uranium and radon exposure and circulating metabolites among 40 male participants of the FCC. We used unsupervised dimensionality reduction to find linear combinations of metabolites associated with radiation exposure, adjusted for age. RESULTS:The mean (standard deviation) age of participants was 59.8 (2.5) years. We generated

principal components (PCs) using metabolomic data and tested their association with uranium and radon exposure. PC7 was significantly associated with exposure and explained 3% of variance in the metabolomic data. The metabolic features with the highest absolute loadings on PC7 enriched glycerophospholipid, glycine, serine, and threonine, and alpha-linolenic acid metabolic pathways as well as pantothenate and CoA, and aminoacyl-tRNA biosynthesis pathways.

CONCLUSIONS:To our knowledge, this is the first population study exploring the metabolic response to low-dose radiation exposure. Our results show a metabolic response to radiation consistent with effects reported in toxicological studies using rodent models and cell lines, which may contribute to adverse human health effects.

Keywords: radiation, uranium, radon, metabolome, population studies.

OP-257[Chemical exposures » Other (to be specified with keywords in the keywords section)]

Risks of exposure to benzotriazoles: from genotoxicity to human liver stem cells to exposure levels in Czech male population

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BACKGROUND AND AIM: Benzotriazoles (BTRs), mostly used as corrosion inhibitors, have been classified as high-production-volume chemicals of emerging concern due to wide distribution in the environment (including human tissues) and significant toxicological data gaps. This study aims to evaluate genotoxic effects of BTRs on human liver stem cells and assess the exposure levels in Czech male population.

METHOD:HL1-hT1 cells were used for Comet assay to assess genotoxicity of 5 frequently used benzotriazoles – 1H-benzotriazole (BTR), 1-methyl-1H-benzotriazole (1M-BTR), 4-methyl-1H-benzotriazole (4M-BTR), 5-methyl-1H-benzotriazole (5M-BTR) and 4-hydroxybenzotriazole (4OH-BTR). No-observed-adverse-effect-level (NOAEL) was derived from the results. Furthermore, a liquid chromatography-electrospray ionization tandem mass spectrometry (LC-ESI(+)MS/MS) method for determination of BTRs in human urine have been developed. 165 male urine samples were analysed and the levels in blood were determined by toxicokinetic modelling based on renal clearance. RESULTS:Significant increase in DNA damage induced by 1H-BTR, 4M-BTR, and 4OH-BTR was detected at the concentration 17 ng.mL-1 and higher, with derived NOAEL of 1.7 ng.mL-1. Detection frequency (DF) was highest for 1M-BTR (76.9%) and 1H-BTR (66.7%) with medians 1.79 and 0.24 ng.mL-1, respectively. Other compounds had DF lower than 17%. The sum of 5 BTRs in human urine ranged from <LOD to 47.6 ng.mL-1. The estimated 1H-BTR blood concentrations ranged from <LOD up to 0.84 ng.mL-1.

CONCLUSIONS: In this study, benzotriazoles were tested for genotoxic effects on human cells, to the best of our knowledge, for the first time. The results point to potential genotoxic effects at environmentally relevant concentrations and provide the ground for future human health risk assessment. More toxicokinetic and human biomonitoring studies focusing on benzotriazoles are warranted.

This project received funding from the EU's Horizon 2020 N°857340 and the research council of Norway (N°ES577371) and was supported by RECETOX RI (No°LM2018121), CETOCOEN EXCELLENCE (No°CZ.02.1.01/0.0/0.0/17_043/0009632) and CETOCOEN Plus (No°CZ.02.1.01/0.0/0.0/15_003/0000469).

Keywords: Toxicology, Exposure assessment, Outcomes, Risk assessment,

Saliva and Urine Sampling to Quantify Trace Metal Exposure for Epidemiologic Studies

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BACKGROUND AND AIM:Urine is a common biospecimen used for trace metal analysis in epidemiological studies, but the results of measurement vary depending on the timing of sample collection and adjustment methods used. Saliva is a natural filtrate of blood that consist of leukocytes and endothelial cells, contains small molecules, trace metals, proteins, and DNA, making it ideal for epidemiological studies on individual's exposome. This study aims to examine results from spot urine collection versus 24-hour urine collection, to determine the efficacy of saliva versus urine sampling for trace metal analysis.

METHOD: Two pilot experiments were conducted: Experiment 1 (n=10) tested the efficacy of spot versus 24-hour urine collection, while Experiment 2 (n=100) tested the efficacy of spot urine versus saliva sampling to quantify arsenic and cadmium. Both studies quantified heavy metals using the inductively coupled plasma mass spectrometry (iCAP RQ ICP-MS, Thermofisher).

RESULTS:Experiment 1 found significant positive correlations between spot and 24-hour urine collections for arsenic [Specific Gravity (SG) adjusted; r=0.998] and cadmium (SG adjusted; r=0.97). A non-significant decreasing trend were observed among spot samples throughout the day, particularly after the first spot urine samples. Experiment 2 found significant differences among urine adjustment methods depending on population demographics. While saliva concentrations are substantially lower than urine concentrations, Pearson correlations observed a significant positive coefficient among arsenic [Creatinine/Specific Gravity (CR/SG) adjusted; r=0.66], but not cadmium. Weighted kappa correlations observed significant agreement between arsenic tertiles (CR/SG adjusted; $\kappa=0.415$).

CONCLUSIONS:Although the trace metal measurements varied throughout the day, the results of spot samples are comparable to 24-hour urine samples when measuring arsenic and cadmium concentrations. Further, in comparison to urine, saliva sampling is a reasonable method to determine the variation of arsenic for epidemiological studies. Similar correlations did not exist in cadmium between urine and saliva samples.

Keywords: Epidemiology, Heavy metals, Environmental epidemiology, Biomarkers of exposure, Exposures

Association of prenatal and childhood exposure to benzophenones and neurobehavioral development in children

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BACKGROUND AND AIM: Benzophenones (BPs) are used as UV filters and photoinitiators to be added to various products, such as cosmetics, printing inks, etc. The daily usage of such products increases exposure to BPs, including pregnant women and children. This study aims to determine the exposure of various BPs in the urine of pregnant women and their children and to investigate the correlation between prenatal and childhood BPs exposure and neurobehavioral development in children. METHOD: This study collected urine samples from 796 pregnant women and 364 children aged 2 to 6 from four regions of Taiwan (TMICs), and levels of various BPs were detected and quantified using UHPLC-MS/MS. The neurobehavioral development was evaluated using the Wechsler Preschool and Primary Scale of Intelligence (WPPSI–IV), and information on socio-demographics was collected through a questionnaire.

RESULTS:Prenatal geometric mean (GM) concentrations of BP, BP-1, BP-3, BP-8, and 4-OHBP in the 796 Taiwanese pregnant women, corrected for creatinine, were 4.96 μ g/g Cr, 0.05 μ g/g Cr, 0.03 μ g/g Cr, <LOD μ g/g Cr, and 0.002 μ g/g Cr, respectively. The GM concentrations of BP, BP-1, BP-3, BP-8, and 4-OHBP in the 364 children, corrected for creatinine, were 4.03 μ g/g Cr, 0.05 μ g/g Cr, 0.008 μ g/g Cr, <LOD μ g/g Cr, and 0.001 μ g/g Cr, respectively. BP-2 and BP-4 were not detected. Prenatal BP and BP-3 exposures were negatively correlated with almost all WPPSI-IV scale index scores, and prenatal BP exposures approached a significant negative correlation with children's FRI (Fluid Reasoning Index) scores, whereas exposure to BP in children approached a significant negative correlation with PSI (Processing Speed Index) scores. CONCLUSIONS: The BPs exposure patterns of pregnant women and children in Taiwan differ greatly from those of other countries. Further studies will be required to identify the sources of BPs exposure and the effects of prenatal and children's BPs exposure on neurobehavioral development.

Keywords: endocrine disrupting chemicals, exposure assessment, neurodevelopmental outcome

OP-260[Chemical exposures » Heavy metals]

The Association of Children's Blood Lead Levels and Prevalence of Stunting in Tin Mining Area in Indonesia

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BACKGROUND AND AIM: Metal mining and smelting activities are regarded as major sources of heavy metals such as lead, mercury, arsenic and cadmium in the environment and humans living at surrounding area. Among others, lead can enter and accumulate in the human body and very influential in children's growth and development. This study aims to assess the association between children's blood lead levels and stunting in a mining area in Indonesia

METHOD:A cross-sectional design was implemented by involving 193 children living surrounding Tin Mining in Bangka Island, Indonesia. Venous blood was drawn, and blood lead level was measured by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Stunting status was measured by anthropometry standing height and converted to sex- and age-specific Z-scores based on World Health Organization (WHO) growth reference. Children's dietary was assessed using 24-hour dietary recall method. Statistics of chi-square test and multiple-logistic regression were performed for the analyses

RESULTS:The geometric mean of Blood Lead Levels (BLLs) was 5.5 microgram/dl (\pm 2.6 µg/dl; 95% CI: 5.1 - 5.9). The interquartile range of BLLs and height for age Z-score (HAZ) were 3.0 microgram/dl and -1.5, respectively. The data revealed that 23.3% children were stunted (HAZ < -2). The multiple logistic regression models suggest that elevated BLLs was an independent predictor of the stunting. The odds stunted if blood lead concentration elevated was about ten times higher [adjusted odd ration (AOR) = 9.75 (95% Confidence interval (CI): 3.1 – 30.7); p<0.001] in comparison to the odds of normal BLLs. The BLLs of children at age 2 - 9 years were found associated with stunting after controlling of mother's education, residence, and the intake of energy, protein, zinc, vitamin A, calcium, and phosphorus

CONCLUSIONS: The study suggested that living at surrounding Tin Mining was dangerous for children health and their development

Keywords: Children, Blood Lead Levels, Stunting, Tin Mining

Understanding Pediatric Susceptibility Across Temperature and Environment in New York (UPStATE NY)

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BACKGROUND AND AIM: This project will identify community stressors and assets that shape relationships between climate-related exposures [heat, ozone (O3), fine particulate matter (PM2.5)] and child health, across the urban-rural gradient. Communities with high social stressors (e.g., poverty) also have health-promoting assets (e.g., greenspace), which may be utilized or enhance to improve child health and resilience.

METHOD: We are working with statewide partners - the Pediatric Environmental Health Specialty Units (PEHSU), Children's Environmental Health Centers (NYSCHECK) network, and community and government partners – to identify stressors and assets which may buffer child health impacts, under climate scenarios. Candidate assets are identified following the Resilience Activation Framework (aspects of human, economic, social, political, environmental capital), and the NYS DEC Climate Justice Working Group.

We use complete data on emergency department visits and hospitalizations for 2005-19 from the Statewide Planning and Research Cooperative System (SPARCS) (~7 million cases), for children aged 0-17. We have generated fine-scale estimates for heat, O3, and PM2.5, and are examining exposure-health relationships using case-crossover and other methods (e.g., structural equations models). Finally, we will apply climate projections to estimate future impacts, and integrate findings into local and state climate adaptation and pediatric clinical initiatives.

RESULTS:Preliminary results suggest that a 10-deg F increase in Tmin conferred increased risk of hospitalization on case day (1.14% excess risk, 95% CI: 0.91, 1.37),) after adjustment for case-day PM2.5, with stronger associations among children aged 0-4 or 14-17, in urban areas, and in EJ areas. We also observe positive associations for PM2.5 and epilepsy/ seizure risk, among children aged 2-4 years, in NYC, with possible weaker relationships in high-crime neighborhoods.

CONCLUSIONS: We will identify stressors and assets which exacerbate or buffer climate impacts on health across a diverse state, and provide guidance to partners on targeted investments in EJ communities which may alleviate climate impacts on health.

Keywords: particulate matter, ozone, temperature, socio-economic factors (non-chemical stressors), children's environmental health
OP-262[Birth and pregnancy outcomes » Birth outcomes]

Environmental risk factors associated with birth defects in a war-zone in Iraq

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BACKGROUND AND AIM: Ever since the war started in 2003, Iraqi doctors have reported an increase in the birth of children with congenital anomalies. According to them, the rise in incidence could be attributed to war-related exposure e.g. from mercury, depleted uranium, lead and arsenic. As the war impeded research, the current post-conflict situation has given space for research. The aim of the present study is to assess to what extent exposure to environmental pollution might be associated with the incidence of congenital anomalies in Iraq.

METHOD:: A case-control study was conducted in Fallujah, a heavily bombarded city, comparing 50 parents of children with birth defects and 50 parents of children without birth defects. We used a questionnaire to comprehensively document environmental exposure and history of residence of each couple. Further, we complemented the interviews with biomonitoring through hair analysis of parents on heavy metals using ICP-MS. In addition, we took soil samples of the city of Fallujah using grid sampling and compared this to a control city in northern Iraq which has been less bombarded. We used R to statistically assess the differences in case and control groups regarding exposure and heavy metal concentrations, correcting for confounders like age and socio-economic status. RESULTS:Our results point towards a relation between congenital anomalies and the occupation of fathers. Fathers of children with birth defects are more often construction workers, working on houses often damaged or levelled by war. In addition, analyses also show that mothers of children with congenital anomalies more often experienced bombing compared to mother of healthy children. CONCLUSIONS:Having a child with a congenital anomaly in Iraq seems associated with indicators of paternal and maternal environmental exposure.

Keywords: Heavy metals, Exposome, Neurodevelopmental outcomes, Children's environmental health, Environmental justice

Associations Between Gestational Environmental Phenols and Preterm Birth in a Diverse Population; a Prospective Study of Racial Disparities

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BACKGROUND AND AIM: Studies report associations between gestational exposure to environmental phenols (EPs) and preterm birth (PTB), which may vary by maternal race. We conducted a prospective investigation to investigate racial disparities

METHOD: We enrolled n=299 mothers with a pregnancy, n=27 with PTB; n=139 self-identified as Black and n=160 self-identified as non-Black. We determined urinary levels of methyl- (MP), ethyl-, propyl-, and butyl parabens, benzophenones 1 (BZP-1) and 3 (BZP-3), pentachlorophenol (PCP), triclosan, and bisphenols A and S (BPS), in urine specimens collected between 18-22 gestational weeks, using liquid chromatography-tandem mass spectrometry. We used logistic regression to estimate associations between individual EPs and PTB, log transformed and scaled to the interquartile range, adjusting for specific gravity, maternal age, race, BMI, education, and infant sex. We estimated the association between PTB and co-exposure to the mixture of 10 urinary EPs using Bayesian kernel machine regression (BKMR).

RESULTS: Greater BZP-1 (OR: 0.65; 95%CI: 0.39, 1.09) and BPS (OR: 0.09; 95%CI: 0.03, 0.25) were associated with lesser odds of PTB, whereas PCP measured above the detection limit was associated with greater odds of PTB (OR: 12.41; 95%CI: 4.31, 36.46). Maternal race interacted with MP (P=0.092) and PCP (P=0.055), such that there were stronger inverse and positive association for MP and PTB, respectively, among the Black than the non-Black racial grouping. Using BKMR the association was non-linear; the greatest PTB risk was for the 60th %ile relative to the 50th %ile of the EP mixture distribution, adjusted for covariates. BZP-3, BPS, and PCP were the most important mixture components.

CONCLUSIONS: Gestational urinary BZP-1, BPS, and PCP associated with PTB and associations diverged by race for MP and PCP. There was a non-linear association for PTB with the mixture of 10 gestational urinary EPs. Our results suggest that select EPs are associated with PTB and may be modified by maternal race.

Keywords: Phenols, Environmental disparities, Mixtures

Prioritizing interventions to reduce children's exposure to urban exposures: a Delphi study

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BACKGROUND AND AIM: Urban exposures such as air pollution have been shown to negatively impact health with young people especially vulnerable. Interventions to reduce harmful exposures in the urban environment are likely to improve health but there is little evidence of the types of interventions which may be most effective and whether they would be acceptable and feasible to implement in communities.

METHOD: A Delphi consensus study was carried out among a wide range of stakeholders to prioritize interventions. A list of candidate interventions were identified from stakeholder and community consultations and published systematic reviews focusing on interventions aimed at reducing urban exposures and improving health outcomes in children under 18 years old. A Steering Group comprised of research, community, and key stakeholders mapped and provided contacts to relevant health and community research groups and local and national governments and agencies. Three survey rounds were planned to reach consensus on effectiveness, acceptability, feasibility and impact. Responses will be analyzed descriptively and will explore whether ratings differ by stakeholder groups. Findings will be refined into a key list of recommendations in workshop consultations with key stakeholder groups. RESULTS: Twenty-three interventions were identified and included individual behaviors such as walking buses to local structural changes such improvement to green and active infrastructure, as well as larger policy initiatives such as implementation of low emission zones. Results from the survey and workshop consultations will be presented.

CONCLUSIONS: Findings will provide insight into whether different stakeholder groups consider different interventions more effective and implementable.

Keywords: air pollution, built environment, community-engaged research, children's environmental health, health co-benefits

Heat and risks of emergency department visits in the Medicaid population in South Korea: a longitudinal health insurance-based cohort study

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BACKGROUND AND AIM: The association between hot temperatures and health is a well-established area of environmental research; however, little is known about how the association differs in the Medicaid population – low-income individuals who might be disproportionately affected by environmental health hazards. This study aimed to evaluate the association between heat and visits to Emergency Department (ED) for beneficiaries eligible to Medicaid with a longitudinal nationwide cohort in South Korea.

METHOD: We collected data from the National Sample Cohort of the National Health Insurance Service from 2002 to 2019 in South Korea. From the data, we constructed a longitudinal cohort for the Medicaid beneficiaries. A conditional logistic regression was performed to estimate the relationship between summer temperatures and all-cause ED visits with a time stratified case crossover design. RESULTS: In our cohort, a total of 78,973 ED visits were recorded among Medicaid beneficiaries per 1,000,000 people for any cause. Heat was associated with an excess risk of ED visits (Odds Ratio (OR): 1.09, 95% Confidence Interval (CI): 1.00-1.18) for the 95th percentile of summer temperatures, compared to the minimum ED visits temperature. Also, the association was higher in the Medicaid people aged below 35 (OR: 1.26, 95% CI: 1.04-1.52) than the Medicaid people aged over 65 (OR: 1.17, 95% CI: 1.04-1.31).

CONCLUSIONS:Our results identified the association between heat and ED visits in the Medicaid population in South Korea. The association with heat in the Medicare population was more pronounced than that of the general population estimated by previous studies, and the results provide the appropriateness of differentiated heat action plans for vulnerable populations.

Keywords: Temperature extremes, Socio-economic factors, Climate

Anomalous temperatures increase occupational injuries, illnesses and associated costs in Australia

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BACKGROUND AND AIM: Anomalous ambient temperatures elevate the risk of occupational injuries and illnesses (OIIs). However, the associated economic burden is underexplored internationally yet likely substantial. Understanding the temperature-attributable variations in OIIs and costs can mitigate occupational burden. This study aimed to establish a national Australian profile of heat- and cold-attributable OIIs and their associated costs.

METHOD: Workers' compensation claims from seven Australian capital cities were extracted from July 2005 to June 2018. OIIs and associated costs attributable to daily maximum wet bulb globe temperature (WBGT) were estimated, including stratification of both workers and WBGT by indoor/outdoor status. Individual models were pooled to produce national and city-level estimates. Results were projected to 2030 (2016-2045) and 2050 (2036-2065).

RESULTS:The heat-attributable and cold-preventable fractions of OIIs were 1.66% (95% eCI: 1.38-1.94) and 0.66% (95% eCI: 0.45-0.89%), respectively. These represented 38,540 heat-attributable OIIs and 15,409 cold-preventable OIIs. 1.53% (95% eCI: 0.77-2.27%) and 1.33% (95% eCI: 0.66-1.97%) of costs were heat- and cold-attributable, respectively, with increased costs per OII during cold despite less OIIs. The associated financial burdens were AU\$651 and AU\$574 million, respectively, collectively representing AU\$94 million annually. In 2050 under Representative Concentration Pathway [RCP]8.5, heat-attributable and cold-preventable fractions of OIIs were 0.21% (95% eCI: 0.12-0.54) and 2.10% (95% eCI: 1.50-2.66%), respectively, and heat- and coldattributable fractions for costs were 0.76% (95% eCI: 0.08-1.43) and 0.05% (95% eCI: -1.84 to 1.83).

CONCLUSIONS: Environmental heat and cold temperatures in workers poses a substantial morbidity and cost burden in Australia. The relationship between anomalous temperatures and costs does not necessarily follow that of OII occurrence, which is likely more influenced by heat compared to cold relative to their associated costs. Although heat adaptation is likely more important for preventing OIIs than cold adaptation, addressing both is important to reduce OII-associated costs.

Keywords: Environmental epidemiology, Modeling, Occupational exposures, Occupational epidemiology, Temperature

The impact of multiple marginalization on the association between acute exposure to hot summer temperature and reduced childhood cognitive performance

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BACKGROUND AND AIM:Climate change is increasing the number of extremely hot days. Previously, we reported that acute exposure to high temperatures may decrease childhood cognitive performance. However, children who are socially marginalized may be more susceptible to heat than their socially advantaged peers. Here, we extend our prior work to explore how intersecting forms of marginalization may alter susceptibility to heat for child cognitive performance.

METHOD: We linked daily maximum heat indexes from PRISM meteorologic data to cognitive performance data from 4,387 children (age 9-10y) who completed NIH Toolbox neurocognitive assessments (age-normed total cognition score; mean=100.5; sd=17.9) from June-August, 2016-2018, in the Adolescent Brain Cognitive Development Study. We modeled 7-day lagged heat index-cognition relationships using a statistical learning method combining distributed lag models and Bayesian additive regression trees to identify characteristics that induce heterogeneity from a high-dimensional set of potential modifying factors. We considered 4 possible effect modifiers: climate type (5 types) and 3 proxies of marginalization (race / ethnicity, 5 groups; parental education, 5 levels; family income, 4 levels).

RESULTS:439 of 500 possible combinations for climate type, race / ethnicity, family income, and parental education were represented in our data. Effects were largest among non-Hispanic Black children of low family income and low parental education living in a cold climate: each 1C over 30C was associated with a -0.62 (95% credible interval (CI): -1.45, -0.26) unit decrease in total cognition score. Overall, race / ethnicity and parental education appeared as the most salient effect modifiers. For example, among Hispanic children of low-income households in a hot-dry climate, effects of each 1C over 30C were larger among children of lower educated parents (-0.36, 95% CI: -1.15, -0.08) than of higher educated parents (-0.07, 95% CI: -0.95, 0.20).

CONCLUSIONS: Multiple forms of social marginalization may combine in unique ways to alter heat susceptibility among children.

Keywords: climate, temperature, neurodevelopmental outcomes, environmental justice

Epidemiological characteristics of heat-related illness: nationwide data between 2000 and 2018 in Taiwan

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BACKGROUND AND AIM: Heat-related illness (HRI) is expected to occur more frequently and become a prominent issue in the context of global warming and climate change. Previous epidemiological studies of HRI were generally limited to selected populations or specific settings. The objective of this study was to characterize the epidemiological characteristics of HRI in a general population at the national level to fill the data gaps.

METHOD:Using the National Health Insurance Research Database, we identified all HRI patients in Taiwan between 2000 and 2018. We described the epidemiological characteristics of HRI patients and evaluated the differences between the two sexes. In addition, we evaluated the mortality rates of different types of HRI.

RESULTS: We identified 101,614 HRI patients, and male patients constituted the majority (56.2 %). The mean age was 48.2 years, and most of the patients were between 20 and 44 years old (44.8%). In comparison with female patients, male patients were younger (46.4 vs. 50.5 years, p < 0.001) and more likely to receive treatment in hospitals (51.6% vs. 25.3%, p < 0.001). Among HRI, heat stroke was the most common diagnosis and had the highest mortality rate. The 7-day, 1-month, and 3-month mortality rates in heat stroke patients were 0.5%, 0.7% and 1.0%, respectively.

CONCLUSIONS: In Taiwan, patients with HRI are more likely to males and between 20 and 44 years old. Male patients were younger and more likely to receive treatment in hospitals. Heat stroke was the most common HRI and had the highest mortality rate, which calls for establishment of the prevention and treatment strategies.

Keywords: epidemiology, incidence

Heatwaves and renal disease-related mortality during summer seasons in Japan

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BACKGROUND AND AIM: High ambient temperature can trigger renal failure and increase the risk of hospitalization for acute kidney injury based on existing research. However, the impacts of heatwaves remain poorly understood, including Japan. This study examines the association between heatwaves and mortality due to renal diseases in 47 prefectures of Japan during warm seasons (June to September).

METHOD: We collected daily count of mortality for all renal (ICD10: N00-N39), acute renal injury (N17) and chronic renal disease(N18) during 1979-2019. We created six heatwave indicators using a combination of different prefecture-specific temperature thresholds (the 95th, 97.5th and 99th percentile) of mean temperature and duration (2 or 4 consecutive days). We performed a two-stage analysis using a time-stratified case-crossover study design and combined the first-stage prefecture-specific estimates using a meta-analytical approach. Distributed lag nonlinear model was used to investigate the lagged effects of heatwaves. We adjusted for ambient temperature (two-day moving average) to explore an alternative explanation of heatwaves as an added effect.

RESULTS:A total of 300,506 renal deaths were analyzed. Heatwaves were associated with increased risks of mortality for all renal diseases including acute renal injury and chronic renal diseases, with relative risks (RR) that varied by heatwaves definitions and ranged from 1.03 (95% confidence interval [CI] 1.01-1.06) to 1.11 (95% CI 1.00-1.25). When a 10-lag period was considered, these associations disappeared, except for acute renal injury mortality, which remained associated with heatwaves (97.5th percentile and 4 days) after the adjustment of temperature.

CONCLUSIONS: Heatwaves are associated with increased risks of renal disease mortality in Japan including both chronic and acute conditions. Public health interventions should target populations with renal problems to raise their awareness for preventive measures.

Keywords: Temperature extremes, Mortality, Outcome, Environment epidemiology

Acute Effects of Psychosocial Stress and Diesel Exhaust on Cardiovascular Health: Evidence from a Controlled Exposure Facility

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BACKGROUND AND AIM:Traffic-related air pollution exposure, including diesel exhaust (DE), and psychosocial stress are known to independently increase the risk of cardiovascular disease, likely through changes in the sympathetic nervous system and oxidative stress. We conducted a randomized blinded case cross-over trial in a controlled exposure facility where participants were exposed to DE and psychosocial stress simultaneously to measure acute health effects.

METHOD: Eighteen healthy participants 20-49 years old received four separate two-hour exposures randomized to order: two with filtered air (FA), and two with 200 μ g/m3 diesel exhaust (DE). On two of the exposure days, the participants were challenged with the Trier Social Stress Test (TSST) that asked participants to give a short speech in front of trained evaluators and do an arithmetic test quickly and correctly without aids. Exposures were separated by 3-4 weeks. Outcomes of interest included systolic and diastolic blood pressure and complete blood count. Blood pressure was measured before exposure, during exposure (15 minutes, 40 minutes, 60 minutes, 1 hour 50 minutes) and 2.5, 5, 6 and 24 hours after exposure began. Blood samples were collected before exposure, and 2.5, 6, and 24 hours after exposure began. T-tests compared within and between exposure conditions. RESULTS:Average PM2.5 concentrations were 208 μ g/m3. Participants were able to detect filtration status about 57% of the time. Preliminary results suggest a higher systolic blood pressure when exposed to DE with the TSST as opposed to DE alone 1 hr 50 min after exposure. Results for neutrophils and white blood cells were null.

CONCLUSIONS:Our study contributes to the larger body of evidence on acute effects of DE by incorporating psychosocial stress, which has implications for vulnerable populations.

Keywords: Socio-economic factors (non-chemical stressors), Cardiovascular diseases, Toxicology

Impact of air pollution on the incidence of outof-hospital cardiac arrest: a nationwide casecrossover study in South Korea

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BACKGROUND AND AIM: The negative effects of air pollution on health have been established in epidemiological studies. However, there is still a lack of evidence on the association between air pollution and the incidence of out-of-hospital cardiac arrest (OHCA). Therefore, we aimed to evaluate the impact of air pollutants, including CO, NO2, O3, PM10, PM2.5, and SO2, on OHCA occurrence nationwide in South Korea.

METHOD: We used individual-level OHCA data in a study period of 2008–2018 provided by the Korea Disease Control and Prevention Agency. Air pollution data were collected on an hourly basis from the Korea Environment Corporation, then we calculated average concentrations for five air pollutants, and a daily average 8-hour maximum concentration for O3 across 229 districts. Daily averages of temperature and relative humidity are also obtained. District-specific daily air pollution concentrations and meteorological information were linked to each patient (n=220,227) corresponding to the residential district and the date of the OHCA event, as well as a few days before (1 to 3 days) the OHCA occurrence to consider lagged impact. We used a time-stratified case-crossover design to analyze the impact of air pollution on OHCA occurrences. We estimated the odds ratio (OR) per IQR increase of each pollutant level and 95% confidence interval (95% CI) using a conditional logistic regression model.

RESULTS: We found that exposure to CO (OR 1.006, 95% CI 1.000-1.012), O3 (OR 1.016, 95% CI 1.006-1.025), and SO2 (OR 1.006, 95% CI 1.001-1.011) on the same day was related to an increase in OHCA risk and the risks lasted up to three lagged days, with no substantial risk observed on the other air pollutants.

CONCLUSIONS: Exposure to higher concentrations of CO, O3, and SO2 has been associated with an elevated risk of OHCA incidence, along with the lagged impacts observed at least up to 3 days earlier.

Keywords: Air pollution, Short-term exposure, Cardiovascular disease

Long-term Exposure to PM2.5 Species and Cardiovascular Hospital Admissions Among Medicare Beneficiaries 2000-2016

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BACKGROUND AND AIM: The goal of this study was to examine the effects of exposure to PM2.5 species on the risk of first hospitalization with cardiovascular diseases (CVDs).

METHOD: We examined the relationship between long-term exposure to fifteen PM2.5 species; namely: elemental carbon, organic carbon, ammonium, sulfate, nitrate, bromine, calcium, copper, iron, potassium, lead, nickel, silicon, vanadium, and zinc, and rates of first hospital admissions with CVDs in the fee-for-service Medicare population from 2000 to 2016. Our outcomes of interest included all cardiovascular outcomes, as well as specific outcomes such as: myocardial infarction, cerebrovascular infarction, atrial fibrillation and flutter, and congestive heart failure. We used estimates from high-resolution spatiotemporal models aggregated to zip code to assign annual exposure levels. We included demographic and socioeconomic characteristics, seasonal temperature and time trends as covariates in all our models. We used a weighted quantile sum approach to assess this relationship.

RESULTS: RESULTS: Our initial results show that each decile increase in the levels of the PM2.5 mixture increased the rate of hospitalization for all CVDs by 4.3% (95% CI: 4.2%-4.3%). Of the fifteen species included, those with the highest weights in the exposure mixture were sulfate, nickel, zinc, vanadium, and elemental carbon, respectively. Similarly, for MI, the rate of first hospitalization increased by 3.8% (95% CI: 3.7%-3.9%) for each decile increase in the levels of the PM2.5 mixture. The highest weights contributing to MI toxicity were sulfate, nickel, vanadium, lead, and nitrate, respectively.

CONCLUSIONS: The results thus far suggest that exposure to PM2.5 species as a mixture increases the rate of first hospitalization with CVDs. The species with the highest contribution to toxicity found in this study suggest that sources of air pollution such as combustion of coal, oil, and other fossil fuels may be detrimental to cardiovascular health.

Keywords: air pollution, PM2.5 species, cardiovascular disease, mixtures analysis

Long-term exposure to air pollution and incidence of major cardiovascular diseases: a Danish nationwide administrative cohort study

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BACKGROUND AND AIM: The association between long-term exposure to air pollution and ischemic heart disease

and stroke is well established, yet evidence for other major cardiovascular diseases (CVD) remains limited. In a large nationwide cohort, we examined the associations of long-term exposure to low-levels of air pollution with incidence of myocardial infarction (MI), stroke, atrial fibrillation (AF), and heart failure (HF).

METHOD: We followed ca. 3,330,000 subjects aged \geq 30 years and residing in Denmark on 1st of January, 2000, until first-ever hospital contact (inpatient, emergency or outpatient) for MI(ICD-10: I21), ischemic stroke(I63), AF(I48), or HF(I50, I13, I42), death or 31 st December, 2018, whichever came first. Annual residential mean levels of particulate matter with diameter <2.5 µm (PM2.5), nitrogen dioxide (NO2), and black carbon (BC) at baseline were estimated by hybrid landuse regression models developed for ELAPSE (Effects of Low-Level Air Pollution: A Study in Europe) project. We used Cox proportional hazard models to estimate the associations between air pollution and the four CVDs, separately, adjusting for gender, age, and individual and area-level socioeconomic status.

RESULTS:Of total subjects without MI (n=3,015,916), stroke (3,026,984), AF (3,046,321), and HF (3,058,897) in 2000, during mean follow-up of 18 years 134,536, 198,583, 196,556, and 124,956 subjects developed MI, stroke, AF, and HF, respectively. The hazard ratios (HR) (95% confidence intervals) per 5 μ g/m 3 increase in PM 2.5 were 0.98(0.96-1.00) for MI, 1.06(1.05-1.08) for stroke, 1.03(1.02-1.05) for AF, and 1.13 (1.11-1.15) for HF. The HRs per 10 μ g/m 3 increase in NO 2 were 1.00(0.99-1.01) for MI, 1.06(1.05-1.06) for stroke, 1.02(1.01-1.02) for AF, and 1.11(1.10-1.12) for

HF. Results for BC were almost identical to those for NO2.

CONCLUSIONS: In this nationwide study, we found that long-term exposure to low levels of air pollution,

even at low levels, may lead to development of ischemic stroke, AF and HF.

Keywords: Air pollution, long-term exposure, cohort, cardiovascular diseases

OP-275[Air pollution » Particulate matter]

Evaluating Source-Specific PM2.5 Cardiovascular Health Effects from a Natural Experiment Intervention

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BACKGROUND AND AIM:Despite their differing sources and compositions, particulate matter (PM) particles are implicitly assumed to have equivalent toxicity in PM2.5 regulatory activities. As a result, the health benefits from interventions regulating potentially higher toxicity particles, such as from coal-based power and industrial sources, may well be underestimated in present health benefit analyses. By inducing a dramatic source-specific air pollution reduction, the shutdown of the Shenango, Inc. coke plant in Pennsylvania, US, in January 2016 provided an ideal intervention by which to evaluate the source-specific health impacts from a coal-related PM2.5 emission source. METHOD:Air pollution data were obtained from Allegheny County Health Department Air Monitoring Network. Daily cardiovascular emergency department (ED) visit data were from the Pennsylvania Department Health. Quasi-Poisson time-series analyses were applied to the same population 3 years before vs. 3 years after the coke plant closure to assess the associations between daily PM variations and daily cardiovascular ED visits. An interrupted time-series analysis was also applied to assess the change in PM effects after the plant closure.

RESULTS: We confirmed a statistically significant association between PM2.5 mass exposures and increased risk of cardiovascular ED visits before the closure of the coke plant, but after the closure the association became non-significant. The interrupted time series analysis yielded a significant decrease in the central estimate of the PM2.5 mass cardiovascular ED effect after closure, associated with roughly a 20% step decrease in PM2.5 mass. This effect was larger than expected vs. CVD ED risk estimates per μ g/m3 of PM2.5 in general, such as provided in the EPA BenMAP.

CONCLUSIONS:Our study provides evidence that regulating source-specific PM can contribute significant improvements in local cardiovascular health, and that coal-related PM2.5 particles have a larger than average CVD health effect vs. general ambient PM2.5.

Keywords: Cardiovascular diseases, Environmental epidemiology, Public health

In vitro DNA methylome and transcriptome analysis in human alveolar epithelial cells after long-term exposure of diesel exhaust particles

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BACKGROUND AND AIM:Due to the extensive usage of diesel engines in various industries, diesel exhaust particles (DEP) have become one of the factors that have a lifelong impact on the health of citizens. Long-term exposure of DEP can induce airway hyperresponsiveness, lung fibrosis, and inflammation. However, the molecular mechanisms underlying the adverse effects of DEP are poorly understood. It is well known that changes in methylation levels can alter gene expression and affect cellular status, tissue metabolism, and health. Here, we performed *in vitro* experiments to investigate the effect of DEP on DNA methylome after long-term exposure. The results obtained were then compared to changes in transcriptome levels.

METHOD:Human lung epithelial A549 cells were treated in triplicate with medium containing 0, 3, 10, and 30 μ g/ml of DEP for 4 weeks. DNA and RNA were extracted from the cells after 4-week exposure of DEP. Infinium Methylation EPIC arrays (Illumina) and SurePrint G3 Huma GE microarrays (Agilent) were used to analyze DNA methylation levels and gene expression levels, respectively.

RESULTS:A549 cells exposed to DEP for 4 weeks showed a dose-dependent change in methylation levels, with statistically significant changes in cells exposed to 30 μ g/ml of DEP. Integrated analysis of DNA methylome and transcriptome data identified 85 differently methylated CpG sites and 6 differently methylated regions in or near 50 genes with significantly altered expression levels. These genes were significantly enriched for extracellular matrix and epithelial-mesenchymal transition pathways.

CONCLUSIONS: This study is the first to characterize coordinated changes in DNA methylation and gene expression in A549 cells and will provide insight into the mechanism of action of DEP following the long-term exposure.

Keywords: traffic-related, epigenomics, exposure assessment

OP-277[Air pollution » Traffic-related]

Traffic-related air pollution and Parkinson's disease in central California

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BACKGROUND AND AIM: Air pollution exposure may increase the risk of Parkinson's Disease (PD). We assessed associations between long-term traffic-related air pollution exposures and PD in central California.

METHOD: We generated air pollution exposures for 688 PD patients and 851 population controls enrolled in the Parkinson's, Environment and Genes (PEG) studies 1 and 2. First, we estimated annual average carbon monoxide (CO) concentrations between 1981-2016 using the California Line Source Dispersion Model, version 4 (CALINE4) to model local traffic sources and, additionally, fine particulate matter (PM2.5) concentrations between 2000-2016 based on a high-resolution geoscience-derived model. Exposures were assessed as 10-year averaged CO and 5-year averaged PM2.5 prior to a PD diagnosis and a reference date in controls. We used logistic regression models to estimate odds ratios (OR) and 95% confidence intervals (95%CI), adjusting for age, sex, race, education, and study wave. RESULTS:For CO, each interquartile range (IQR) increase in 10-year average exposure prior to diagnosis was found to be associated with an OR of 1.06 (95% CI: 1.01-1.11) for residential and of 1.08 (0.99-1.18) for occupational address-based exposures. A per IQR increase in 5-year average PM2.5 prior to PD also increased the OR for PD at occupational address (OR=1.26; 95% CI 0.96-1.67). Associations were similar for 5- and 15-year exposure averages and were robust to adjustment for smoking or pesticide exposures.

CONCLUSIONS: We found consistent evidence for positive associations between PD and long-term exposure to local traffic-related air pollution in central California measured by CO and PM2.5 at home and workplace addresses.

Keywords: Air pollution, Environmental epidemiology, Long-term exposure, Neurodegenerative outcomes, Traffic-related

Global DNA methylation levels of LINE-1 in patients with leukoplakia and oral cancer

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BACKGROUND AND AIM:In 2016, oral cancer was ranked fifth among all cancers in Taiwan. Oral potentially malignant disorders, such as leukoplakia, have a high risk of malignant transformation. The well-known risk factors of oral cancer included tobacco smoking, alcohol consumption, and betel quid chewing; however, the roles of epigenetic factors (e.g. DNA methylation) in the risk of oral cancer still need to be further explored. This study aimed to compare the LINE-1 methylation levels, a global DNA methylation biomarker, between patients with leukoplakia and oral cancer.

METHOD:A total of 200 subjects (including 100 oral cancer patients and 100 leukoplakia patients) were included in this study. LINE-1 methylation levels were measured by using pyrosequencing methods and represented as percentage. The mean percentage of LINE-1 between patients with leukoplakia and oral cancer was compared by Student's t-test. LINE-1 methylation level was also divided into high and low groups based on the median in leukoplakia patients. The odds ratio (OR) and 95% confidence interval (CI) of high versus low levels of LINE-1 methylation between leukoplakia and oral cancer was analyzed by logistic regression.

RESULTS: The levels of LINE-1 methylation in leukoplakia patients ($0.83\%\pm0.01\%$) was significantly higher than in oral cancer patients ($0.80\%\pm0.02\%$) (P<0.001). Comparing the binary LINE-1 methylation level in leukoplakia patients, oral cancer patients have 2-times risk of low level of LINE-1 methylation (OR=2.00, 95% CI=1.14-3.52, P=0.016). After adjusting for age, alcohol consumption, tobacco smoking, and betel quid chewing in a multivariate logistic regression, the OR increased to 2.14 (95% CI=1.16-3.94, P=0.015).

CONCLUSIONS: The finding suggests that LINE-1 hypomethylation may play a role in the malignant transformation of oral cancer. Further studies including a healthy group and with a large sample size are needed to validate this observation.

Keywords: Oral cancer, Oral potentially malignant disorders, Epigenomics

Thermal and optical carbon fractions for sourcespecific epidemiological studies

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BACKGROUND AND AIM:A recent epidemiological study in New York state (doi: 10.1016/j.envint.2019.02.018) successfully linked increased gasoline engine exhaust PM2.5 source contributions to excess rates of cardiac arrhythmia hospitalizations and increased diesel engine exhaust with increased rates of congestive heart failure hospitalizations. METHOD:This source-specific attribution was made possible by applying the positive matrix factorization (PMF) receptor model to long-term measurements from the U.S. Chemical Speciation

Network (CSN) acquired within the region. Specific use was made of the thermal carbon fractions obtained from the IMPROVE_A protocol (doi: 10.3155/1047-3289.57.9.1014) that produces four well-defined organic carbon (OC) fractions in an inert helium (He) environment (OC1, OC2, OC3, and OC4 evolving at 140, 280, 480, and 580°C, respectively), and three elemental carbon (EC) fractions in an O2/He carrier gas (EC1, EC2, and EC3 at 580, 740, and 840°C, respectively). The higher temperature fractions are more prominent in diesel exhaust.

RESULTS:After 18 October 1, 2018, there was an undocumented change in instrumentation and procedures to implement the IMPROVE_A protocol for CSN samples resulting in inconsistencies in the long-term trends for the carbon fractions. The protocol changes resulted in large shifts in the OC4, OP, and EC2 fractions, thereby precluding further use of the data set in extended health studies. When sample remnants were re-analyzed using the original method, it was found that OC4 concentrations increased and EC2 concentrations decreased by large amounts, thereby biasing the source apportionment and decreasing the utility of CSN data for epidemiological studies. From 2016 to 2018, CSN carbon analysis also included multiwavelength measurements of filter transmittance and reflectance, thereby permitting more specific attribution of biomass burning contributions as indicated by a brown carbon (BrC) fraction derived from these optical absorption measurements. CONCLUSIONS:As the IMPROVE_A carbon fractions are widely used for PM2.5 characterization, it is important to verify their consistency over multiyear periods.

Keywords: Epidemiology, Particle components, Long-term exposure, Traffic-related,

Genome-wide DNA methylation landscape associated with high arsenic exposure

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BACKGROUND AND AIM:Alterations in DNA methylation result in changes in gene expression and lead to the development of a spectrum of human diseases. Numerous environmental stressors have been shown to affect DNA methylation. Furthermore, interplay between DNA methylation and the environment is recognized as an important step in the response to environmental stimuli and the onset of disease. However, little is known about the epigenetic modifications in relation to arsenic exposure.

METHOD:133 salivary DNA samples randomly selected from participants of the Arkansas Rural Community Health (ARCH) study cohort, where more than 26,000 women from all 75 counties in Arkansas contributed saliva samples and answered a short baseline questionnaire. Arsenic levels were quantified using the inductively coupled plasma mass spectrometry (iCAP RQ ICP-MS). DNA samples were processed for bisulfide conversion and genome-wide DNA methylation profiles were conducted using the Illumina Infinium MethylationEPIC 850K array. R package CpGassoc was used to identify probes that are significantly associated with arsenic levels.

RESULTS:Our analysis found that arsenic levels were strongly associated with methylation status. Using the relative beta values, we identified the top 100 probes associated with high (top 15%) salivary arsenic concentrations when compared with low (bottom 85%) concentrations among 133 ARCH participants, with 5 genes hypermethylated and 15 genes hypomethylated including the proapoptotic gene TP53AIP1. When the participants were stratified by breast cancer diagnosis, arsenic levels were significantly higher among breast cancer patents than healthy participants were. CONCLUSIONS:Heavy metals are endocrine disruptors with the ability to induce epigenetic aberration. Here we demonstrated the strong correlation of epigenetic alterations from arsenic exposure. Further study is needed to understand mechanisms underlying those changes to address the environmental heavy metal exposure and high cancer incidence in rural communities.

Keywords: Arsenic, DNA methylation, breast cancer, rural

OP-281[Methods » Environmental epidemiology]

Assessing the Risk of Bias for Epidemiological Studies Evaluating the Association Between Long-Term Exposures to PM2.5 & All-Cause Mortality

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BACKGROUND AND AIM:Risk of bias (RoB) tools are used in systematic reviews of environmental epidemiology to increase the quality of evidence (Eick et al., 2020). This pilot study aimed to determine the comparability and consistency of specific RoB tools.

METHOD: We focused on the World Health Organization (WHO) commissioned systematic review of long-term exposure to PM2.5 and all-cause mortality (Chen et al., 2020). We selected the first 15 references based on the last name of the first author from the alphabetically arranged reference list of included studies. We applied the WHO RoB tool to the selected studies, documenting the rationale for our ratings. We further selected 5 high and 5 low WHO-rated studies, based on the confounding and exposure assessment domains to apply the WHO RoB tool for evaluating the reproducibility of ratings. Finally, we applied the Newcastle Ottawa Scale (NOS) and The Office of Health Assessment and Translation (OHAT) RoB tools to the initially selected 15 studies.

RESULTS: The study demonstrated rating variability due to tool differences and assessor interpretation. For example, for the initial selection of fifteen studies, our study ratings for confounding and exposure assessment domains based on the WHO tool contrasted with the WHO analysis but were largely consistent for other domains. Our ROB ratings were largely in agreement with WHO for studies that were rated as high risk of bias for exposure assessment and confounding. However, studies rated by WHO as low risk of bias frequently differed from our assessment for the exposure assessment domain. Lastly, RoB assessments using NOS and OHAT were in agreement with our RoB ratings but inconsistent with the WHO ratings.

CONCLUSIONS: While a direct comparison of the RoB tools was challenging, the results suggest that differences in the interpretation of evaluation criteria across tools contribute to variability in ratings which may have significant policy implications.

Keywords: Long-term exposure, Particulate matter

Proposing a Potential Mechanistic Link Between Early Life Air Pollution Exposure and Childhood Obesity Risk in Latinos

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BACKGROUND AND AIM: Exposure to ambient air pollution (AAP) is associated with childhood obesity risk, independent of diet or inactivity. The biological mechanisms driving this relationship are not wellunderstood, but AAP exposure has been linked with the gut microbiome. The fecal metabolome may represent a functional readout of gut bacteria, with potential systemic metabolic effects. This study sought to assess the longitudinal relationship between prior month AAP and the fecal metabolome during the first 2 years of life.

METHOD:Participants included 127 Latino mother-infant dyads from the Southern California Mother's Milk Study. AAP indicators, PM10, PM2.5, NO2, were modeled using residential addresses and infant fecal metabolome was profiled via untargeted liquid chromatography with high-resolution mass spectrometry at 1-,6-,12-,18-, and 24-months. Linear mixed effects models estimated the relationship between AAP and logged intensity of fecal metabolites, both for known metabolites identified with level-1 evidence (N=247) and unknown features (N=18,164), adjusting for infant sex, socioeconomic status, study visit season, breastfeeding, and mean AAP from birth-2-years. The Benjamini-Hochberg (BH) procedure was used to adjust for multiple testing using PBH < 0.2. Metapone was used for pathway enrichment analysis.

RESULTS: There were 581 metabolic features associated with PM10, 3 associated with PM2.5, and 122 associated with NO2. 28 known metabolites were associated with PM10 and 18 with NO2. Unidentified metabolic signatures were found to be enriched in pathways including fatty and amino acid metabolism. Known metabolites linked with AAP (e.g., histamine, tryptophan, hypoxanthine, carnitine) were enriched in pathways including amino acid and fatty acid, which have previously been linked with body weight and satiety.

CONCLUSIONS: These findings provide preliminary evidence that AAP may impact the infant fecal metabolome, contributing to the known associations between AAP and childhood obesity. Future work in this cohort will include integrated analyses of the gut microbiome and fecal metabolome and association with childhood obesity risk.

Keywords: Air pollution - Particulate matter, Outcomes - Obesity and metabolic disorders, Omics technology - Metabolomics

OP-283[Air pollution » General]

Air pollution and childhood cancer: Methodological challenges in exposure assessment for epidemiological research

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BACKGROUND AND AIM: Exposure to outdoor air pollution has been associated with different types of childhood cancer but evidence remains inconclusive. The aim of this contribution is to explore and discuss methodological issues related to exposure assessment.

METHOD: We conducted a selective literature review to identify methodological main issues in observational studies on outdoor air pollution and childhood cancer: Exposure metrics, periods of exposure, the complex and multiple nature of exposure.

RESULTS:Different methods of exposure metrics have been employed to assess the effect of airpollutants on childhood cancer. Self-reports to assess exposure has potential for recall bias. Ecological approaches, like the comparison of urban high-polluted areas with rural areas and traffic-related measures only indirectly address the potential for air-pollutants exposure. Monitored concentrations of air-pollutants might induce misclassification, particularly if monitoring stations represents large geographical units. Concerns have arisen for the potential of misclassification of exposure when using mathematical models to estimate exposure. However, misclassification is not expected to produce false positive results but rather influence the association towards the null.

The effects of exposure in different life-stages might be different. Meta-analyses showed generally stronger associations for exposures that happened during the postnatal period compared to the prenatal period. However, other studies showed a role of the period during pregnancy. In order to address this issue complete residential history of persons under study is warranted.

Studies are often based on models, which use exposure to single pollutants and control for other pollutants. However, since populations are simultaneously exposed to a complex mixture of multiple-pollutants, a multiple-pollutant approach is warranted.

CONCLUSIONS: So far, the investigation on air pollution and childhood cancer has brought to results, which still need to be confirmed. Furthermore, several methodological issues have arisen in this field, which require high quality data on exposure.

Keywords: Air pollution, Children's environmental health, Exposure assessment

Inhibitory control mediates the association between perinatal exposure to air pollution and childhood obesity: The PROGRESS cohort study

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BACKGROUND AND AIM:Perinatal exposure to air pollution has been linked to impaired inhibitory control and obesity in children. Evidence also indicates that lower inhibitory control is associated with unhealthy eating behaviors contributing to obesity. We propose that inhibitory control mediates the effect of air pollution on childhood obesity as part of a temporal neuro-program.

METHOD: We assessed children in the longitudinal PROGRESS birth cohort in Mexico City (N = 389) with complete data on the Conner's Kiddie Continuous Performance Test (KCPT) at age 4 to assess inhibitory control; prenatal and postnatal daily PM2.5 and Body mass index (BMI) z-scores and percent body fat (PBF) at mean age 9.7. We use a k-means clustering analysis on KCPT outcomes as our index of poorer inhibitory control, categorizing t-scores of inhibitory control phenotypes as normal, inattentive, and impulsive. We applied a covariate-adjusted multinomial causal mediation analysis to assess the relationship between prenatal and postnatal air pollution (PM2.5) with BMI and PBF and the mediation effect of inhibitory control, estimating the natural total, direct, and indirect (i.e., mediated) effects.

RESULTS:After adjusting for socioeconomic status, child age, and sex, our analysis showed a significant natural indirect effect between postnatal exposure to PM2.5 levels and increased BMI-z score (β =0.1, 95%CI: 0.002-0.23) and PBF (β =3.5, 95%CI: 1.5-5.5). No evidence of mediation by inhibitory control was found for prenatal PM2.5 predicting BMI and PBF.

CONCLUSIONS: Postnatal PM2.5 predicts obesity-related outcomes indirectly through a pathway mediated by poor inhibitory control. Our findings show that prior research on air pollution as a predictor of neurodevelopment and obesity may be connected as a common neurobehavioral pathway.

Keywords: Air Pollution, Inhibitory Control, Childhood Obesity, Mediation Analysis, Childhood Health

Prenatal residential air quality and childhood neurobehavioral diseases - A nationwide birth cohort follow-up approach

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BACKGROUND AND AIM:Air pollution was associated with decreased brain functions. However, representative large prospective follow-up studies with prenatal air quality data are scarce. The aim is to To investigate the incidence of children's prevalent complex diseases and their association with prepregnancy and perinatal exposure to air pollution in a population-based birth cohort across Taiwan METHOD:We utilized the Taiwan Maternal and Child Health Database (TMCHD), linking to the birth registry, and the National Health Insurance Research Database (NHIRD) to establish a birth cohort from the whole island. There were 478,735 singletons born in 2007~2011 and follow-up till 8 years of age to study the neurobehavioral disorder of attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) without major pregnancy complications nor congenital diseases. We integrated the data from 73 stationary air monitors and considered air quality for each child from 8 weeks before conception till birth. We restricted the pediatric psychiatrist's underlying diagnosis for the conditions by the International Classification of Disease 9th and 10th versions for ≥ 3 times or hospitalization \geq once within a year.

RESULTS: The children experienced increased neurobehavioral diseases from the 2nd compared to the 1st Quartile of nitric dioxide (NO2) level (>13 ppb) before birth. Further, the Hazard Ratio (HR) were 1.10 (confidence interval 0.98~1.24), 1.16 (1.01~1.32), and 1.27 (1.10~1.47) for Q2~Q4 for ADHD in girls, adjusted for sex, maternal smoking status, insurance premium, and parental history of ADHD, PM2.5 and urbanization in the Cox's model. The results are similar for ASD to ADHD. There were no significant associations for epilepsy as expected because of its different pathogenesis from neurobehavioral abnormalities.

CONCLUSIONS: The result corresponded to the new WHO guideline of optimized 20 ppb or even lower for NO2 as a surrogate exposure index. Early-life traffic-related air pollution control might be essential for preventing children's ADHD and ASD.

Keywords: Birth cohort, Attention deficit and hyperactivity disorder, Autism spectrum disorder, National health insurance data, Nitrate dioxide

Setting a baseline for human biomonitoring and epigenetic studies of pesticides in Morocco: The PaPOE study

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BACKGROUND AND AIM: In Morocco, due to the lack of education and the presence of a counterfeit and illegal market, pesticides constitute a major problem to be addressed by occupational and environmental health. In fact, growing evidence suggests a link between pesticides exposure and epigenetic changes, including variations in DNA methylation. In this context, the purpose of the PaPOE study is to examine comprehensively whether multi-residue exposure to commonly used pesticides, could induce epigenetic alterations.

METHOD: The PaPOE study is divided into two major phases: a cross-sectional study assessing the occupational exposure among farmworkers and pesticide appliers in Meknes (Morocco), and a birth cohort where pregnant healthy women attending maternity care hospitals in Meknes.

Survey questionnaires have been conducted between 2018 and 2022 to assess pesticide exposures and work practices of the farmers. AChE and BuChE were analyzed in blood. The biomonitoring approach using LC-MS and GC-MS targeted the profiling of 28 pesticides and their metabolites in urine. Oxidative stress biomarkers include GSH and 8-OHdG. Global DNA methylation is performed using LC-MS in blood.

RESULTS:Overall, knowledge was significantly associated with education level and previous training on pesticides use, while health risks were significantly associated with the use of PPE. Pesticides were detected in 77% of samples, with mainly organophosphates and organochlorines. Glutathione and 8-OHdG were significantly associated with pesticides exposure. Global DNA methylation status is altered in the pesticides-exposed population compared to the non or less-exposed group.

CONCLUSIONS:Our study paves the way for a biomonitoring system in Morocco to assess environmental and occupational exposures and to provide insight into the long-term course and potential health consequences of the pesticides exposure.

Keywords: Occupational exposure, Epigenome, Morocco.

Exploring the association between nonoccupational pesticides exposures and metabolomics biomarkers

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BACKGROUND AND AIM: The relationship between pesticide exposures and metabolomics biomarkers is not well understood. We examined the changes in the serum metabolome (early biomarkers) and the metabolic pathways associated with various pesticide exposure scenarios (OPE: overall exposure, PEM: exposure in months, PEY: exposure in years, and PEU: reported specific pesticides use). METHOD: We utilized questionnaire data on pesticide exposures and blood samples for nuclear magnetic resonance (NMR)-based metabolomics analyses from the Northern Finland Birth Cohort 1966 31-year cross-sectional examination. For exposures and metabolites associations, participants size varied between 2361 and 5035. To investigate associations between metabolomics biomarkers and exposure to pesticide scenarios compared to those who reported no exposures multivariable regression analyses stratified for sex and adjustment with covariates (season of pesticide use, socioeconomic position (SEP), alcohol consumption, BMI, and latitude of residence) were performed. Multiple testing by Benjamini–Hochberg false discovery rate (FDR) correction. RESULTS: Pesticide exposures differed by sex, season of pesticide use, alcohol, SEP, latitude of residence. Our results showed that all pesticide exposure scenarios were negatively associated with decreased HDL concentrations across all lipoprotein subclasses in women. OPE, PEY, and PEU were associated with decreased branched-chain amino acid concentrations in men and decreased albumin concentrations in women. OPE, PEY and PEU were also associated with changes in glycolysis metabolites and ketone bodies in both sexes. Specific pesticides exposure was negatively associated with sphingolipids and inflammatory biomarkers in men. In women, OPE, PEM, and PEU were associated with decreased apolipoprotein A1 and increased apolipoprotein B/apolipoprotein A1 ratio. CONCLUSIONS: Our findings suggest that identification of early biomarkers of disease risk related to pesticide exposures can inform strategies to reduce exposure and investigate causal pathways. Women may be more susceptible to non-occupational pesticide exposures when compared to men, and future sex-specific studies are warranted.

Keywords: pesticides, metabolomics, biomarkers of exposure, chemical exposures, cardiovascular

diseases

Evaluating the effectiveness of aerial pesticide application in reducing the risk of pesticide-related diseases

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BACKGROUND AND AIM: The purpose of this study was to evaluate the risk of pesticide-related diseases among pesticide-spraying personnel compared to farmers and to assess the effectiveness of the new method of aerial pesticide application in reducing this risk.

METHOD: This study included all 2,725 pesticide-spraying personnel who passed the national certification examination from 2010 to 2021. To compare their risk of pesticide-related diseases with farmers, we matched them with four times the number of farmer controls of the same age, gender, and enrollment area (n=10,858). The study population was linked to the National Health Insurance Research Database from 2010 to 2020 to track inpatient/ outpatient cases. The target diseases of this study were pesticide-related diseases, including pesticide poisoning (ICD-10 CM: T60), acute liver failure (K72), acute renal failure (N17), asthma (J45, J46), chronic bronchitis (J410, J411, J418, J42), Parkinson's disease (G20, G21)). Logistic regression was used to assess odds ratios and 95% confidence intervals for outcomes.

RESULTS: This study found only a slight increase in the prevalence of pesticide poisoning among pesticide-spraying personnel compared to the farmer controls (25.69 per 100,000 vs. 23.95 per 100,000), but there was no statistical difference between the two groups. To further analyze the effectiveness of different application methods, we compared the risk of disease between aerial pesticide applicators (n=1,001) and ground pesticide applicators (including indoor facility fumigation, outdoor soil fumigation, and seed disinfection) (n=1,724) among pesticide-spraying personnel. After correcting for age, gender, and place of residence, we found that the aerial applicators had a lower risk of asthma (OR=0.30; 95%CI=0.15-0.57) and chronic bronchitis (OR=0.20; 95%CI=0.06-0.66) compared to the ground pesticide applicators.

CONCLUSIONS: This study suggests the aerial pesticide spraying can reduce the risk of asthma and chronic bronchitis in applicators compared to ground application. Field surveys are recommended to verify these potential health risk indicators.

Keywords: Pesticides, Respiratory and allergic outcomes, Aerial pesticide application

Efficacy of electrolyzed water in degrading and hydrolyzing pesticides

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BACKGROUND AND AIM: This study aimed to investigate the efficacy of electrolyzed oxidizing (EO) water and electrolyzed reducing (ER) water in degrading and hydrolyzing diazinon, cyprodinil, and phosmet in aqueous solution. The effect of pH, available chlorine content (ACC), and treatment time of both EO and ER waters were tested. The study also investigated the appropriate methods for pesticide inoculation and washing procedure for grapes.

METHOD:Pesticide extraction was carried out using Quechers method and the remained pesticides were determined by an ultra-performance liquid chromatography with tandem mass detector. RESULTS:EO water at pH 2.80 was significantly (P < 0.05) more effective than at pH 5.00 and 6.00 in degrading diazinon, cyprodinil, and phosmet. Higher ACC and longer treatment time also enhanced the reduction of the tested pesticides. ER water, however, was only shown to be effective in hydrolyzing phosmet (99.7% reduction), slightly effective in reducing diazinon (7.4% reduction), and ineffective on cyprodinil (0.0% reduction).

CONCLUSIONS: The oxidizing power of free chlorine in EO water may be the main reason for its effectiveness in degrading pesticides. The difference in the tested pesticides chemical structure may play an important role in determining the sensitivity of each pesticide against EO and ER water treatment. Soaking grapes in 12 mg/L mixed pesticide solution for 10 min was found to be the most consistent method for pesticide inoculation. A 500 ml of EO water combined with 100 rpm shaking was found to be the best condition to wash 200 g grapes.

Keywords: electrolyzed water, diazinon, cyprodinil, phosmet, chlorine

Associations of air pollution with risks of decline of kidney function: An analysis of mediation by diabetes mellitus

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BACKGROUND AND AIM: Studies on the effect of air pollution on the decline of kidney function are still limited. Furthermore, whether diabetes mellitus plays a mediating role in the associations between air pollution and the decline of kidney function remains unclear. We aimed to create an assessment model investigating the associations between air pollution and the decline of kidney function and to investigate whether diabetes mellitus acts as a mediator between air pollution and kidney function progression.

METHOD: We recruited 83,349 adults as participants who received health check-up at MJ clinic from 2010 to 2017. Participants with an eGFR decline≧30% from baseline were defined as having progression of kidney function decline. Allowing a latent period of 3 years, land use regression (LUR) models were used to estimate participant's exposures to air pollutions including PM2.5, PM10, CO, O3, NO2, and SO2. Mediation analyses for progression of kidney function decline risk were performed using logistic regression models. Generalized additive models (GAM) were used to estimate the associations between exposures and the kidney function progression.

RESULTS:In all, 641 (0.8%) participants were found to experience kidney function decline progression during a median follow-up of 2.5 years. The direct effect of PM2.5, PM10, and SO2 was associated with an increased risk of kidney function decline progression, independent of diabetes mellitus. A mediation analysis clarified that diabetes mellitus only explained 2%~5% of the associations of air pollution exposures with the decline of kidney function. GAM also showed exposure-response relationships of PM2.5 and PM10 with kidney function decline progression.

CONCLUSIONS: This study demonstrated a significant associations of renal function decline progression and PM2.5, PM10, and SO2 exposures, but not CO, O3, and NO2, in the past 3 years. On the other hand, diabetes mellitus contributed little to mediate the relationships between air pollutants and renal function decline progression.

Keywords: air pollution, reduced renal function, estimated Glomerular Filtration Rate (eGFR), causal mediation analysis, cohort study

Ambient air pollution exposure and incidence of cataract surgery: the prospective 3City-Alienor study

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BACKGROUND AND AIM: Cataract is the leading cause of blindness worldwide. It is a multifactorial disease, involving oxidative stress mechanisms. The aim of our study was to investigate the relationship between air pollution exposure and incidence of cataract surgery.

METHOD: The 3C-Alienor study is a population-based cohort of residents of Bordeaux, France, aged 65 years or more, recruited in 1999-2000 and followed every 2-3 years until 2017. Cataract surgery was self-reported and checked at slit-lamp. Air pollution exposures (particulate matter <= 2.5 microns (PM2.5), black carbon (BC), nitrogen dioxide (NO2)) during the 10 years preceding the inclusion were estimated at the participants' geocoded residential address using Land-Use Regressions models. Associations of air pollution exposure with incidence of cataract were estimated using Cox proportional hazard models adjusted for age as the time-scale, sex, deprivation index, corticosteroid use, asthma, diabetes, hypertension, body mass index, ultraviolet exposure, smoking status.

RESULTS: The study included 829 subjects without prior cataract surgery; the mean age at inclusion was 72.6 years (Standard deviation (SD): 4.2) and 61% were women. The median (Interquartile-range (IQR)) [Minimum-maximum] follow-up duration was 7.7 years (5.8) [0.01-17.3] during which 507 participants underwent cataract surgery. The 10-year median (IQR) of average of NO2 concentrations was 34.1 µg/m3 (7.5) with range from 25.6 to 73.3 µg/m3. Participants exposed to a concentration \geq 40 µg/m3, which corresponds to the current regulatory limit value in Europe, had a 50% increased risk of incident cataract surgery during follow-up compared to those exposed to <40 µg/m3 (HR=1.50, CI (1.19, 1.90), p<0.001). No statistically significant association was found between PM2.5 or BC and the risk of cataract surgery.

CONCLUSIONS: Exposure to a NO2 concentration $\geq 40 \ \mu g/m3$ was associated with a 50% increased risk of cataract. Although this regulatory limit value has been ratified since 2008 in Europe, it is still not achieved in several cities.

Keywords: Environmental epidemiology, Incidence, Oxides of nitrogen, Particulate matter

Short-term exposure to ultrafine particles and children's hospital admissions in Copenhagen, Denmark

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BACKGROUND AND AIM:Ultrafine particles (UFP; particulate matter <100 nm in diameter) may be more harmful to human health than larger particles, but epidemiological evidence on their health effects is still limited. Short-term exposure to UFP may trigger morbidity from respiratory diseases, potentially even more so among children. In this study, we examined the association between shortterm exposure to UFP and children's hospital admissions, and possible modification of this association by socio-economic status, age and sex in Copenhagen, Denmark.

METHOD: Daily levels of UFP (particle number concentration in a size range 11-700 nm) and meteorological factors were monitored at an urban background station in central Copenhagen during 2002-2018. Daily counts of hospital contacts (outpatient and inpatient) from respiratory diseases among children (<14 years) in Copenhagen were obtained from Danish health registers. Hospital admissions associated with interquartile range (IQR) increases in UFP exposure for up to six days preceding the admission were examined in a case-crossover study design. Odds ratios (OR) with 95% confidence intervals (CI) were estimated after adjusting for temperature and relative humidity. Additionally, we analyzed the associations for different sex, age and disposable family income groups. RESULTS: We observed 126,156 hospital admissions between 2002 and 2018. Hospital admissions due to respiratory diseases were significantly associated with IOR increases in two-day moving averages of UFP (OR: 1.04 [95% CI: 1.00, 1.07]). Among the specific causes, the strongest associations were found for asthma hospital admissions and five-day moving averages of UFP (1.18 [1.06, 1.31]). Associations were highest among boys, younger children, and those in the lowest income group. CONCLUSIONS: We find that short-term exposure to UFP can trigger respiratory diseases in children, with strongest associations with asthma. We also find that boys, youngest children, and children from families in lowest income groups are most susceptible.

Keywords: Respiratory outcomes, Asthma, Children's environmental health

Long-term exposure to air pollution and dementia incidence among elderly individuals of a Danish nationwide administrative cohort

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BACKGROUND AND AIM: Evidence on the association between air pollution and dementia is growing, but it remains mixed for pollutants other than fine particulate matter (PM2.5). Furthermore, only a few studies examined vulnerability by socioeconomic status (SES). Here we aimed to evaluate associations between long-term exposure to air pollutants and dementia incidence and to investigate whether SES modifies this association.

METHOD: We followed all inhabitants in Denmark aged ≥ 60 years on 1-Jan-2000 (N=934,767) until 31-Dec-2018. Incident dementia was defined as the first dementia hospital contact or a prescription of anti-dementia drugs during the follow-up, whichever came first. Annual mean PM_{2.5}, nitrogen dioxide (NO₂), and black carbon (BC) levels at baseline addresses were estimated by hybrid land-use regression models. We used Cox proportional hazard models to estimate associations, adjusting for demographic and socioeconomic factors, smoking status, and obesity. We considered household income, education level, and employment status as potential effect modifiers.

RESULTS:During the mean follow-up of 11.6 years, 81,728 subjects developed dementia. We detected associations with all 3 pollutants, with hazard ratios (HR) (95% confidence intervals) of 1.41 (1.35, 1.48) per 5 μ g/m³ for PM_{2.5}, 1.23 (1.21, 1.27) per 10 μ g/m³ for NO₂, and 1.22 (1.19, 1.24) per 0.5×10⁻⁵/m for BC. Additionally, we found that individuals with lower household incomes and those unemployed at baseline had a higher risk of developing dementia than those with higher incomes or employment. For instance, HRs per 5 μ g/m³ for PM_{2.5} were 1.56 (1.50, 1.62) for the lowest income quintile and 1.21 (1.13, 1.29) for the highest, and the corresponding HRs were 1.45 (1.41, 1.48) for the unemployed and 1.22 (1.14, 1.31) for the employed.

CONCLUSIONS: This nationwide study provides strong evidence of a link between long-term exposure to air pollution and an increased risk of dementia in older people, with those in lower SES groups being the most vulnerable.

Keywords: neurodegenerative outcomes, Incidence, Environmental epidemiology, socio-economic

OP-296[Exposure assessment methods » Risk assessment]

Estimation of Health Risks Caused by Metals Contained in E-cigarette Aerosol through Passive Vaping

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BACKGROUND AND AIM: It is expected that secondary exposure to e-cigarette aerosol (passive vaping) will soon become an issue of public health. Passive vaping inhales e-cigarette aerosol containing similar harmful substances as active vaping. However, parallel studies on passive vaping are minimal. Therefore, there is a need for passive vaping-related health risk studies to assess the impact of vaping on public health.

METHOD: This research conducted a series of experiments in a test room using a puffing machine and the Mobile Aerosol Lung Deposition Apparatus (MALDA) to study e-cigarette aerosol respiratory deposition caused by passive vaping. The experimental data acquired were then applied to estimate the deposited mass and health risks caused by toxic metals contained in e-cigarette aerosol. Five popular e-cigarette products were used in this study to generate e-cigarette aerosol for respiratory deposition experiments. Besides, size-segregated e-cigarette aerosol samples were collected, and the metal compositions in the e-cigarette aerosol were carefully analyzed by the ICP/MS technique. RESULTS:No potential non-cancer health risk was found under the passive vaping exposure scenarios studied. However, cancer risks caused by chromium (Cr VI) contained in e-cigarette aerosol revealed an unacceptable risk ranging from 1.3x10-6 to 4.3x10-6, slightly higher than the generally acceptable lifetime excess cancer risk (10-6).

CONCLUSIONS: Based on the data acquired, it is the e-cigarette aerosol concentration inhaled by the passive vaper that determines the respiratory deposited mass and the daily dose of metals contained in e-cigarette aerosol and then causes related health risks. Therefore, by using a suitable ventilation rate to dilute the e-cigarette aerosol in the room and by applying enough distance between the active and passive vapers, the e-cigarette aerosol concentration inhaled by the passive vaper could be drastically decreased. In this way, health risks caused by toxic metals contained in the e-cigarette aerosol could be reduced.

Keywords: E-cigarette aerosol, Passive vaping, Respiratory deposition, Health risk

The Associations of Exposure to Ambient PM2.5 with Hypertension, Diabetes and Multimorbidity among Floating Population in China

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BACKGROUND AND AIM: Studies on the relationships between air pollution exposure and chronic disease multimorbidity were inconclusive and showed scarce evidence of floating people from China. In this context, we examined the associations of exposure to ambient PM2.5 with diabetes, hypertension, and multimorbidity among the floating population.

METHOD: The study used the China Migrants Dynamic Survey data in 2017, including information on socio-demographic characteristics, PM2.5, temperature, humidity and other related meteorological data. The multivariable logistic regression models were performed to examine the association between PM2.5 and chronic diseases in the floating population after adjusting for covariates. Stratified analyses were also performed to identify whether the association varied across subgroups.

RESULTS: Overall, every 10 μ g/m3 increment in annual average PM2.5 was associated with increased odds of hypertension (OR=1.053, 95%CI: 1.018-1.087) and multimorbidity (OR=1.099, 95%CI: 1.006-1.201) in the floating population in China. The results suggested that there was no significant association between ambient PM2.5 and diabetes. The stratified analysis showed that there was a high health risk of PM2.5 in males, older adults, low education status and people living in the western region of China.

CONCLUSIONS: This study suggests that PM2.5 exposure was associated with an increased risk of hypertension and multimorbidity in the floating population, particularly among older people and residents in western China. Air pollution reduction strategies should be considered by policymakers for improving the migrants' health status.

Keywords: Air pollution, Hypertension, Diabetes, Multimorbidity, Floating population
Understanding Age-Specific Mortality Impacts Associated with Wildland Fires: An Assessment for the Continental United States, 2005-2018

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BACKGROUND AND AIM:Climate change and other related factors have contributed to an increase in catastrophic wildfires. As wildfire disasters continue to increase in the United States, the use of planned burning (e.g., prescribed burning) to reduce wildfire risk has also increased. Wildland fire smoke, which is a combination of both wildfires and planned burning activities, poses a significant threat to air quality and public health.

METHOD: We analyzed a county-level, daily time series of all-cause mortality and environmental variables in the continental United States, for years 2005 – 2018. A conditional quasi-Poisson regression with strata by county, year, month, and day of the week was used to estimate the relative risk (RR) and 95% confidence interval (CI) of mortality associated with smoke-related fine particulate matter (smoke-PM) and ozone (smoke-O3) concentrations. The modelling framework controlled for non-fire related air pollutants and other relevant risk factors, and estimated overall cumulative RRs [CI] for age groups over a 1-day lag period.

RESULTS:Deaths associated with smoke exposure can be observed across all regions in the continental United States. A 10 μ g/m3 and a 10 ppb increase in smoke-PM and smoke-O3, respectively, were significantly associated with mortality for age groups, between 0-65 (RR [95% CI]smoke-PM:1.009 [1.006, 1.012]; RR[95% CI]smoke-O3: 1.004 [1.002, 1.007]) and >= 65 (RR [95% CI]smoke-PM: 1.010 [1.008, 1.012]; RR [95% CI]smoke-O3: 1.002 [1.000, 1.004]). Across age groups, a total of 3,179 (95% CI: 2,645 - 3,686) and 1,012 (95% CI: 531 - 1,548) deaths were attributable to smoke-PM and smoke-O3 exposures each year, respectively; most of these smoke-attributable deaths were observed among adults aged 65 and over.

CONCLUSIONS: From a public health perspective, quantifying smoke-related mortality impacts by sensitive subgroups, such as older adults, could shed light on interventions that are population-specific and help reduce air quality and health impacts associated with wildland fires.

Keywords: Wildland fires, Mortality, Air Pollution, Climate Change

Personal Exposure Monitoring During Wildfire Smoke Events

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BACKGROUND AND AIM: Wildfire events have become more prevalent in the Pacific Northwest in recent years and regional PM2.5 concentrations may not reflect personal exposures. METHOD: Twenty-six wearable particle sensors were deployed among a convenience sample of volunteers during a 2022 wildfire impacted period Seattle for personal, indoor, and outdoor PM2.5 measurements. We corrected wearable sensor measurements with nephelometer colocation and EPA correction factors. We compared our findings to hourly Puget Sound Clean Air Agency (PSCAA) regional PM2.5 concentrations and used linear regression to assess relationships between calibrated personal, indoor, outdoor, and hourly regional concentrations.

RESULTS: Findings indicated higher outdoor than indoor or personal PM2.5 concentrations as well as a significant correlation between personal and indoor exposure levels. Results showed around two-fold higher regional PM2.5 concentration compared to the personal and indoor concentrations. While there were differences in outdoor sensor concentrations by site, overall, these differences were relatively similar to the regional PSCAA PM2.5 concentrations.

CONCLUSIONS: Findings from the wearable particle sensors suggested that regional concentrations do not fully capture the variations in personal individual exposures, which tended to be lower than regional outdoor concentrations, and were more correlated with indoor concentrations. Findings support public health guidance to shelter indoors during wildfire smoke events.

Keywords: Air pollution, Exposure, Exposure assessment, Particulate matter, Wildfires

Prenatal exposure to wildfire smoke and pregnancy loss in Colorado, USA

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BACKGROUND AND AIM: Wildfires—which are expected to be larger and more intense due to climate change—pose a threat to human health. Although past studies have shown that exposure to wildfire smoke (WFS) may be associated with adverse birth outcomes, its association with pregnancy loss has been understudied. We examined the association between prenatal WFS exposure and pregnancy loss in Colorado, USA.

METHOD: We retrieved all birth records from the 17 "front range" counties of Colorado, containing 84% of the Colorado population, from 2007-2018 (n=614,321). We considered WFS exposure from two products: 1) overall PM2.5 from the Community Multiscale Air Quality Modeling System downscaling files and 2) wildfire-specific PM2.5 from a novel machine learning model. For both, we calculated daily average county-level exposure by taking a population-weighted average of censustract level estimates. We fitted distributed lag quasi-Poisson models for each WFS exposure separately, adjusting for temperature and time trends, to estimate their associations with live-birth identified conceptions (LBICs), from which we can infer about WFS-pregnancy loss associations. RESULTS: Average weekly number of LBICs was 1095 (standard deviation [SD]: 63). Average weekly overall and wildfire-specific PM2.5 was 6.4 µg/m3 (SD: 6.4) and 0.3 µg/m3 (SD: 1.1), respectively. Both WFS exposures were associated with fewer LBICs (i.e., more pregnancy loss). The cumulative risk ratio (RR) for a 1-µg/m3 higher overall PM2.5 sustained throughout pregnancy was 0.981 (95% CI: 0.973, 0.989). Although the cumulative association for wildfire-specific PM2.5 was null, gestational weeks 6-13 appeared to be a critical exposure window. The cumulative RR for a 1-ug/m3 higher wildfire-specific PM2.5 sustained throughout weeks 6-13 was 0.994 (95% CI: 0.990, 0.999). CONCLUSIONS: Our findings suggest that higher WFS exposure was associated with more pregnancy loss and adds to the growing literature on the harmful effects of wildfires.

FUNDING: National Institute of Environmental Health Sciences R01 ES029943.

Keywords: air pollution, wildfires, particulate matter, pregnancy outcomes

Exposure to wildfire related PM2.5 and site specific cancer mortality in Brazil from 2010 to 2016: A retrospective study

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BACKGROUND AND AIM:Long-term exposure to fine particles less than 2.5 micrometres in diameter (PM2.5) has been linked to cancer mortality. However, the effect of wildfire related PM2.5 exposure on cancer mortality risk was unknown. This study evaluates the association between wildfire related PM2.5 and site specific cancer mortality in Brazil, from 2010 to 2016.³³

METHOD:Nation-wide cancer death records were collected during 2010-2016 from Brazilian Mortality Information System. Death records were linked with municipal level wildfire and non-wildfire related PM2.5 concentrations, at a 2.0° latitude by 2.5° longitude resolution. We applied a variant difference in difference approach with quasi-Poisson regression, adjusting for seasonal temperature and gross domestic product (GDP) per capital. Relative risks (RRs) and 95% confidence intervals (CIs) for the exposure on specific cancer sites were estimated. Attributable fractions and cancer deaths were also calculated.

RESULTS:In total 1,332,526 adult cancer deaths (age \geq 20), from 5,565 Brazilian municipalities, covering 136 million adults were included. The annual wildfire related PM2.5 concentration was 2.38 µg/m3 and the non-wildfire related PM2.5 was 8.20 µg/m3. The RR for mortality from all cancers was 1.02 (95% CI: 1.01-1.03), per 1 µg/m3 increase of wildfire related PM2.5 concentration, which was higher than non-wildfire related PM2.5 (1.01, [1.00-1.01]). Wildfire related PM2.5 was associated with mortality from cancers of the nasopharynx (1.10, [1.04-1.16]), oesophagus (1.05, [1.01-1.08]), stomach (1.03, [1.01-1.06]), colon-rectum (1.08, [1.05-1.11]), larynx (1.06, [1.02-1.11]), skin (1.06, [1.00-1.12]), breast (1.04, [1.01-1.06]), prostate (1.03, [1.01-1.06]) and testis (1.10, [1.03-1.17]). For all-cancers combined, the attributable deaths were 37 per 100,000 population and ranged from 18/100,000 in Northeast of Brazil, to 71/100,000 in Central West.

CONCLUSIONS: Exposure to wildfire related PM2.5 can increase the risks of cancer mortality at many sites and the effect for wildfire related PM2.5 was higher than non-wildfire sources.

Keywords: Mortality, Cancer and cancer precursors, Wildfires

OP-302[Climate » Natural disasters]

The Association between Wildfire and Emergency Department (ED) Visits for Anxiety Disorders in the Western United States

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BACKGROUND AND AIM: Wildfire is a growing threat to the global economy and public health. However, little is known about whether wildfire smoke PM2.5 is associated with mental health outcomes, especially anxiety disorders. Therefore, we aimed to examine the association between wildfire smoke PM2.5 and emergency department (ED) visits for anxiety disorders in the Western United States (WUS).

METHOD: We used a case-crossover design for the present study. Records of ED visits were obtained from five different WUS states, including Arizona, California, Nevada, Oregon, and Utah. Anxiety disorders were defined as ICD-10 codes F40-F48. Exposure to wildfire smoke PM2.5 and background PM2.5 was evaluated with an ensemble learning method. We used a conditional logistic regression to evaluate the association between wildfire smoke PM2.5 and ED visits for anxiety disorders. RESULTS: A total of 1,898,023 cases from 2007-2018 were included in this study. We found that per 10 μ g/m3 increase in wildfire smoke PM2.5 was associated with an 0.6% (OR = 1.006 [1.001,1.012], p = 0.029) increase in the risk of ED visits for anxiety disorders. Age- and sex-stratified analysis showed that females (OR per 10 μ g/m3 = 1.012 [1.002,1.021], p = 0.020) and the elderly population (OR per 10 μ g/m³ = 1.035 [1.017, 1.054], p < 0.001) were more vulnerable to wildfire smoke PM2.5 regarding anxiety disorders. Additionally, an extreme smoke event (defined as smoke PM2.5 contributed to >= 75% of the total PM2.5 in the past 48 hours) was also associated with an increase in the risk of ED visits for anxiety disorders (OR = 1.063 [1.015, 1.113], p = 0.009). CONCLUSIONS: We found that exposure to wildfire smoke PM2.5 and smoke events were both associated with an increased risk of ED visits for anxiety disorders. Females as well as the elderly population were more susceptible to wildfire smoke PM2.5 regarding anxiety disorders.

Keywords: wildfires, Mental health outcomes, Environmental epidemiology

Wildfire exposure and academic performance in Brazil: a causal inference approach for spatiotemporal data

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BACKGROUND AND AIM: To estimate the effect of wildfire exposure on academic performance of high school students in Brazil between 2009 and 2015.

METHOD: We obtained data on academic performance from the High School National Exam, which was divided into the following subjects: natural sciences, social sciences, mathematics, Portuguese language, and essay writing. Wildfire data were provided by the National Institute of Spatial Research of Brazil, which were then aggregated to estimate the spatial density of wildfires in each municipality of Brazil. Low and high levels of wildfire exposure were defined based on the first and third sample quartiles of the municipalities-specific wildfire densities, respectively. We estimated the average causal effect (ACE) comparing low and high levels of wildfire exposure on academic performance using spatially varying regression models which adjust for potential confounders. We also performed subgroup analyses to investigate how these effects change over time.

RESULTS:Data from 8,183 high schools across 1,571 municipalities in Brazil were included in our analyses. We estimated that the average performance in most academic subjects decreased as the density of wildfires increased (e.g., a decrease of 9.43 points in the natural sciences (p-value = 0.02)), although the average performance in essay writing increased. In the subgroup analyses, we found that the ACE estimates became more negative over time. For instance, in the subgroup analysis comparing data before and including 2012 to data after 2012, the ACE estimates decreased in all academic subjects, ranging from 13.70 points (p-value = 0.04) in the natural sciences to 36.83 points (p-value = 0.02) in essay writing. Similar trends were observed in the subgroup analyses with other cutoff years.

CONCLUSIONS:Our results suggest that exposure to wildfires may worsen performance in most academic subjects and that such effects are becoming increasingly pronounced.

Keywords: children's environmental health, causal inference, spatial statistics

Wildfires are becoming a major contributor to population exposure to PM2.5 pollution in the Continental United States

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BACKGROUND AND AIM:As the frequency and intensity of wildfires increase in a warming climate, fire smoke has emerged as a critical contributor to ambient air pollution and its associated health risks. METHOD:To better understand the impact of wildfire smoke on air quality, we developed a modeling system to estimate daily PM2.5 concentrations attributed to both fire smoke and non-smoke sources across the Continental US.

RESULTS:We found that wildfire smoke has the most significant on air quality in the West Coast, followed by the Southeastern US. Between 2007 and 2018, fire smoke affected daily PM2.5 concentrations at 40% of all regulatory air monitors in EPA's Air Quality System (AQS) for more than one month each year. People residing outside the vicinity of an EPA AQS monitor were subject to 36% more smoke impact days compared to those residing nearby. This underscores the importance of satellite- and model-based air quality assessment tools with wider spatial coverage to ensure a more comprehensive understanding of PM2.5 levels nationwide. Lowering the national ambient air quality standard (NAAQS) for annual mean PM2.5 concentrations to between 9 and 10ug/m3 would result in approximately 29% to 40% of the AQS monitors falling in nonattainment areas without taking into account the effect of fire smoke. When fire smoke impact is considered, this percentage would rise to 35% to 49%, demonstrating the significant negative impact of wildfires on air quality. CONCLUSIONS:Our study highlights the growing threat of wildfires to air quality and public health in the Continental United States.

Keywords: Wildfires, Exposure assessment, Modeling, Climate

Ambient variation of fine particulate matter associated with asthma treatment

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BACKGROUND AND AIM: This study was to examine associations of daily averages and daily variations in ambient relative humidity (RH), temperature, and fine particulate matter (PM_{2.5}) on asthma treatment.

METHOD:A cross-sectional study was conducted on 288 asthma patients recruited from hospitals in Taipei between July 2018 and December 2020. The radial basis function method was used to spatially estimate meteorological and PM_{2.5} data of each case location. Logistic regression was used to examine the odds ratio (OR) of outcome variables (daily mean or difference in PM_{2.5}, RH, and temperature for 1, 7, and 30 days) with asthma treatment defined by GINA guideline. Two-factor logistic regression models were conducted to further examine the OR of PM_{2.5} with the daily mean or difference in humidity or temperature with the asthma treatment.

RESULTS:We observed associations of mean PM_{2.5} and RH with respective increases of 0.047 and 0.053 step 4 use in 1-day difference and 1-month difference. PM_{2.5} and RH were associated with the respective increases of 0.052 and 0.047 medium ICS+LABA use in 1-day difference and 1-month difference. An increase in daily PM_{2.5} difference of 1 μ g/m³ increased 0.115 step 4 treatment use. A daily RH increase of 1% increased the step 2 treatment use by 0.180, whereas a daily increase in the temperature of 1°C increased the step 3 treatment use by 0.408. In addition, a daily decrease in the temperature of 1°C decreased the step 4 treatment use and medium ICS+LABA treatment use by 0.336 and 0.353, respectively. The two-factor model confirmed the most robust associations of ambient PM_{2.5} with the asthma treatment.

CONCLUSIONS: Short-term ambient variations in PM2.5, RH, and temperature were associated with changes in the treatment of asthma patients. Minimizing exposure to high levels of ambient PM2.5, RH, and temperature could have a positive impact on asthma management.

Keywords: air pollution, asthma, climate, particulate matter, temperature

Association between respiratory tract deposited inhaled dose of PM0.25-10 mass-count and airway inflammation based on individual exposure assessment

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BACKGROUND AND AIM: Short-term exposure of particulate matter mass and count could be related to airway inflammation for children.

This research is to find different risk level of airway inflammation by size-segregated PM from 0.25 um to 10.0 um.

METHOD: Based on individual exposure assessment, PM mass and count were monitored for 5 consecutive days against 51 children.

Baseline information including exposure factors related airway inflammation was surveyed. Real-time portable monitoring device able to detect both mass and count over size from 0.25 um to 10 um was utilized.

The PM sizes were classified into six categories: PM0.25-10.0, PM0.25-4.0, PM0.25-2.5, PM0.25-1.0, PM0.25-0.5, PM0.25-0.25.

FeNO was measured two times day (early morning and late evening) under the standardized procedures by the American Thoracic Society.

All participants were adjusted accelerometer device in order to consider physical activity level. Deposition fraction of particle in each respiratory region (ET: Extrathoracic, TB: Tracheobronchial, AV: Alveolor) was calculated by using dosimetry model (MPPD v3.04 by ARA. US).

Dose was calculated with concentration of PM mass and count by size, inhalation rate from accelerometer, and deposition fraction from dosimetry model.

We applied distributed non-linear lag model and linear mixed-model to evaluate the FeNO and PM mass-count association.

RESULTS: Different relative risk level and dose-response relations was observed in different PM masscount sizes.

Risk was higher when PM size was smaller.

Different dose-response between PM mass and count in same respiratory regions was detected.

Also different dose-response over PM sizes in same respiratory regions was detected.

Risk patterns were different in different respiratory region for same PM size

CONCLUSIONS:Our study showed clear risk pattern of FeNO by PM mass and count over sizes and by respiratory tract.

Small size of PM is more vulnerable than Big size of PM.

Particle count shows more risk than PM mass.

Keywords: PM mass-count, FeNO, Dose, Risk

Long-term exposure to air pollution and the risk of obstructive lung disease in a Danish nationwide administrative cohort

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BACKGROUND AND AIM: Air pollution has been associated with obstructinve lung disease in adults, including asthma and chronic obstructive pulmonary diseases (COPD). However, the evidence is still mixed, and the definition of the incidence of these outcomes varies across studies. Therfore, we aimed to explore associations of long-term exposure to air pollution with asthma and COPD incidence in adults and a joint outcome defined by medication use for obstructive airway disease.

METHOD:All residents in Denmark aged \geq 30 years (3,074,599) were followed for their first hospital contact for asthma or COPD and the prescribed medication for obstructive respiratory diseases from 1-Jan-2000 until 31-Dec-2018. Annual residential mean levels of fine particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), and black carbon (BC) at baseline addresses were estimated by hybrid land-use regression models. We used Cox proportional hazard models, adjusting for potential confounders, to assess the associations.

RESULTS:During mean follow-up of 16 years, we identified 52,648 and 146,269 individuals with incident asthma and COPD from hospitalization records, respectively, and 419,203 individuals from the prescribed medication for obstructive airway disease. We observed that a 5 μ g/m³, 10 μ g/m³, and 0.5×10⁻⁵/m increase in PM_{2.5}, NO₂, and BC, respectively, were associated with higher risks of asthma incidence [hazard ratio: 1.30 (95% confidence interval: 1.23, 1.38); 1.17 (1.14, 1.19); 1.18 (1.15, 1.21)], COPD incidence [1.11 (1.07, 1.16); 1.06 (1.05, 1.08); 1.08 (1.06, 1.09)], and medication use [1.04, (1.01, 1.06); 1.05 (1.04, 1.06); 1.03 (1.02, 1.05)].

CONCLUSIONS:Long-term exposure to air pollution were strongly associated with asthma and COPD incidence defined by hospital contact and weakly with the joint outcome defined by medication use in the Dnaish nationwide analysis.

Keywords: Asthma, incidence, Respiratory outcome

Long-term exposure to air pollution and risk of hospital admissions for obstructive lung disease among older English people

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BACKGROUND AND AIM: Air pollution is the established risk factor for adverse respiratory health outcomes, yet its effect on hospital admission for obstructive lung disease, especially for the elderly, remains unclear. We aimed to examine the associations of incident obstructive lung disease with long-term exposure to fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2).

METHOD: We followed 6,343 respondents (aged > 50 years) from the English Longitudinal Study of Ageing (ELSA), from the time of study interview in wave 5 (2010-2011) to 31-1-2018 for hospital admission for obstructive lung disease. Incident obstructive lung disease was defined as the first hospital contact for chronic obstructive pulmonary disease or asthma between baseline and 2018. Annual mean levels of residential exposure to PM_{2.5} and NO₂ were assessed by the Data Integration Model for Air Quality at 0.1°×0.1° spatial resolution during the follow-up. We examined the associations with time-varying Cox proportional hazards models adjusting for potential confounders. We also examined effect modifications by socioeconomic status (SES) and urbanicity. RESULTS:During the mean follow-up of 6.3 years, 340 incident obstructive lung disease cases were detected. We observed the suggestive association between incident obstructive lung disease and PM2.5 with a hazard ratio (HR) (95% confidence interval) of 1.18 (0.85-1.64), per 5 μ g/m³, not with NO₂ (HR: 0.99, 0.87-1.12). We did not observe effect medication by SES, while increased associations were detected in rural area for both pollutants [HR (95% CI) for rural vs urban area: 1.24 (0.63-2.43)

vs 1.15 (0.80-1.66) per 5 μ g/m³ for PM_{2.5}, respectively; 1.27 (0.90-1.80) vs 0.91 (0.78-1.07) per 10 μ g/m³ for NO₂, respectively]. CONCLUSIONS:This study suggests that long-term exposure to PM_{2.5}, or NO₂ in rural area, may lead

to incident chronic lung disease in the elderly, and that the risk may be higher in rural area. Future studies for elucidating what drive this difference is needed.

Keywords: Respiratory outcomes, Environmental epidemiology

Investigating links between long-term air pollution exposure and SARS-CoV-2 infection, hospitalisation and mortality:a meta-analysis of cohort studies

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BACKGROUND AND AIM: Exposure to air pollution has harmful effects on respiratory health. However, it was unclear after the COVID-19 pandemic, whether air pollution increases the chance of catching COVID-19 or worsens health outcomes such as mortality after being infected. A plethora of studies has been published, but they vary widely in quality and content. We conducted a systematic review and meta-analysis to synthesize the current evidence available concerning exposure to PM_{2.5}, PM10, NO₂, and O₃ and risk of SARS-CoV-2 infection, hospitalisation, and mortality, focusing on cohort studies with individual-level information.

METHOD: We systematically searched EMBASE, Medline, Scopus and Web of Science. Studies retrieved were screened with inclusion and exclusion criteria set a priori. Relevant data was extracted, and study quality was assessed using the WHO Air Quality Guidelines Risk of Bias Evaluation tool. Effect estimates were scaled to per 1μ g/m³ increment and converted to odds ratios (OR). Pooled ORs were calculated using random-effect meta-analysis for the respective pollutant-outcome pairs.

RESULTS:12 studies were included in the meta-analysis. A 1µg/m³ increase in PM_{2.5} exposure was associated with a higher risk of SARS-CoV-2 infection (OR = 1.06, 95% Confidence Interval: 1.01 – 1.11) and hospitalisation (1.08, (0.99 - 1.17)). A 1µg/m³ increase in NO₂ exposure was associated with a higher risk of SARS-CoV-2 mortality (1.01, (1.00 – 1.01)). O₃ exposure was not significantly associated with the SARS-CoV-2 outcomes investigated. An insufficient number of studies were available to meta-analyse the relationship between NO₂ exposure and risk of SARS-CoV-2 mortality, and O₃ exposure and risk of SARS-CoV-2 hospitalisation among SARS-CoV-2 positive individuals. CONCLUSIONS:Higher previous exposures to PM_{2.5} and, to a lesser extent, NO₂, were associated with higher risk of SARS-CoV-2 infection and hospitalisation. Long-term exposure to these pollutants may increase the vulnerability of populations to SARS-CoV-2 infection and severity. More studies are needed to confirm the associations found.

Keywords: COVID-19, Outcomes

OP-310[Respiratory and allergic outcomes » Respiratory outcomes]

Effects of climate-mediated PM2.5 on lung function decline in chronic obstructive pulmonary disease

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BACKGROUND AND AIM: This study aims to examine the mediating effects of short-term exposure to fine particulate matter (PM2.5) on the associations of climate with lung function among chronic obstructive pulmonary disease (COPD) patients.

METHOD:A cross-sectional study was conducted among 930 COPD patients in three hospitals in Taiwan. Exacerbation history, modified Medical Research Council dyspnea scale, and COPD Assessment Test score were measured to categorize different groups of COPD patients (A, B, E) based on the Global Initiative for COPD guideline. Lung function was linked to the daily mean or difference for 1, 7, and 30 days of individual-level exposure to relative humidity (RH), temperature, and PM2.5. A mediation analysis was conducted to examine the mediating effects of PM2.5 on the associations of daily mean or difference for RH and temperature with lung function.

RESULTS:We observed that a 1oC decrease in mean temperature for 1 day was associated with a 0.21% decrease in FEV1/FVC and 0.29% in FEV1 among group A COPD patients. A decrease in the 1-day RH difference of 1% was associated with a 0.91% decrease in FEV1, and a 0.92% decrease in FVC among group B COPD patients, while an increase in the 7-day RH difference of 1% was associated with a 0.95% increase in FVC among group B COPD patients. A 1 μ g/m3 increase in mean PM2.5 for 1 day, 7 days, and 30 days were associated with 0.61%, 0.55%, and 0.56% decreases in FEV1 and were associated with 0.69%, 0.67%, and 0.69% in FVC among group B COPD patients, respectively. The association of RH difference with FEV1 among group B COPD patients was partially mediated by PM2.5.

CONCLUSIONS: Climate-mediated PM2.5 increases the risk of lung function declines among COPD patients. The study highlights the importance of climate variability associated with air pollution in the health outcomes of COPD patients.

Keywords: Climate, Environmental epidemiology, Particulate matter, Respiratory outcomes, Short-term exposure

OP-311[Outcomes » Mortality]

Mortality trends of chronic obstructive pulmonary disease in South Korea, 1995–2021 using joinpoint regression analysis

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BACKGROUND AND AIM: Chronic obstructive pulmonary disease (COPD) is the third leading cause of death in worldwide. Regional differences in COPD mortality trends exist, but studies on Asian countries are insufficient. We aimed to analyze COPD mortality trends by sex and age from 1995 to 2021 in South Korea.

METHOD: This study obtained COPD deaths between 1995 and 2021 from the Korean Statistics Information Service (KOSIS), using the International Classification of Diseases 10 (ICD-10) codes J40 (bronchitis), J41-42 (chronic bronchitis), J43 (emphysema), J44 (other COPD), and J47 (bronchiectasis). Using the world standard population, we estimated COPD age-standardized mortality rates (ASR), and executed a joinpoint regression analysis.

RESULTS:ASR per 100,000 population decreased from 8.12 to 3.84 between 1995 and 2021. It showed some fluctuation for the study period. ASR was high increased from 7.50 to 15.68 between 1998 and 2002, after that it steadily reduced from 15.68 to 3.84. Further stratifying sex, ASR per 100,000 has decreased from 13.43 to 7.24, from 5.23 to 1.72 in male and female for the study period, respectively. It was found that the gender gap in COPD mortality was narrowing. CONCLUSIONS:We found an upward trend from 1998 to 2002 and downward trend from 2002 to 2021 of COPD mortality in South Korea. A gap of mortality by sex has been narrowed and it was supposed to be smoking rate change. We found similar pattern of the trends that concentration of particulate matter $\leq 10 \ \mu$ m increased 1998-2002 and decreased 2002-2012 in Seoul. COPD mortality trends could be considered as making policy related to smoking cessation and particulate matter reduction.

Keywords: COPD, Mortality, Particulate matter

Hepatitis C Virus Antibody Positivity Strongly Associated with Prevalent Asthma

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BACKGROUND AND AIM:Although asthma prevalence in Taiwan is only around 3.54%, it is one of the primary sources of health concern. In addition, hepatitis has long been regarded as one of the most prominent diseases in Taiwan, with 17.3% of the population being carriers of hepatitis B virus (HBV) infection, and an estimated 4.4% prevalence of hepatitis C virus (HCV) infection. However, studies that investigate potential association between asthma and hepatitis are lacking. We aimed to investigate the relationship between hepatitis and asthma among the Taiwanese adult population. METHOD:This study analyzed the data of 122,071 subjects aged between 30 to 70 years old in Taiwan Biobank, with information of asthma status, socioeconomics and lifestyle factors obtained via questionnaire and hepatitis and antibody measurements obtained from physical examination results. Demographic analyses of both diseases were first carried out, then calculations of odds ratio (OR) and 95% confidence intervals (CI) were made to evaluate association between asthma and hepatitis. A logistic regression model was used with adjustment for potential confounders. All statistical analyses were performed via the SAS 9.4 software.

RESULTS: The results showed that the two diseases had differing demographic distributions. It was also found that while HBV infection had a significant association with asthma (OR=1.237, 95% CI=1.082-1.393, P=0.0015), HCV positivity had a stronger significant association with asthma (OR=1.379, 95% CI=1.145-1.66, P=0.0007). Increased risk of asthma was particularly more strengthened in subjects infected with HCV alone, with OR=1.519 (95% CI=1.078-2.140, P=0.0168), compared to non-hepatitis subjects.

CONCLUSIONS: The study's findings offer more insight into the relationship between hepatitis and asthma and suggests that asthma and HCV may be closely linked. This prompts a strong recommendation for future studies to explore the underlying mechanisms that bring about such a relationship.

Keywords: Asthma, Hepatitis

The relationship between reproductive hormones and asthma-related outcomes in boys residing in the rural Western Cape

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BACKGROUND AND AIM:Asthma is more prevalent and severe among boys but this pattern reverses after puberty. It has been suggested that reproductive hormones may play a role in explaining these sex differences after puberty, but the evidence is still limited especially for children living in low- and middle-income countries. This study investigated the association between reproductive hormones and asthma-related outcomes among boys residing in a rural setting.

METHOD:A cross-sectional study of 314 boys (9-16 years), residing in the rural Western Cape province of South Africa was conducted. General questionnaires were administered to the boys and their caregivers including an abbreviated International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. Testosterone (TST and FT), luteinizing hormone (LH), serum folliclestimulating hormone (FSH), oestradiol and serum hormone-binding globulin (SHBG), were assessed using electrochemiluminescence immunoassays. Multivariate logistic regression models were used to assess the relationship between asthma and measured endocrines levels.

RESULTS: The mean age of the boys was 11.2 (Standard deviation -1.7 years). Current wheeze (CW), asthma symptom score \geq 2 (ASS) and parental reported asthma (PA) prevalence were 6.1%, 6.7% and 8.0%, respectively. In the adjusted multivariate logistic regression models, total serum testosterone (TST) levels were negatively associated with CW (OR=0.66, 95% CI: 0.45-0.98), ASS (OR=0.64, 95% CI: 0.43-0.95) and PA (OR=0.86, 95% CI: 0.59-1.25). Free testosterone (FT) levels were similarly negatively associated with all three asthma-related outcomes. Similar associations were also found for LH and FSH, but there were no clear associations for estradiol and SHBG with asthma-related outcomes. The concentration-response curves confirmed that higher levels of testosterone (TST and FT) were associated with reduced risk of asthma-related outcomes.

CONCLUSIONS: This study provides evidence that increasing testosterone levels are associated with reduced asthma risk among rural boys in South Africa.

Keywords: Male, reproductive outcomes, children's environmental health,

Long-term exposure to ambient ozone and lung function decline over 20 years in adults: The ECRHS study

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BACKGROUND AND AIM: Short-term exposure to ambient ozone consistently shows adverse effects on lung function in children and adults. However, little is known whether long-term exposure also has detrimental effects on lung function.

We explored the association between long-term exposure to ozone and lung function decline over 20 years in 3014 adults from 17 centers in 8 countries participating in the population-based cohort of the European Community Respiratory Health Survey (ECRHS).

METHOD:Pre-bronchodilation forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) were measured by spirometry when participants were 25–44, 30–55, and 40–64 years old. Annual mean values of daily maximum running 8-hour average ozone concentrations were assigned to the individual residential addresses at each lung function measurement. Co-pollutants (PM2.5 and NO2) and greenness (Normalized Difference Vegetation Index, NDVI) were also considered for adjustment. Associations between rate of lung function decline and ozone concentrations were analyzed by adjusted linear mixed effects regression models.

RESULTS: Mean ambient ozone concentrations were around 65 μ g/m³. An increase by an interquartile range of 7 μ g/m³ ozone concentration was associated with a faster decline in FEV1 by -2.08 mL/year (95% confidence interval: -2.79, -1.36) and in FVC by -2.86 mL/year (-3.73, -1.99) mL/year. Associations were robust across different models, including adjustments for co-exposure to PM2.5, NO2, and NDVI. They were more pronounced in residents of northern Europe and those with higher education or older. No consistent associations were detected with the FEV1/FVC ratio.

CONCLUSIONS:Long-term exposure to elevated ambient ozone concentrations was associated with a faster decline of spirometric lung function over 20 years in middle-aged European adults.

Nevertheless, further studies in other regions with other populations and exposure levels are needed to substantiate the associations identified in this study.

Keywords: Long-term exposure; Green space; Respiratory outcomes; Environmental epidemiology

Association between smoke haze and respiratory clinic visits in Central Kalimantan

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BACKGROUND AND AIM: Smoke haze due to vegetation fires is one of the major air pollution issues in Southeast Asia. Exposures of the residing populations to the smoke haze may pose health impacts, but such evidence from the Southeast Asia remains scarce. In this study, we examined the association between smoke haze and respiratory clinic visits in Central Kalimantan. Specifically, we investigated whether duration and intensity modify the association.

METHOD: The study period spanned from July 7th, 2015 to December 31st, 2019, with different date range for each clinic depending on data availability. We applied a time-stratified case-crossover design, adjusting with smoothing spline on three-days moving average of temperature and indicator variable of holidays. PM10 was estimated using a combination of ground-measured, Himawari-8 satellite, albedo, and visibility data. Fire hotspot counts derived from fire radiative power (FRP) information was used to define haze, duration of continuous haze days, and intensity of haze days, in combination with PM10 concentration. Haze day was defined if PM10 $\geq 100\mu g/m^3$ and FRP >0. Duration indicators were defined as at least one- and three- continuous haze days over the past seven days. Intensity of low and high were distinguished by: "low" (PM10 $\geq 100\mu g/m^3$ and 0<fire hotspot ≤ 10 (50th-percentile of fire hotspot in whole region), and "high" (PM10 $\geq 100\mu g/m^3$ and fire hotspot ≥ 10 .

RESULTS:Overall, we found weak evidence for smoke haze effects on respiratory clinic visits in Central Kalimantan, although a few significant higher risks were observed at specific lags in some clinics. CONCLUSIONS:This study further discussed the possibility of associations near the null, and the role of duration and intensity in estimating health risks of smoke haze.

Keywords: wildfires, respiratory, Southeast Asia

Ambient air pollution in relation to ovarian reserve and oocyte quality in young, healthy oocyte donors

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BACKGROUND AND AIM: Our objective was to evaluate the effects of air pollution on ovarian reserve and outcomes of ovarian stimulation among young, healthy females.

METHOD:We included 184 oocyte donors who underwent 244 ovarian stimulation cycles at a fertility clinic in Atlanta, Georgia, USA (2006-2011). Daily ambient exposure to nitric oxide (NOx), carbon monoxide (CO), and particulate matter <2.5 (PM2.5) was estimated using a fused regional+line-source model for near-surface releases at a 250 m resolution based on residential address. Antral follicle count (AFC) was assessed with transvaginal ultrasonography and mature oocyte count was assessed following oocyte retrieval. Poisson regression models with robust standard errors were used to estimate the associations of each air pollutant with AFC and oocyte count adjusted for age, race, BMI, smoking, education, year, and season.

RESULTS:The median (interquartile range, IQR) age among oocyte donors was 26.0 (4.0) years and 25% were racial/ethnic minorities. The median (IQR) exposure to NOx, CO, and PM2.5 in the 3 months prior to stimulation was 40.6 (29.2) ppb, 699.2 (364.4) ppb, and 12.2 (3.0) μ g/m3, respectively. Air pollution in the 3 months prior to ovarian stimulation was not associated with AFC. Higher exposure to PM2.5 (but not NOx or CO) during ovarian stimulation (8-13 days) was associated with significantly fewer mature oocytes retrieved (% change: -10.5, 95% CI -19.5, -0.5 per IQR increase). When modelled using cubic splines, there was a strong, negative association between PM2.5 and AFC up to 14 μ g/m (the 75th percentile), with no additional decrements with higher PM2.5 exposures (p-value for non-linearity <0.001).

CONCLUSIONS: In our cohort of young, healthy women, higher exposure to PM2.5 was associated with poorer response to ovarian stimulation. Future work will investigate whether there are additional impacts of PM2.5 on embryo and clinical outcomes following the use of these vitrified donor oocytes by recipient couples.

Keywords: air pollution, fertility, ovary, fecundity

Diminished association of acute exposure to ambient pollutants and preterm premature rupture of membranes risk with the usage of facemasks

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BACKGROUND AND AIM: Maternal exposure to ambient air pollutants has been shown to be associated with a variety of adverse perinatal outcomes, including preterm premature rupture of membranes (PPROM). Face masks are regarded as a common personal-level intervention to reduce ambient air pollutant exposure. The usage of face masks has become prevalent since the outbreak of COVID-19. This study was designed to explore the association of the usage of face masks with acute exposure to ambient pollutants and PPROM risk.

METHOD:Pregnant women receiving antenatal care at hospitals were enrolled. Women who delivered between January 2020 and December 2021 were included in the group with face mask usage, while those who delivered outside that period were included in the group without face mask usage. The effects of ambient pollutants on PPROM risk were estimated using generalized additive models (GAMs). Exposure-response relationship curves were also evaluated using GAMs after adjustment for confounding factors. Potential lagged effects were examined using distributed lag nonlinear models. RESULTS:During the period from October 2013 to December 2019 without face mask usage, an increased risk of PPROM was associated with increased concentrations of PM2.5, PM10, SO2, CO and NO2 on lag day 2, while no association was found during the period from January 2020 to December 2021 with face mask usage after the outbreak of COVID-19. After adjustment for confounding factors, the exposure-response curves did not indicate positive associations between PPROM risk and PM2.5, PM10, SO2, and CO exposure during the period with face mask usage; however, positive associations were indicated during the period without face mask usage.

CONCLUSIONS: Acute exposure to six critical air pollutants was associated with an increased risk of PPROM. The usage of face masks may reduce the impact of air pollution exposure on PPROM risk.

Keywords: acute exposure, ambient pollutants, preterm premature rupture of membranes, face masks

Antioxidant Consumption as an Effect Modifier in the Association Between Air Pollution Exposure and Preterm Birth

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BACKGROUND AND AIM: Exposure to particulate matter likely contributes to risk of preterm delivery among pregnant women due to increased oxidative stress and systemic inflammation. Consumption of antioxidants during pregnancy may help to reduce these effects, and ultimately reduce the risk of preterm delivery. We calculated dietary antioxidant intake during pregnancy to evaluate individual and joint associations of prenatal antioxidant intake and exposure to fine particulate air pollution (PM2.5) with preterm delivery.

METHOD:Data were from the Pregnancy Research on Inflammation, Nutrition, and City Environment: Systematic Analyses (PRINCESA) cohort in Mexico City; participants were enrolled and followed from 2009-2015. Antioxidant intake was assessed through a food frequency questionnaire based on food servings per week and PM2.5 exposure was estimated using geostatistically kriged data from the Mexico City Atmospheric Monitoring System. Adjusted Cox proportional hazards models were used to evaluate the associations between trimester-specific and entire pregnancy PM2.5 exposure and preterm birth and to assess effect modification by antioxidant intake.

RESULTS: Mean antioxidant consumption did not differ by preterm birth status among 817 participants. After adjusting for mother's age, prepregnancy body mass index, education, parity, marital status, secondhand smoke, and infection, PM2.5 exposure was not associated with preterm birth (for any point during pregnancy). The hazard ratios and 95% confidence intervals (CI) for first, second, third trimester and overall exposure to PM2.5 were 0.98 (0.92, 1.04), 1.05 (0.98, 1.12) and 0.95 (0.90, 1.00), and 0.97 (0.84, 1.12), respectively. Considering interaction between PM2.5 and dietary antioxidant index did not affect this null association.

CONCLUSIONS: Although no association between PM2.5 exposure and preterm birth was observed in this sample, other research suggests that pollutants may impact the risk of adverse birth outcomes in pregnant women. Future studies should explore the effects of additional pollutants on the risk of preterm delivery as well as their interaction with dietary antioxidant intake.

Keywords: Particulate matter, Birth outcomes, Food/nutrition

OP-319[Exposures » Water quality]

Nitrate contamination in drinking water and the risk of preterm birth: Overview of a national retrospective cohort study

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BACKGROUND AND AIM:OBJECTIVES: To provide an overview of a large national retrospective birth cohort assessing the relationship between nitrate contamination in drinking water and preterm birth. To provide an opportunity for collaboration using a powerful individual-level database of routinely collected government information called the Integrated Data Infrastructure (IDI) in New Zealand. METHOD:METHODS: We have established a national birth cohort of all babies born 2009-2021 (13 years) (~700,000 births) identified in the IDI. The IDI is a database of routinely collected information (health, tax, crime, census, housing, social services) linked at the individual-level using probabilistic matching that can be used for public good research in New Zealand.

RESULTS: RESULTS: We have an established retrospective cohort of births between 2009-2021 which provide opportunities to investigate the impact of environmental exposures. Our project is currently collating drinking water data from the 67 territorial authorities responsible for drinking water service provision in New Zealand. Future research is anticipated to look at the relationship between nitrate and other birth outcomes including congenital abnormalities, and bowel cancer.

CONCLUSIONS: CONCLUSION: The IDI is a powerful national scale database with the capacity to answer research questions related to environmental epidemiology. Nitrate exposure is one aspect of water quality that will be first investigated, but future studies could investigate a broader range of water quality contaminants. This research is funded by the Health Research Council of New Zealand (HRC#22-059).

Keywords: water quality, birth outcomes, public health, methodological study design, environmental epidemiology.

Associations of early pregnancy air pollution with adverse birth outcomes and infant neurocognitive development

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BACKGROUND AND AIM: This study aimed to investigate the associations of traffic-related air pollution exposures in early pregnancy with birth outcomes and infant neurocognitive development in the Complex Lipids in Mothers and Babies (CLIMB) cohort in Chongqing, China.

METHOD:1,273 pregnant women enrolled in 2015-2016 and 1,174 births were included in this analysis. Air pollution concentrations at their home addresses, including particulate matter (PM) with diameter $\leq 2.5 \mu m$ (PM2.) and nitrogen dioxide (NO2), during pre-conception and each trimester period (TI, T2, T3) were estimated using land-use regression models. Mental and psychomotor development functions were assessed using the Mental Development Index (MDI) and the Psychomotor Development Index (PDI) of the Bayley Scales of Infant Development (BSID) at 12 months of age. The associations of exposure to air pollution in each time window, with birth and neurodevelopment outcomes were estimated by linear and logistic regression models, adjusted for maternal age, infant sex, maternal body mass index (BMI), parity, monthly household income level, and season of births. RESULTS: Median PM2.5 exposure levels were 57.31 µg/m3 (IQR: 5.76) and median NO2 exposure levels were 50.46 µg/m3 (IQR: 5.51) during the whole pregnancy period. An association between small for gestational age (SGA) and per IQR increases in NO2 was found during the whole pregnancy (OR: 1.34, 95% CI: 1.01, 1.77) and in T1 (OR: 1.58, 95% CI: 1.07, 2.34) in fully-adjusted model. PM2.5 exposure in the 90 days prior to conception was associated with lower PDI score (β : -6.06, 95% CI: -8.77, -3.34). NO2 was associated with lower PDI in all pregnancy periods, except T2. These effects were stronger in the two-pollutant models.

CONCLUSIONS: Air pollution pre- and during pregnancy were associated with increased risk of SGA and infants' neurocognitive development. Pre-conception PM2.5 exposure was associated with adverse neurodevelopment outcomes at 12 months of age only.

Keywords: Particulate matter, Oxides of nitrogen, Neurodevelopmental outcomes, Children's

environmental health,

Relationship of Long Working Hours and Early Chronic Kidney Disease: A Retrospective Cohort Study in Taiwan

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BACKGROUND AND AIM: The relationship between long working hours and early chronic kidney disease (CKD) is still unclear. We aimed to evaluate the association between long working hours and estimated glomerular filtration rate (eGFR) among healthcare workers.

METHOD: We conducted a retrospective cohort study among healthcare workers in a tertiary medical center in Taiwan from 2002 to 2021. All hospital employees aged 20-65, except for physicians, who lack of records of working hours, were eligible. We excluded participants with eGFR <60 ml/min/1.73 m2 at enrollment to focus on early CKD. The total working hours in each year were collected. We compared the baseline characteristic among tertiles of total working hours in the enrolling year. We assessed the relationship between total working hours and eGFR using the generalized linear mixed model (GLMM), adjusting for demographic and laboratory profiles.

RESULTS: The study included 10117 participants with the mean age of 26.7 years (standard deviation 7.1), 88.9% were females. The median follow-up was 4 years (interquartile range 2 to 9 years). For every 10-hour increase in weekly working hours, the eGFR decreased by -1.59 (-2.13, -1.06). Increases in age, diastolic blood pressure, glucose, uric acid, and male sex were all associated with lower eGFR. Comparing with the effect of age, the effect of 10-hour increase in weekly working hours are nearly twice of that of every 2-year increase in age.

CONCLUSIONS:Long working hours were associated with lower eGFR. Regulation of working hours could be one way to halt the progression to early chronic kidney disease.

Keywords: long working hours, chronic kidney disease, lower glomerular filtration rate

The effect of hypoxia on salivary α-amylase in flight cadets

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BACKGROUND AND AIM:Pilots frequently encounter low-oxygen environments due to the demands of their profession. In-flight, hypoxia is recognized as a stressor that impairs human performance and jeopardizes flight safety. Research has indicated that salivary a-amylase levels are positively correlated with blood norepinephrine, which increases under conditions of stress. Accordingly, the objective of this study was to investigate the fluctuation of salivary a-amylase levels before and after exposure to hypoxia.

METHOD: This study was conducted in October 2022 at the Aviation Physiology Research Laboratory in Taiwan, recruiting flight cadets from the Air Force Academy attending hypoxia awareness training. The hypobaric chamber Contract 540 (Guardite Inc., Chicago, IL) was used during the training, and saliva samples were taken before and after the training to measure a-amylase levels with a Nipro CM-21 salivary a-amylase monitor. The time of useful consciousness (TUC) at 25,000 feet was also recorded during the training, and all data was analyzed using SPSS 24.0 software.

RESULTS:Twenty-two participants (20 males, 2 females) aged 22-24 years old were studied. The mean time of TUC at 25,000 feet was 3.6 ± 0.9 minutes. Results indicated that the a-amylase value significantly increased after training (before: 14.8 ± 8.6 kIU/L; after: 21.2 ± 14.6 kIU/L, p value = 0.036). However, no correlation between a-amylase and TUC was observed during the training. CONCLUSIONS:Our findings suggest that hypoxia exposure can elevate a-amylase levels in flight cadets. This could be a potential factor for understanding physiological responses to in-flight hypoxia. Nevertheless, the small sample size and the inability to exclude demographic factors and lifestyle habits limit the generalizability of the results. Further research with larger sample sizes and more detailed information is needed to clarify the relationship between a-amylase and TUC and the effect of altitude.

Keywords: hypoxia, a-amylase, pilot, flight

Kidney Function Affected by Heat Stress and Pesticide Exposure in Migrant Farmworkers

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BACKGROUND AND AIM: The risk factors of Chronic Kidney Disease of Undetermined Etiology (CKDu) are not fully understood; however, several factors, such as pesticides and heat exposure, have been proposed to explain the pattern of this disease. Llittle is known about the impact of short-term exposure to heat/pesticides in intense work-environmental conditions on kidney functioning. METHOD: We recruited 72 male migrant farmworkers in a large-scale grape farm. To determine kidney functioning during the pre-harvest and late-harvest season, urine and serum were collected and analyzed for several biomarkers. The estimated glomerular filtration rate (eGFR) was calculated from serum creatinine. The association between heat stress was measured using the Physiological Strain Index (PSI), which was calculated from participants' ear temperature and heart rate at rest and during their working activities. Several urinary pesticide biomarkers, including those for organophosphates and pyrethroids, were analyzed to evaluate a possible association between pesticides and kidney function. Linear mixed model regressions were built with eGFR as the dependent variable, while PSI and pesticide biomarkers were the main predictors after adjusting for demographic-occupational factors.

RESULTS:We found that for a 1% increment in their PSI, a significant decrease of eGFR of 19.14 mL/min/1.73 m2 (95% CI: -26.92, -11.36) was observed. Regarding the exposure to pyrethroid pesticides, we determine a significant decline of eGFR 3.10 mL/min/1.73 m2 (95% CI: -5.13, -0.98) and 4.17 mL/min/1.73 m2 (95% CI: -7.5, -0.81) for every 1% increment of the urinary 3-phenoxybenzoic acid and 4-fluoro-3-phenoxybenzoic acid, respectively. Also, for every 1% increase in the urinary organophosphate marker of chlorpyrifos, a significant eGFR decline of 2.97 mL/min/1.73 m2 (95% CI: -5.54, -0.40) was observed.

CONCLUSIONS:Our results indicated that heat stress in combination with pesticides can affect kidney function. This study provided a better understanding of the association between environmental risk factors and kidney functioning in migrant farm workers.

Keywords: Kidney function, pesticide exposure, heat stress, farmworkers

Combined effects of occupational physical activity and ambient heat on kidney function in female harvest workers in Southern Spain

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BACKGROUND AND AIM: Heat stress (HS) due to physical activity in high temperatures has been shown to reduce kidney function in sport settings. We studied the association between occupational physical activity and ambient temperatures with kidney function throughout one work shift in female harvest workers.

METHOD:Physical activity was measured in vector magnitude units (VMU) and heart rate (HR) in women picking berries in greenhouses. We calculated the mean (VMU_mean; HR_mean), standard deviation (VMU_sd; HR_sd), and 3-minute-maximum (VMU_max; HR_max) for those variables. HS in greenhouses was estimated using wet bulb globe temperature (WGBT). Pre-post-shift differences in serum creatinine (scr_dif), urinary neutrophil gelatinase associated lipocalin (NGAL_dif) and Cystatin C (Cystatin C_dif) were measured. Acute Kidney Injury (AKI) was defined as a post-shift increase in serum creatinine ≥ 0.3 mg/dl or ≥ 1.5 times the pre-shift levels. We used linear and logistic regressions adjusted for age, body mass index, and HS.

RESULTS:At an average WBGT of 25.2 $(\pm 3.6)^{\circ}$ C, 67 of 90 women experienced HS, 61 were dehydrated, and 6 women's serum creatinine changes were consistent with the definition of AKI. Women with and without AKI had a scr_dif of 0.33 (± 0.10) vs. 0.04 (± 0.13)mg/dl, a NGAL_dif of 27.85 (± 18.39) vs 12.02 (± 24.91)ug/l, and a Cystatin C_dif of 0.00 (± 0.02) vs.0.03 (± 0.07)mg/l.

Results pointed towards a positive association between VMU_sd and AKI (OR: 1.57 (95% CI: 0.82; 3.21, p-value = 0.2)), NGAL (β : 2.2 (95% CI: -2.5; 6.9, p-value = 0.4) per 100 VMU_sd increases), and Cystatin C (β : 0.90 (95% CI: -0.80, 2,7; p-value = 0.3 per 100 VMU_sd increases). CONCLUSIONS:Whether positive associations between VMU_sd and all kidney markers are indicative of kidney injury remains unclear. The lack of increase in Cystatin C suggests that increased creatinine levels post-shift are not explained by a reduction in renal filtration. However, the increase detected in NGAL levels warrants further research.

Keywords: Temperature; Occupational exposures; agricultural productivity; occupational epidemiology, renal health

Occupational and Sociodemographic Factors Influencing Pregnant Women's Awareness and Knowledge of the New York City Pregnant Workers Fairness Act

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BACKGROUND AND AIM:Although the New York City (NYC) Pregnant Workers Fairness Act (PWFA) was enacted in 2014 to provide greater flexibility for pregnant workers' accommodations, no studies to date have evaluated effectiveness of PWFA from employees' perspectives. We examined occupational and sociodemographic factors associated with pregnant workers' PWFA awareness and knowledge in a female working population with lower socioeconomic status in NYC.

METHOD:Analyses included 481 pregnant workers attending prenatal visits at Mount Sinai Hospital Obstetrics and Gynecology clinics between January–September 2017. Detailed occupational and sociodemographic data were collected via in-person interviews. Information on PWFA awareness, knowledge, and benefits received was also ascertained. Multivariable-adjusted logistic regressions were used to identify the factors associated with PWFA awareness and benefits received. Zero-inflated Poisson regressions assessed the relationships with knowledge of benefits. Covariates considered include age, race/ethnicity, education, marital status, and manager status.

RESULTS:Participants were primarily black and/or Hispanic (84%) with low household income (<\$30,000, 64%); 86% reported never heard of PWFA, 8% were informed of PWFA by employers, and 6% learned about PWFA from other sources. Higher education level (>12 years) was associated with increased PWFA awareness (OR=1.80, 95% CI=1.03–3.17). Those unsure about or with no maternity leave policy at workplace had lower PWFA awareness than others (p=0.05). Regardless of PFWA awareness, unpaid maternity leave policy was associated with higher risk of having no knowledge of eligible pregnancy-related benefits (β =5.56, p<0.01 vs. paid policy). Women working ≥5 years at their job were more likely to receive time off after childbirth than those working <5 years (OR=5.82, 95% CI=2.88–11.77).

CONCLUSIONS: Education level, workplace maternity leave policy, and job tenure were associated with PWFA awareness and/or benefits received. As more women continue to work during pregnancy, interventions targeted at promoting PWFA awareness and knowledge may be particularly important for protecting pregnant women and their children's well-being.

Keywords: Socio-economic factors, Policy, Occupational exposures, Non-chemical stressors, Female

A four year exposure assessment of ambient PM2.5 Concentration in Kampala, Uganda: Experiences from The Eastern Africa GEOHealth Hub

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BACKGROUND AND AIM:Air pollution (AP) remains a major a major environmental risk to the public health. Worldwide, 3.7 million deaths occur every year as a result of exposure to ambient air pollution. In Africa, AP is the 2nd largest death threat, causes more deaths than tobacco, alcohol, road accidents, and drug abuse. Sources of AP: traffic, especially in urban areas where traffic is a threat to PH (Samet 2001); biomass fuel burning; Industrial process. We prospectively monitored the PM2.5 levels in Kampala city and examined the daily and seasonal trends of PM2.5

METHOD:A time series design, we prospectively monitored daily ambient AP (PM2.5) concentration levels in micrograms per cubic meter (μ g/m3). The study site was Kampala Capital City, Uganda. The PM2.5 sampling site is located at the Makerere University School of Public Health premise, Mulago National Referral Hospital. The study used data for the period 1st January 2018 to 31st December 2021

RESULTS: the annual PM2.5 Concentration for 4 years (2018-2021) was 39.3 μ g/m3, 34.9 μ g/m3, 37.4 μ g/m3 & 42.0 μ g/m3 respectively. December, January, and February stand out with the highest concentration above 80 μ g/m3. The 4 years of monitoring AP in Kampala shows that PM2.5 concentrations were above the WHO annual interim target 1 of 35 μ g/m3

CONCLUSIONS: the findings show that air pollution in Kampala is way above the WHO Air Quality Guideline values, thus this situation poses an increased risk for adverse health effects including deaths attributed to air pollution

Keywords: Air Pollution, PM2.5

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The impact of secondhand smoke on air quality in partially enclosed hospitality venues: A systematic review

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BACKGROUND AND AIM: Smoking is a leading cause of premature mortality and morbidity globally. The pollutants generated from smoke are not only harmful to smokers, but also to those exposed to secondhand smoke. Although smoke-free policies have been widely implemented in indoor public spaces, outdoor smoking control policies have developed much more slowly. As a result of increasingly restrictive indoor smoke-free policies in many countries, there is a tendency for tobacco smoking to move outdoors into partially enclosed settings in hospitality venues. The aim of this systematic review was to evaluate the impact of secondhand smoke on air quality in partially enclosed public spaces such as pubs, bars and restaurants.

METHOD: A systematic search of the literature was conducted following PRISMA guidelines and using two electronic databases (PubMed and Scopus) in addition to manual searches.

RESULTS: The literature search identified a total of 625 articles, of which 13 studies met the inclusion criteria and were included in this review. All reviewed studies indicated that air quality within partially enclosed public spaces where smoking is permitted is unlikely to meet current World Health Organization (WHO) ambient air quality guidelines for PM2.5. Secondhand smoke can also drift into adjacent smoke-free outdoor areas or infiltrate into indoor environments thus affecting air quality in spaces where smoking is not permitted.

CONCLUSIONS:Customers and staff in partially enclosed public spaces with active smoking, and in adjacent outdoor and indoor non-smoking areas, are potentially exposed to secondhand smoke at levels exceeding WHO guidelines. Although scarce in the literature, studies of e-cigarette emissions in outdoor locations indicate that PM2.5 levels can also exceed WHO ambient air quality guidelines. Stronger smoking control policies that include e-cigarettes are recommended for partially enclosed outdoor public spaces to protect the health of customers and staff from harmful secondhand smoke exposure.

Keywords: Secondhand smoke; Tobacco, Air pollution; PM2.5; Hospitality venue
Arsenic in Groundwater Sources from Selected Communities Surrounding Taal Volcano, Philippines: An Exploratory Study

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BACKGROUND AND AIM: After the eruption of Taal Volcano in the Philippines in 2020, followed by continuous volcanic activity throughout 2020, we sought to investigate the extent of As contamination of groundwater sources in volcanic regions to provide the first comparative documentation in a volcano-sedimentary region in the Philippines.

METHOD:Matched, repeated As measurements were performed in 26 individual wells from 11 municipalities and 1 city in Batangas province from July 2020 to November 2021. Physico-chemical analyses using the electrothermal atomic absorption spectrometric method were conducted and analyzed using a Wilcoxon signed-rank test and bivariable regression qualitative methods. RESULTS:Analysis of the wells revealed that 23 out of 26 (88.46%) had As levels above the WHO limit of >10 ppb while 20 out of 26 wells (76.92%) had persistently high As levels a year later in both 2020 (p-value < 0.001) and 2021 (p-value = 0.013). There was also no evidence of an association found between As levels and distance (p-value 2020, 2021 = 0.537, 0.128) or elevation in relation to the source (p-value 2020, 2021 = 0.500, 0.584).

CONCLUSIONS:Lack of difference in proximal and distal As levels coupled with persistently and significantly elevated As groundwater levels in areas suggest As contamination through volcanic hydrothermal systems. Ground movements, as a result of volcanic activity, is known to cause greater interactions between groundwater and As-rich rocks, causing an increase in As concentrate. The geochemical and geomicrobiologic processes working in concert may have led to the long-distance transportation of As. We recommend geomapping of the hydrothermal system that interacts with the provincial groundwater aquifer and the inclusion of further sampling sites to more accurately determine the extent of the affected population's exposure to As.

Keywords: Water quality, Public health, Exposures

Multi-omic signatures of traffic related air pollution (TRAPs) in London

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BACKGROUND AND AIM:Traffic-related air pollutants (TRAPs) are a major source of urban air pollution and are associated with adverse health outcomes. However, the downstream molecular signatures of acute exposure to TRAPs remain underexplored. This work aimed to identify metabolic, transcriptomic and multi-omic biomarkers of five TRAPs measured in a crossover experimental study. METHOD:In the Oxford Street study, 60 participants visited Oxford Street and Hyde Park. Their exposures to NO₂, PM25, PM10, black carbon and number of particles, were measured. Serum samples were taken 2 hours before, 2 and 24 hours after visits for metabolomics and transcriptomics profiling. Multivariate normal (MVNs) regressions were used to identify -omic features associated with TRAP exposures. Pathway analysis was performed using Mummichog to identify enriched metabolic pathways. Conditional independence networks were performed at each time point using features significantly associated with TRAPs to characterise correlations between -omic signals that cannot be explained by other features.

RESULTS:In regression models, 78 metabolic features and 38 mRNAs were significantly associated with short-term TRAP exposures. NO₂ had the most associations amongst the 5 TRAPs. Several significant metabolic features had identical retention times, suggesting they were likely fragments from the same compounds. Pathway analysis identified 9 significantly enriched metabolic pathways, including leukotriene, tryptophan, and linoleate metabolisms. Novel conditional independent correlations emerged in multi-omic network models amongst significant metabolic and transcriptomic features 2 and 24 hours after exposure, which were absent prior to exposure.

CONCLUSIONS:NO₂ is the predominant TRAP in molecular signatures. Novel metabolic pathways associated with TRAP exposure are identified. Conditional independence networks provided snapshots of multi-omic responses to TRAP exposure at each time point, showing increased interplay amongst biomarkers in response to TRAP-related perturbations which could be functionally important. The funding sources of this work include MRC centre for environment & health, NIHR health protection research unit, EXPOSOMICs, and EXPANSE project.

Keywords: Air pollution - Traffic-related, Omics technology - exposome, Exposure assessment - biomarkers of exposure

Integrating micro-air quality sensors and satellite-based measurements to establish a high spatial-temporal resolution PM2.5 model in Taiwan

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BACKGROUND AND AIM: Fine particulate matter (PM2.5) estimation models are frequently limited by insufficient temporal coverage of in-situ measurements from routine air quality monitoring stations. The micro air quality sensor can provide high temporal-spatial resolution data owing to its high coverage and rapid data updated frequency. Hence, our study aimed to improve the spatial-temporal resolution of the existing model in Taiwan by integrating the micro sensors data with satellite-based aerosol optical depth (AOD).

METHOD: This study collected micro-air quality sensor data, multi-Angle Implementation of Atmospheric Correction (MAIAC) AOD, meteorological variables, and land use data in 2020. A two-stage random forest model has been applied to build the model. The first-stage model was used to calibrate the micro sensors data. The second-stage model was leveraged to build a daily 250-m resolution PM2.5 prediction model. The model performance was evaluated by using the ten-fold cross-validation (CV) and the temporal validation that used data in 2019.

RESULTS: The results have shown that the CV Coefficient of determination (R2) of the first-stage model was 0.97. After integrating the data from 11,612 sensors, the second-stage model showed an excellent performance with training R2 (root mean square error [RMSE]) and CV R2 (RMSE) of 1 (0.42 μ g/m3) and 0.99 (0.75 μ g/m3), respectively. The t

OP-ten most important predictors were temperature, zonal winds, precipitation, meridional winds, AOD, surface pressure, boundary layer height, downward UV radiation, surface solar radiation, and relative humidity. The temporal validation by 2019 data showed that R2 (RMSE) was 0.49 (7.76 μ g/m3).

CONCLUSIONS:Our model can improve spatial resolution and provide accurate PM2.5 estimates by integrating micro sensors data, while the temporal validation still represented the model was overfitting. It is expected that the future study need to train the model with more data and reduce the model complexity to improve performance.

Keywords: EPA air quality micro station, particulate matter, aerosol optical depth, machine learning

Air Pollution Monitor Network Design for Fair Exposure Estimation

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BACKGROUND AND AIM:Land-use regression (LUR) is widely used for predicting air pollution exposure for epidemiological studies. LUR uses a few monitored locations and land-use characteristics such as traffic to predict pollution concentrations throughout an area. Several monitor network design (MND) algorithms have been proposed to select the monitor locations. As an algorithmic process, LUR may be prone to unfairness due to biases in the location of the air pollution monitors. We assessed associations between monitor sites, neighborhood socioeconomic status (SES), and prediction accuracy under different MNDs.

METHOD:Ground-truth pollution measurements for particulate matter, black carbon, NO, and NO2 were obtained from mobile monitoring deployments in Pittsburgh, Pennsylvania and San Francisco, California. We studied four different MNDs via 30 monitor placement simulations per MND, per city. For each simulation, we built a stepwise linear regression model and predicted pollution concentrations throughout the study area. Monitor coverage was quantified by the number of monitors located within a 2, 3, 5, and 10 km radius from each census tract, adjusting for geographic and data-availability constraints. The association between average mean squared error and census tract SES was assessed via Spearman's correlation coefficient.

RESULTS:Three MNDs showed, on average, a non-zero correlation (p < 0.005) between census tract SES and monitor placement: higher SES tracts received more coverage in San Francisco and vice versa in Pittsburgh. More monitors within 2 and 3 km of the census tract was associated with lower prediction root mean squared error. Tracts with higher SES had higher prediction error in Pittsburgh for all MNDs but lower prediction error in the Bay Area for some MNDs. Prediction errors were large and comparable to pollution levels relevant to health risks.

CONCLUSIONS: Placing monitors by optimizing only for air pollution variance may lead to biased measurement quality by neighborhood SES.

Keywords: Methodological study design, Environmental disparities, Environmental justice

Arsenic Exposure and Accelerated Aging: The Association with Cardiovascular Disease and All-Cause Mortality in the Strong Heart Study

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BACKGROUND AND AIM:Inorganic arsenic (As) may increase the risk of cardiovascular disease (CVD) and all-cause mortality through accelerated aging, which can be measured by epigenetic-based measures. We evaluated three DNA methylation-based aging measures (PhenoAge, GrimAge, DunedinPACE) as potential mediators of the previously reported association of As exposure with CVD incidence, CVD mortality, and all-cause mortality in the Strong Heart Study (SHS), an epidemiological cohort of American Indians.

METHOD: Blood DNA methylation and urinary As levels were measured in 2,323 SHS participants (41.5% men, mean age 55 years). PhenoAge and GrimAge values were calculated using a residualbased method. We tested the association of As with epigenetic aging measures using linear regression, and conducted a mediation analysis of As-related CVD incidence, CVD mortality, and allcause mortality by epigenetic aging measures using additive hazards models.

RESULTS:SHS participants with higher vs. lower urinary-As levels had similar PhenoAge age, older GrimAge age, and faster DunedinPACE. Comparing the 75th vs. 25th percentiles of GrimAge and DunedinPACE, participants with older GrimAge and faster DunedinPACE were at increased risk for incident CVD [GrimAge HR=1.29 95%CI (1.16, 1.43); DunedinPACE HR=1.27 (1.16, 1.39)], CVD mortality [GrimAge 1.75 (1.46, 2.11); DunedinPACE HR=1.50 (1.28, 1.77)], and all-cause mortality [GrimAge HR=1.78 (1.61, 1.97); DunedinPACE HR=1.46 (1.34, 1.60)]. In mediation analyses, GrimAge and DunedinPACE mediated 10.3-20.7% of associations between As and the three health outcomes.

CONCLUSIONS: Arsenic exposure was associated with older GrimAge and faster DunedinPACE measures of biological age. Furthermore, accelerated biological aging measured from DNA methylation accounted for a relevant fraction of As-associated risk for CVD, CVD mortality, and all-cause mortality in the SHS, supporting the role of As in accelerated aging. Research of the biological underpinnings can contribute to a better understanding of the role of aging in arsenic-related disease.

Keywords: Epigenetic aging, arsenic, DNA methylation, cardiovascular disease

Systematic review of lead (Pb) effects on social cognition and autism

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BACKGROUND AND AIM:Social cognition effects of lead (Pb) exposures are an emerging area of research, and to our knowledge, systematic review methods have not yet been applied to this body of evidence. We will conduct a systematic review of the epidemiologic studies of children and youths (<21 years old) and experimental animal studies (all ages) to evaluate the relationships between Pb exposure and outcomes including autism, adaptive skills, social-emotional development, social communication, and social behavior.

METHOD: This review is informed by COSTER and PRISMA guidelines. Titles and abstracts focusing on studies that evaluate Pb concentrations in blood, tooth, or bone will be identified from keyword and citation network searches of all publication years. These will be double screened using a machine learning tool to predict relevant references, and then undergo full-text double screening using PECO criteria.

RESULTS:Preliminary work identified 16 epidemiologic studies in children and 1 rodent study published between 2011 and 2022. Positive associations between tooth and blood Pb levels (BLLs) and autism status/severity and social development were observed in three studies, of which two reported low mean BLLs ($<5 \mu g/dL$). Twelve studies reported null associations with autism and social cognition, of which four noted nonsignificant decreases in social scores. Four studies reported interactions with biological or psychosocial factors potentially explaining heterogeneity in the results.

CONCLUSIONS:Preliminary evidence did not find strong evidence of an association between Pb exposure and social cognition. However, a pattern of social cognition deficits at BLLs $<5 \mu g/dL$ was supported by several studies. The application of formal systematic review methods will strengthen findings and conclusions regarding the effect of Pb exposure on social cognition in children and youths.

The views expressed in this abstract are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

Keywords: Children's environmental health, Heavy metals, Risk assessment

Influence of folate+B12 supplementation on arsenic methylation: A double-blinded, placebocontrolled trial in Bangladeshi children

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BACKGROUND AND AIM: Inorganic arsenic (iAs) is metabolized to less toxic mono- (MMA) and dimethyl- (DMA) species via one-carbon metabolism (OCM). OCM is driven by folate and B12 and previous randomized control trials (RCTs) showed that that folic acid (FA) supplementation increases arsenic methylation in adults. This RCT investigated the effects of FA+B12 supplementation on arsenic methylation in children, a key developmental stage where OCM supports growth. METHOD: A total of 240 participants (8-11 years, 50% female) dependent on wells with iAs concentrations $>50\mu q/L$, switched to low iAs wells and were randomized to receive 400µg FA+5µg B12 or placebo daily for 12-weeks. Urine and blood samples were collected at baseline, week1 (only urine) and week12. GEE models were used to assess treatment effects on arsenic species in blood and urine. RESULTS: At baseline, the mean total blood and urinary arsenic were $6.2\pm3\mu$ g/L and $93.8\pm89\mu$ g/L; and the mean plasma folate, B12, and homocysteine levels were 25.1±15nM/L, 346±171pM/L, and 7.6±2.1µmol/L respectively. Overall, total blood and urine arsenic decreased by 11.7% and 17.6% at the end of follow up, likely due to well switching. Compliance with the nutritional intervention was excellent. Compared to placebo, the supplementation group experienced a significant increase in the concentration of blood DMA by 14.0%(95%CI 5.0, 25.0) at 12 weeks. Similarly, there was a significant increase in the urinary %DMA by 2.4%(95%CI: 0.6, 4.2) and a significant decrease in %MMA by 0.9%(95%CI: -1.6, -0.3) in the supplementation group after one week compared to placebo group. These changes in urinary metabolites remained until the end of follow up compared to baseline, though they were not statistically significant.

CONCLUSIONS: This RCT confirms that FA+B12 supplementation increases iAs methylation in children as reflected by decreased MMA and increased DMA in blood and urine. Nutritional interventions may improve arsenic methylation and elimination in children, potentially reducing toxicity.

Keywords: Arsenic, nutrition, folate, children health

Urine Cadmium Levels and Coronary Artery Calcification: A Longitudinal Study in the Multi-Ethnic Study of Atherosclerosis (MESA)

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BACKGROUND AND AIM:Growing evidence indicates that cadmium is a risk factor for cardiovascular disease (CVD). Urinary cadmium is a biomarker of long-term exposure. We hypothesized that higher urine cadmium levels are associated with higher levels of coronary artery calcium, a subclinical marker of atherosclerotic CVD.

METHOD: We used data from 6,226 participants in MESA with urine cadmium levels at baseline (2000-2002) and 1-4 repeated measures of spatially weighted coronary calcium score (SWCS) over a 10-year period. SWCS is a unitless measure highly correlated to the Agatston score but with numerical values assigned to Agatston score=0. We used linear mixed effect models to assess the association of baseline urine cadmium with baseline SWCS, annual change in SWCS, and SWCS at ten years of follow-up. Urine cadmium levels were reported in $\mu g/g$ creatinine and log transformed. SWCS was log transformed. Models were adjusted for baseline sociodemographic factors and estimated glomerular filtration rate, lifestyle factors, and clinical factors.

RESULTS:At baseline, the median (25th, 75th) SWCS and cadmium were 6.31 (0.75, 58.5) and 0.53 (0.35, 0.79) μ g/g creatinine. Participants who were older, male, of White race, with less education, currently smoking, diagnosed with diabetes, and with higher cadmium levels had higher SWCS. In fully adjusted models, the geometric mean ratio (GMR) (95%CI) of SWCS per interquartile range change in urine cadmium was 1.32 (1.16, 1.50) at baseline and 1.35 (1.05, 1.74) at ten years of follow-up; the annual change was 1.002 (0.989, 1.015). The GMRs of baseline SWCS were 1.16 (0.97, 1.39), 1.45 (1.17, 1.80), and 1.53 (1.06, 2.20) among 3,139 never, 2,289 former, and 798 current smokers, respectively.

CONCLUSIONS:Long-term exposure to cadmium, as measured in urine, was associated with subclinical CVD at baseline and at follow-up. These findings support the hypothesis that cadmium is a pro-atherogenic factor.

Keywords: metals, cardiovascular disease, subclinical disease, longitudinal study

Environmental arsenic exposure, hypertension, and diabetes mellitus: a systematic review and dose-response meta-analysis

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BACKGROUND AND AIM:Literature on environmental arsenic exposure in relation to hypertension (HTN) or diabetes mellitus (DM) is not entirely consistent. Therefore, this systematic review and dose-response meta-analysis explores the association between environmental arsenic exposure and risk on HTN and DM across exposure levels.

METHOD: Five electronic databases were searched for HTN and four for DM. Two-stage random-effects dose-response meta-analyses of arsenic concentrations stratified by media (water, urine, blood, plasma, nail) were performed for HTN, DM and gestational DM (GDM), assuming both log-linear associations and restricted cubic splines. Meta-analyses were also performed for arsenic metabolism markers (iAs%, MMA%, DMA%) and HTN.

RESULTS: From the 6,024 retrieved publications, 71 were included (26 HTN, 49 DM, 4 both) in the systematic review, and 41 in meta-analyses (16 HTN, 22 DMT2, 6 GDM). The 71 studies reported predominantly significant or non-significant positive associations for one or more arsenic categories or in continuous models. Few reported non-significant negative associations, and none reported significant negative associations. Dose-response meta-analyses identified consistent positive log-linear associations between water and urinary arsenic exposure and risk of HTN, DM and GDM, with some evidence of a departure from linearity for cumulative water arsenic and HTN, and toenail arsenic and DM. Analyses on low levels of water arsenic utilising 1 μ g/l as the reference category showed positive log-linear associations below 10 μ g/l for all outcomes. Results were consistent across sensitivity analyses. No significant pooled associations for urinary iAs%, MMA% and DMA% with HTN were observed.

CONCLUSIONS: Evidence was most conclusive at moderate-high arsenic levels, whilst highlighting that a potential downward revision of the WHO guidelines (10 μ g/l) may be considered for health protection. Yet, given the inconsistencies around the impact of individual arsenic species and arsenic metabolism on HTN and DM, elucidation of the interplay between arsenic species, arsenic metabolism and HTN and DM warrants further research.

Keywords: Arsenic, diabetes mellitus, hypertension, meta-analysis

Exposure to airborne polychlorinated biphenyls and risk of uterine leiomyomata, endometriosis, and PCOS: a register-based Danish cohort study

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BACKGROUND AND AIM: Polychlorinated biphenyls (PCBs) are some of the most widespread persistent organic pollutants in the environment due to their extensive use in electrical equipment and building materials from the late 1920s to the 1970s and their continuous release from waste and building materials from that period. The industrially produced PCBs are known to possess endocrine properties and to increase cellular levels of reactive oxygen species. They may therefore play a role in the development of hormone-related gynecological conditions including uterine leiomyomata (UL), endometriosis, and polycystic ovarian syndrome (PCOS). Several studies have shown adverse associations between higher-chlorinated PCB congeners and these gynecological conditions, but so far, our knowledge about risk related to lower-chlorinated PCBs which dominate indoor air and constitute the primary exposure for individuals who work or live in PCB-contaminated buildings is scarce. We examined the extent to which female residents of PCB contaminated homes had a higher incidence of hormone-related gynecologic disorders, including UL, endometriosis, and PCOS. METHOD: We studied females from the Health Effects of PCBs in Indoor Air (HESPAIR) cohort comprising residents of two partially PCB contaminated residential dwellings in the Greater Copenhagen area during 1970-2018. We used the Danish National Patient Register to identify the clinical diagnoses of UL, endometriosis, and PCOS. By combining register-based relocation history with measurement-based contamination status, we quantified annual, cumulative PCB exposure. We then fit multivariable Cox regression models with time-varying exposure to estimate associations between PCB exposure and incident UL, endometriosis, and PCOS. To ensure incident cases, we excluded individuals with preexisting UL, endometriosis, PCOS, menopause, hysterectomy, oophorectomy, fibroid operation, and those above 50 years of age. All models were adjusted for ethnicity, parity, socioeconomic status, and calendar time in decades. RESULTS: Results will be ready for the conference

CONCLUSIONS: Conclusion will be ready for the conference

Keywords: PCB, Gynecological, EDC, register, environment

The Association Between Particulate Air Pollution and the Risk of Sudden Death in Patients on Maintenance Hemodialysis: A Case-Control Study

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BACKGROUND AND AIM: Previous evidence has linked high concentrations of PM2.5 to an increased risk of sudden death (SD). However, it is still unknown whether exposure to PM2.5 predisposes patients on maintenance hemodialysis (MHD) to an increased risk of SD.

METHOD: The Clinical Research Data Repository of China Medical University Hospital (CMUH-CRDR) and iHi Platform identified 178 cases of SD among adult patients on MHD between 2003 and 2020. Each patient with SD was individually matched based on age, sex, and dialysis duration with four controls selected from the HD population of CMUH-CRDR. The occurrence of SD was verified using the monthly HD care quality committee report of CMUH and a data algorithm that included MHD patients whose mortality date and last HD session were within 72 hours, but had no admission records. We utilized satellite-based spatiotemporal models with 1-km resolution to individually estimate the 1-year and 3-day average PM_{2.5} concentration prior to the index date of the SD event. Multiple logistic regression modeling was employed to estimate odds ratios (OR) and corresponding 95% confidence intervals (CI) between PM_{2.5} exposure and the occurrence of SD.

RESULTS:The median age and dialysis duration was 70.1 years (IQR, 60.2, 78.6) and 2.9 years (1.1, 5.6), respectively, in this study population. Patients who experienced a sudden death event were more likely to have comorbidities such as cardiovascular disease, diabetes, and atrial fibrillation compared to the control group. Adjusted odds ratio for each 10 μ g/m³ increase in 1-year and 3-day average PM_{2.5} exposure was 1.32 (95% CI, 0.87, 2.00) and 1.019 (95% CI, 0.81, 1.28), respectively. CONCLUSIONS:Our result found a positive association between both long-term and short-term PM_{2.5} exposure and SD among MHD patients, although this association was not statistically significant. Larger-scale studies are needed to confirm whether reducing PM_{2.5} exposure can effectively modify the risk of SD.

Keywords: Environmental epidemiology, long-term exposure, short-term exposure

OP-340[Air pollution » Particulate matter]

Retrospective exposure assessment for a longitudinal study of ultrafine particles (UFP) and mortality

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BACKGROUND AND AIM: Ambient ultrafine particles (UFP: <0.1 micrometers aerodynamic diameter), primarily from vehicle combustion in urban areas in the US, have no ambient air quality standards. In large part, this is because there is no evidence from large, prospective studies of mortality. METHOD: We utilized a published high-resolution (hourly, 20-m-by-20-m), predictive model of particle number concentration (PNC, a surrogate for UFP) for the cities of Boston and Chelsea, Massachusetts, in the northeastern US. The U.S. EPA's latest meteorological preprocessors were used to generate model input data for temperature, wind speed and direction, atmospheric stability, and other necessary variables. The PNC model was then adjusted for residential and occupational time-activity using surveyed data, retrospectively for people enrolled in the Boston Puerto Rican Health Study (BPRHS). Mortality in this cohort has been high (295 deaths out of 1500 participants). RESULTS: The PNC model estimated exposure for all participants in the BPHRS cohort within the two study areas for every hour from 2004 to 2021. Median modeled ambient hourly PNC decreased over time in both Boston and Chelsea (13,000 and 16,000 particles/cm3 in 2004 versus 4600 and 4700 particles/cm3 in 2021, respectively). Previous studies in the BPRHS of cardiovascular measures and CAFEH study found associations with increased PNC and time-activity adjusted PNC. Adjustment of exposure for time activity and tests of association with mortality are in progress and will be reported at the conference.

CONCLUSIONS: This analysis, although of a small prospective cohort, has the potential to provide early evidence for or against association of traffic UFP with mortality due to the high mortality rate, contributing to filling a critical need in the air pollution policy arena.

Keywords: traffic-related air pollution, ultrafine particles, mortality, time-activity

OP-341[Air pollution » Particulate matter]

Impact of air pollution on mortality during the COVID-19 pandemic in South Korea and Japan

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BACKGROUND AND AIM:Multiple studies have reported the impacts of the coronavirus-2019 pandemic on the association between air pollution and mortality. Nevertheless, the generalizability of these studies is limited because of the limited study areas and the nonrepresentative nature of the study populations.

METHOD: We collected nationwide daily time-series data from South Korea (16 regions) and Japan (47 prefectures) from 2016 to 2020. We performed an interrupted time-series analysis to estimate temporal changes in the association between PM2.5 and mortality (total, cardiovascular diseases, and respiratory diseases) before (Jan 01, 2016 to Feb 17, 2020) and during the pandemic (Feb 18, 2020 to Dec 31, 2020).

RESULTS: The average annual concentration of PM2.5 decreased during the pandemic in both countries. For all-cause deaths, the changes in relative risk were not prominent during the pandemic. Whereas, for several cardiovascular diseases (ischemic heart and cerebrovascular diseases) and respiratory diseases, we found an increase in the risks of PM2.5 on mortality during the pandemic in South Korea and Japan, although there were some differences in both countries.

CONCLUSIONS: We found that the risks of short-term exposure to PM2.5 on mortality for cardiovascular and respiratory diseases increased in the first pandemic year in South Korea and Japan, compared to the pre-pandemic years.

Keywords: COVID-19, PM2.5, Mortality

Long-term exposure to PM2.5 and all-cause mortality in India using a Difference in Difference approach

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BACKGROUND AND AIM:Global Burden of Disease estimated 1.7 million deaths were attributed to air pollution in India in 2019. In contrast, a retrospective cohort study 'Million Death Study' reported no excess deaths from all non-accidental causes due to ambient air pollution. These studies used exposure-response functions derived from countries with low air pollution exposure levels. To strengthen the evidence on health effects of air pollution, we studied the association between annual exposure to particulate matter measuring <2.5 μ g/m3 (PM2.5) and all-cause mortality in India using a modified difference-in-difference approach.

METHOD: We used district level annual all-cause mortality and annual population weighted districtlevel PM2.5 exposure from a high-resolution spatiotemporal model for 2009- 2020. Difference-indifference, a causal modeling approach that controls for unmeasured confounders by design was employed to analyze effect of PM2.5 and mortality. We performed sensitivity analyses using statewide death registration levels to account for measurement error. We estimated exposure-response function from our main model.

RESULTS:In 655 Indian districts, the population weighted PM2.5 median was $38.9\mu g/m3$ (19.7 (5th percentile) and 71.8 (95th percentile)) over a decade. Over the study period, death registration levels ranged from 68.7 to 83.7% with less than 10 states having 100% registration through out. For every 10 $\mu g/m3$ increase in PM2.5, we estimated that mortality rate increased by 5.9% (95% CI 3.8,8.1) which were robust to sensitivity analyses. The exposure-response function was slightly non-linear, with steeper slope up to ~ 95 $\mu g/m3$ and levelling afterward.

CONCLUSIONS: Using a causal modelling approach allowed us to harness the full extent of registered deaths in one of the world's most populated and polluted country, we provide new evidence of increased risk of all-cause mortality from long-term exposure to PM2.5 in India. We expect these results to have important implications for current environmental health policy in India.

Keywords: Air pollution, particulate matter, long-term exposure, mortality, causal inference

PM2.5, locally generated pollution and daily mortality in India: Causal analyses modelling and attributable deaths in 10 cities

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BACKGROUND AND AIM: The evidence of acute effects of air pollution on mortality in India is limited. This is the first multi-city study in India that examines the association between particulate matter <2.5 μ m (PM_{2.5}) and daily mortality using causal methods highlighting the importance of locally generated air pollution.

METHOD:We applied a time-series analysis for ten cities in India between 2008-2019. We estimated city-wide daily PM_{2.5} levels using a nationwide spatiotemporal model. We evaluated city-specific effects of PM_{2.5} through a generalised additive Poisson model, and then meta-analysed the associations. We applied an instrumental variable causal approach to evaluate the causal effect of

locally generated air pollution on mortality. We obtained a pooled concentration-response curve through a multivariate meta-regression of the city-specific concentration-response functions (CRF), and calculated the fraction of deaths attributable to $PM_{2.5}$ levels exceeding the World Health Organization (WHO) 24-hour $PM_{2.5}$ guidelines ($15\mu g/m^3$). We further limited the analyses to days with concentrations lower than the current Indian $PM_{2.5}$ standard ($<60\mu g/m^3$).

RESULTS: We observed that a 10 μ g/m³ increase in two-day moving average of PM_{2.5} was associated with 1.4% (95%CI: 0.7-2.2) higher daily mortality, with a stronger effect of locally generated air pollution on mortality, as our instrument (per 10 μ g/m³) was associated with a 3.6% (95%CI: 2.1-5.0) increase in mortality. Our pooled CRF indicated no evidence of a threshold below which air pollutant concentrations are not harmful on mortality. In fact, higher risk of death was observed when restricting our analyses to the Indian PM_{2.5}standard. We observed that 7.2% (95%CI, 4.0-9.9) of all deaths were attributed to PM_{2.5} levels exceeding the WHO guidelines.

CONCLUSIONS:Short-term PM_{2.5} exposure was associated with increased mortality in India, even at concentrations below the current Indian PM_{2.5} standard. These associations were stronger when employing causal modelling methods accounting for locally generated air pollutants, further supporting a plausible causal link.

Keywords: Air pollution, Particulate matter, Mortality, Causal inference, Short-term

A pilot study to determine the impact of prescribed burns on indoor air quality and associated health impacts for residents

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BACKGROUND AND AIM:Bushfire smoke poses a significant threat to human health, especially respiratory, cardiovascular, and mental health. The primary management tool to reduce the risk of bushfire in urban areas is hazard reduction burns (HRB). This study aimed to answer the following questions: Does household air quality worsen during HRB?; Is exposure to particulates from HRB associated with changes in respiratory health?; and what household characteristics influence the penetration of air pollutants?

METHOD: We conducted a pilot pre-post exposure study. Children-adult pairs (n=18) within 1 km of the burn site were recruited from 6 households. Homes were visited prior to the HRB, immediately following and 5 days post-HRB. Indoor and ambient PM2.5 was measured simultaneously using AirVisual Pros. A survey assessed characteristics of the home and health status of participants. Lung function was measured via oscillometry using a TremoFlo device.

RESULTS:Mean outdoor PM2.5 increased by 160% on the day of the burn, from 5.22 μ g/m3 in the pre-burn period, to 13.6 μ g/m3. Indoor PM2.5 was lowest in the pre-burn period (8.8 μ g/m3), rising to 25 μ g/m3 in the 24 hour burn period. Each timepoint showed higher indoor PM2.5 compared with outdoor air (P = <0.01). Small changes in lung function, per unit increase in PM2.5, were seen in R [-0.094 (95% CI -0.118, 0.016) cm H2O.s.L-1, p=0.073] and in X [0.267, (-0.267, -0.016), p-0.084]. These changes are small and not statistically significant but are in the direction that would be seen with a deterioration in lung function.

CONCLUSIONS:Our preliminary work suggests that particles become trapped within the home, and inadequate ventilation prevents them clearing as ambient air quality improves. If confirmed, these data clearly have implications for public health messaging. Our model of HRB provides a useful model of bushfire smoke exposure.

Keywords: Respiratory outcomes, Children's environmental health

Environmentally persistent free radicals in household dust: longitudinal and seasonal trends

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BACKGROUND AND AIM:Epidemiological links between air pollution and adverse health outcomes are strong, but the mechanism(s) remain obscure. A newly recognized combustion by-product, environmentally persistent free radicals (EPFRs), may be the missing link. EPFRs persist for extended periods of time in the environment, however very little is known about the presence of EPFRs inside homes where prolonged exposure is likely to occur. The objective of this study is to explore the presence of EPFRs in household dust and ascertain if EPFR concentration is stable across time and season.

METHOD: The ORChID/ELLF cohort is a longitudinal birth cohort (n=158) with dust samples collected from the family vacuum cleaner at multiple time points. EPFR characteristics were assessed with electron paramagnetic resonance. Our team developed an algorithm to estimate oxygen-weighted concentration and impact score for risk of adverse health outcomes. Kruskal-Wallis rank sum test and Fisher's exact tests were used to assess seasonal differences. A simple mixed-effects linear regression, with random intercepts on participant ID, was employed for longitudinal analysis of EPFR concentration in households that did not move.

RESULTS:83 participants returned 238 dust samples. EPFRs were measured in virtually all samples. Most households were exposed to medium (39%) or high (21%) impact EPFRs. Concentration was stable across visits, except for lower concentration in summer (p=0.05), Oxygen-weighted EPFRs were not stable. There was a seasonal trend with concentration (p=<0.01), oxygen weighted concentration (p=<0.01) and biological impact (p=0.05) all significantly lower in summer months.

CONCLUSIONS:Our results indicate that the concentration of EPFRs in household dust are stable across time in households that did not move, but the oxygen-centred radicals are more sensitive to changes. These findings suggest that exposure to EPFRs occurs in the home and may be a significant place for exposure to highly biologically reactive EPFRs.

Keywords: Particulate matter, Environmental epidemiology

Determinants of indoor air pollution health literacy among adults in Taiwan

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BACKGROUND AND AIM: This study aimed to investigate the level of and covariates associated with Indoor Air Pollution Health Literacy (IAPHL) among adult residents of Taiwan.

METHOD:A cross-sectional web-based online survey of 647 adults aged 20 years and above in Taiwan was conducted from May 2021 to October 2021 using the reliable and valid IAPHL instrument. The IAPHL scored 1 to 4 to indicate the lowest and highest level of IAPHL, respectively. We performed weighted multiple linear regression models to identify covariates significantly associated with overall and 4 matric-specific IAPHL scores.

RESULTS:The weighted sample size was 616 subjects aged between 20 and 88 years old (mean of 45.8 years, SD 18.1). Generally, adult residents of Taiwan showed only a moderate level of overall IAPHL (2.46 ± 0.62) with the highest and lowest metric-specific score for "understanding" (2.58 ± 0.72) and "appraising" (2.36 ± 0.64). The key factors associated with adults' IAPHL included sex, age, working related to indoor air pollution, smoking status, exposed to second hand smoke, budgeting for improve indoor air quality, and number of beneficial goods used.

CONCLUSIONS: People in Taiwan had only moderate levels of IAPHL. Adults with certain characteristics should be the objects of further educational interventions aiming to improve IAPHL.

Keywords: indoor air pollution, environmental health literacy, health competency, cross-sectional studies, community health

OP-347[Air pollution » Other (to be specified with keywords in the keywords section)]

Validation of Computational Fluid Dynamics Models in Predict Domestic Kitchen Hood Performance

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BACKGROUND AND AIM: Cooking emissions, such as PAHs, VOCs, COx, NOx, and particulate matter, are considered pollutants that may harm human health and affect indoor air quality. Using adequate kitchen hoods is the key to reducing these hazards. However, no prediction models for hood performance are available for human exposure assessment. Therefore, our objective is to build a database of validated Computer Fluid Dynamics (CFD) to predict the performance of kitchen hoods commonly used in Taiwanese homes.

METHOD: We established a Computer-Aided Design (CAD) model based on the experimental setup in the simulation kitchen of our lab where we tested kitchen hoods with five different geometric design. We tested the hoods under the fixed flow rates of 6 and 16 m3/min for their temperature and CO2 concentration distribution. We then compared the simulated values and experimental results for validation tests using data from four measurement points. Finally, we calculated the CE values using the simulation results.

RESULTS:CE values determined from measured CO2 concentrations were higher at the high flow rate (CE=0.50-1.18) than at the low flow rate (CE=0.32-0.42). And there was good agreement between the simulated and measured performance. The validated results showed that both the configuration and the flow rate of the hoods could affect the spatial flow field and further influence hood performance.

CONCLUSIONS: In sum, we have successfully established a validated modeling approach which could be applied to predicting the performance of different kitchen hoods in the future.

Keywords: Kitchen Hoods, Capture Efficiency, Carbon Dioxide, Indoor Air Quality, Computational Fluid Dynamics

The Use of Kitchen Exhaust Hoods with Different Capture Efficiency in an Open Kitchen in Taiwan

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BACKGROUND AND AIM:Using a kitchen hood could reduce the risk of adverse respiratory health effects caused by cooking emissions. However, different from the traditional kitchen space design in Taiwan, the open kitchen has gradually become a consideration in modern architectural design. Its more open space may cause the kitchen hood performance to be less than expected. Therefore, this study aims to explore the performance of kitchen hoods with different capture efficiency in a laboratory open kitchen.

METHOD:This study was conducted in a simulated kitchen space. Nebulized sodium chloride solution and carbon dioxide were used as surrogates for cooking emissions, measured with Scanning Mobility Particle Sizer (SMPS) and TSI-7545. The study used two tested kitchen hoods alternately. The experimental stage was divided into three phases: the background phase, the cooking phase, and the post-cooking phase. A total of 8 combinations (4 hood flow rates and whether to continue to use the kitchen hood after the release of pollutants stops) were tested in the study, and each combination was tested per cycle. Finally, these tests were done in triplicates. For data analysis, the measurement results were used to calculate the capture efficiency (CE) and effectiveness (E) of two kitchen hoods. RESULTS:The kitchen hood with better capture efficiency still has a higher effectiveness than the other one. However, whichever kitchen hood was used, the pollutant concentration during the cooking phase could be reduced more if the hood flow rate was higher. In the post-cooking phase, regardless of whether the kitchen hood was continuously used, as long as it was used during the cooking phase, the time for the concentration of pollutants to return to the background value could be halved. CONCLUSIONS:Despite changes in kitchen space design, kitchen hoods could still provide acceptable capture efficiency in the open kitchen.

Keywords: Cooking Emissions, Kitchen Hood, Capture Efficiency, Open Kitchen, Indoor Air Quality (IAQ)

OP-350[Air pollution » Short-term exposure]

Air pollution and health burden of urban fire disaster: A case study from tire factory fire in Korea

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BACKGROUND AND AIM: Urban fire disasters are not commonly studied in terms of smoke exposure and its health impacts. A tire manufacturing factory in Daejeon city, Korea experienced a prolonged fire lasting for 58 hours, starting at 10 PM on March 12, 2023. The aim of this research was to estimate the excess air pollution exposure experienced by residents living close to the factory. METHOD: Hourly air pollution levels (PM10, PM2.5, NO2, O3, SO2 and CO) were gathered from the 11 monitoring stations of Daejeon. The Munpyeong-dong station, located within 500 m from the factory, was used to estimate the air pollution exposure of residents living in 2 administrative districts (Seokbong-dong and Deogam-dong) located within 1.2 km from the factory. The average difference between the hourly air pollution levels of the Munpyeong-dong station and synthetic control using levels of 10 monitoring stations was estimated.

RESULTS:Based on the population registration data, 29,487 persons (2,431 age 0-10; 4,361 age 65-) may be exposed to the excess air pollution from the factory fire. Although there was no increase in monitored air pollutant during the first 24 hours, peaking of PM10, PM2.5, SO2, and CO levels was observed during the 2-4 days after the initial fire event. In the week following the initial fire, the residents may expose to additional 2581.2 (95% confidence interval (CI): 817.6, 3600.7) μ g/m3 of PM10, 985.8 (95%CI: 119.2, 1377.1) μ g/m3 of PM2.5, 626.7 (95%CI: 94.1, 1007.7) ppb of NO2, 482.5 (95%CI: 435.6, 632.8) ppb of SO2, and 14.7 (95%CI: 11.2, 19) ppm of CO. CONCLUSIONS:Residents living close to the tire factory were exposed to excessive amounts of air pollution. Potential measures, such as temporary evacuation and closure of schools, can be considered after urban fire disasters. Future studies using national health insurance data will address excessive healthcare use in residents.

Keywords: Exposures, Particulate matter

OP-351[Air pollution » Long-term exposure]

Air Pollutants and Long-term Kidney Function Changes in Chronic Kidney Disease: Results from Southern Taiwan

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BACKGROUND AND AIM: Taiwan has a t

OP-rank end-stage kidney disease incidence in the world. There is limited information about the air pollutants' roles on kidney health in patients with chronic kidney disease (CKD). The study aimed to investigate associations of air pollutants with long-term kidney function changes in CKD. METHOD: This prospective study enrolled 447 CKD patients from the Pingtung Hospital, Ministry of Health and Welfare 2011–2015. The personal exposure of air pollutants (CO, NO, NO2, NOx, O3, PM2.5, PM10, and SO2) concentrations and ambient temperature were estimated by inverse distance weighting approach. The estimated glomerular filtration rate from 2011-2021 was calculated by the CKD-EPI equation. A mixed model with random intercept and the slope was applied to explore these associations. Both standard classifications and restricted cubic spline by five-knot for air pollutant concentrations were investigated To detect non-linear air pollutant relationships. RESULTS: The average age of the study population was 77.1±12.6 years, and the median eGFR decreased by 1.9 ml/min/1.73m2 per year. We identified NO concentration large and equal to 2.36 ppb significantly associated with long-term kidney function changes (ranges of the regression coefficient from -8.51 to -12.87) after controlling potential confounding effects. The mixed models with a restricted cubic spline showed the significant effects of increased CO, NOx, and PM2.5 concentrations between knots on the eGFR slope: slow, aggregate, slow, and aggregate. CONCLUSIONS: We observed that renal function deterioration was significantly attributed to CO, NO, NOx, and PM2.5 concentrations in patients with CKD. Further research is needed to understand the mechanisms of air pollutants, medical care, human protective behaviors, and their effects on longterm kidney function progression.

Keywords: air pollution, long-term exposure, outcomes.

Hazard and risk assessment for indoor air pollutants: alicyclic compound, 1-butanol, longchain aldehydes, chlorinated organic compounds, and acrolein

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BACKGROUND AND AIM: In the past decades, indoor air pollution has become a major public health concern. Japan has established indoor air quality guidelines for 13 chemicals. However, the types and concentrations of indoor pollutants have not been consistent over time due to alterations in lifestyle and development of novel household products and building materials. Therefore, a comprehensive approach for the overall reduction of health risks caused by indoor air pollutants are required. METHOD: To determine the high-risk indoor air pollutants that should be reduced, we conducted a preliminary risk assessment using data from nationwide exposure assessments and existing hazard data. In this assessment, identifications of the critical effects and the reference concentrations (RfCs) obtained from reviewing the hazard or toxicological data are crucial. In this study, those data for 9 pollutants, including methylcyclohexane (MCH), propylcyclohexane (PCH), 1-butanol, hexanal, decanal, trichlorethylene (TCE), tetrachloroethylene (PCE), 1,2-dichloroethane (DCE), acrolein are reported.

RESULTS:Acute RfCs were not derived for MCH, PCH, 1-butanol, and decanal. Chronic RfC for PCH were not determined. The derived chronic RfCs were as follows: for MCH, 2921 μ g/m3 from renal effects in rats; for 1-butanol, 138 μ g/m3 from neurobehavioral effects in rats; for hexanal and decanal, 130 μ g/m3 from nasal effects in dogs; for TCE, 1.2 μ g/m3 from thymic effects in mice; for PCE, 119 μ g/m3 from effects of color vision in humans; for DCE, 83 μ g/m3 from liver effects in rats; and for acrolein, 2.3 μ g/m3 from respiratory effects in mice. Carcinogenic RfCs associated with excess lifetime risk of 1/100 000 were determined for TCE, 2.4 μ g/m3; for PCE, 1.6 μ g/m3, and for DCE, 1.6 μ g/m3.

CONCLUSIONS: The RfCs for acute and chronic effects for 9 chemicals were evaluated from the reviewed information. RfCs for acute effects in 5 chemicals, chronic effects in 8 chemicals, and carcinogenic effects in 3 chemicals were identified.

Keywords: Chemical exposures, Hazard assessment, Health risk assessment, Indoor environment, Volatile organic compounds

OP-353[Air pollution » Particulate matter]

Assessing the particulate matter exposure reduction and short-term health benefits of Improved Cook Stoves (ICS) in Rural Nepal

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BACKGROUND AND AIM: More than 68% population in rural communities of Nepal still combust biomass fuel in inefficient cook stove that leads to the exposure of high concentration of particulate matter (PM). Exposure to PM can cause chronic and acute health risks, resulting in premature deaths. Improved cook stoves (ICS) have been proposed as a potential solution to reduce HAP exposure, but there are limited studies on their short-term health benefits. This study aims to estimate the effect of enhanced stove design on particulate matter exposure and short-term health impacts in rural Nepal. METHOD: Baseline data on personal exposure to PM and changes in physiological functions were collected in rural households using traditional cook stoves. 30 households were then installed with Alternative Energy Promotion Centre (AEPC) approved two pot mud improved cook stoves. Data on personal exposure to PM and personal blood pressure, oxygen saturation, pulse and CO concentration in exhaled breath were collected immediately after installation and statistical analysis was used to compare data before and after the intervention

RESULTS: The initial data showed a significant reduction in PM exposure after the installation of ICS. The overall mean PM2.5 exposure concentration in households decreased by 35% after the intervention. The exhaled breath CO concentration also decreased from 7.5ppm to 4.5ppm after the installation of ICS. The oxygen saturation level was increased by 1% after the intervention. However, there was no significant difference in pulse rate and blood pressure before and after the intervention. CONCLUSIONS:ICS was effective in reducing personal exposure to PM in the study households of rural Nepal. However, the findings show no significant benefit of exposure reductions on short term health impact. The long term health benefits of reduced exposure from improved cook stove use is hence necessary to elucidate the actual impact of the intervention on health outcomes.

Keywords: Household air pollution, Improved cook stove, Short term health impact, particulate matter, Rural nepal

OP-354[Air pollution » Particulate matter]

Association between exposure to fine particulate matter and risk of osteoporosis

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BACKGROUND AND AIM: The prevalence rate of osteoporosis among people over 65 years old in Taiwan is 14.1%, that is, about 1 out of every 7 people has osteoporosis. Air pollution levels in Taiwan remain high, mainly from the burning of fossil fuels. Recent studies have shown that developing osteoporosis is significantly related to inflammation caused by exposure to fine particulate matter (PM2.5) from air pollutants. However, there is currently no research in Taiwan. We aimed to investigate the association between PM2.5 levels and the risk of osteoporosis and to clarify risk factors for osteoporosis.

METHOD: Using the data of bone mineral density collected by Taiwan Biobank since 2012, combined with data from Taiwan Air Quality Monitoring Station, to explore the association of PM2.5 level and other risk factors with the risk of osteoporosis. In this cross-sectional study, we included 5,346 osteoporosis subjects and 55,114 non-osteoporosis subjects. The stepwise selection was used to establish a multivariate logistic regression model and PM2.5 exposure was evaluated by one-year, three-year, and five-year mean levels. The statistical analysis was conducted by using SAS version 9.4 software and a P-value of less than 0.05 indicated a significant difference.

RESULTS:The results shown that age of 60-70 years old [odds ratio (OR)=5.241], family history of osteoporosis (OR=1.702), smoking (OR=1.589), body mass index less than 18.5 (OR=2.396) and arthritis (OR=1.352) were significant risk factors of osteoporosis, while women (OR=0.675), college education (OR=0.600), regular exercise (OR=0.843), and diabetes (OR=0.851) were protective factors. However, exposure to PM2.5 was not significantly associated with osteoporosis risk. CONCLUSIONS:Although we could not find a clear relationship between PM2.5 exposure and osteoporosis risk, we found important factors associated with osteoporosis risk, which provides evidence for osteoporosis prevention in Taiwan.

Keywords: Osteoporosis, Fine particulate matter (PM2.5), Osteoporosis Risk Factors

Spatio-temporal trends of carbon monoxide poisoning suicide attempts and associated risk factors in England between 2002 and 2016

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BACKGROUND AND AIM: Suicide and mental health disorders are a recognized public concern. Most suicide prevention relies on evidence from mortality data, missing a large pool of population at risk. Herein, describe the spatiotemporal patterns of intentional carbon monoxide (CO) poisoning hospitalization rates in England between 2002 and 2016, and identify population groups at risk. METHOD: We collected data on hospital admissions for intentional CO poisoning in England between 2002 and 2016 and on individual (age at admission, gender and residential postcode) and area-level characteristics (ethnic composition, urbanicity, and socioeconomic deprivation). For each group, we estimated age-standardised rates (ASR) overall and annually and formally tested differences using chi-square test. Temporal trends were assessed through joinpoint regression analysis. RESULTS: Overall, there were 178 hospitalizations for intentional CO poisoning annually. Over 2.6% of patients were hospitalized two or more times, suggesting persistent suicidal thoughts. 81 % of admissions occurred in males. We found higher ASR in rural areas, among men and particularly those aged 35-44 years and living in areas with predominantly white population. The ASR in London (0.08/100,000) was almost six times lower than in the South-West (0.47/100,000). During the study period, the annual percentage rate change was negative particularly among males (-7.0% [95% CI:-8.6%; -5.4%] males vs. -4.1% [95%CI, -6.2%; -1.9%)] females).

CONCLUSIONS: Based on this work, we recommend: i) the implementation of suicide prevention schemes particularly targeted at men, aged 35–44 years old; ii) the systematic collection of data on methods of suicide, including CO poisoning; and iii) routine monitoring at more granular level at the relevant administrative unit to guide effective targeted policies.

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Keywords: Epidemiology, socio-economic factors, short-term exposure, policy

The effect of social and physical environment on mental health among elderly population; comparison between pre- and during COVID-19 pandemic

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BACKGROUND AND AIM: The social and physical environment can have a significant factor on mental health. The COVID-19 pandemic has caused widespread changes in mental health, particularly among the elderly population. The study is to investigate the change in the effect size of the relationship between the social and physical environment and mental health including depressive symptoms or perceived stress among the elderly population during the pandemic compared to the pre-pandemic period. Additionally, we stratified by urbanity to identify regional differences is these associations. METHOD: We used data from the 2019 and 2021 Korean Community Health Survey were used as a representative nationwide sample dataset. We surveyed the mental health variables including the presence of perceived stress, or depressive symptom using the Patient Health Questionnaire-9. Two social environmental variables and five satisfactions with the physical environment were assessed based on the questionnaire in participants. Multivariate logistic regression analysis was performed to explore the association between environmental variables and mental health.

RESULTS:We included data from 73,544 participants in 2019 and 71,287 participants in 2021. In the multiple logistic regression, insufficient social environment variables, including "trust of neighbors", and "exchanging help with neighbors", were significantly associated with depressive symptoms during the COVID-19 pandemic (odd ratio(OR)=2.07, 95% confidence interval(CI): 1.87, 2.28) and (OR=1.82, 95% CI: 1.65, 2.02), respectively. The OR was higher during the COVID-19 pandemic than in the pre-COVID19 period. Furthermore, there was a higher OR of depressive symptoms in rural areas than in urban areas.

CONCLUSIONS: The social and physical environment during the COVID-19 pandemic has a great psychological impact on Korean elderly population. Appropriate strategies that consider individual and community factors related to the social and physical environment are necessary to improve mental health among the elderly population.

Keywords: Social environment, Physical environment, Depression, Perceived stress, Elderly

The association between work and residential location and depressive symptoms during the COVID-19 pandemic in Hong Kong

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BACKGROUND AND AIM: The increasing poor mental health in the global population has raised concerns regarding the well-being and livability of humans. Although recent studies showed a significant association between depression and transportation, the distance between workplace and residence has rarely been analyzed. The aim of the study was to examine the association between depressive symptoms and work and residential location.

METHOD:A cross-sectional study was conducted in Hong Kong from 2022.03 to 2023.01. Social demographic information, work and residential location, and the living environment were collected from full-time workers older than 18 years old. Depression was assessed by the Hospital Anxiety and Depression Scale, with a cutoff point of 8 or higher on the subscale indicating depressive symptoms. A logistic regression model adjusting for relevant covariates was used to assess the association between depressive symptoms and work and resident location. Analyses were conducted by SAS 9.4. Ethics approval: CREC 2021.228.

RESULTS:A total of 1,432 responses were received during the study period, with 1,173 (81.9%) females and 259 (18.1%) males. The average age of the workers was 34.3 ± 8.3 years old. There were 397 (46.1%) participants who scored 8 points or higher on the depression subscale, with an average score of 7.0 \pm 3.8 points. The multivariate logistic regression model showed that working and living in different districts was not associated with depressive symptoms (OR=1.14, 95%CI: 0.83, 1.56) while living on different floors was significantly related to depressive symptoms (4-6 floors vs 11-20 floors: OR=1.85, 95%CI: 1.02, 3.34; 41+ floor vs 11-20 floor: OR=3.68, 95%CI: 1.38, 9.80). Interestingly, female workers were less susceptible to depression than male workers (OR=0.66, 95%CI: 0.44, 0.98).

CONCLUSIONS:Our findings provided preliminary evidence that the residential environment is linked to mental well-being among urban residents. During the COVID-19 pandemic, urban male workers were more depressed than females.

Keywords: Mental health outcomes, Public health, COVID-19

Advancing GReencare in Europe: a multi-scalar approach to improve Mental health Equity (the GreenME project)

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METHOD:GreenME's approach is: (i) to diagnose the current status of green care in participating countries, (ii) to increase scientific evidence on mental health and wellbeing equity in urban, semiurban, rural, semi-rural and coastal settings, and (iii) to empower green care actors by co-creating a set of tools in Sweden, United Kingdom, Spain, Italy, Germany, Poland and the United States. RESULTS:GreenME will: (a) produce a catalogue of identified successful nature-based therapy models and fruitful integrations of these therapies in green care frameworks broadly; (b) design a nature-based therapy general evaluation protocol including cost-effective analyses and health evaluation; (c) identify mental health and wellbeing impacts of nine interventions and their causal mechanisms and cost-effectiveness; (d) identify the impact on mental health equity of nature-in-everyday-life and nature-based health promotion in project study countries; and (e) enhance the European green care network and establish a training course for nature-based therapy providers.

CONCLUSIONS: GreenME will increase the use of nature-based therapy and its integration within a multi-scalar green care framework to ultimately promote just and sustainable healthy communities.

Keywords: Green space, Blue space, Mental health outcomes, Health inequalities, Environmental justice
The association of ambient temperature with depression in elderly women: a cross-sectional study from Germany

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BACKGROUND AND AIM:Depression has been recognized as a common, but serious, mental illness that is influenced by a range of environmental factors. Ambient temperature is an important environmental factor however, there is limited evidence for an association with a depressive state. This study explored the short-term association between temperature and depression in elderly women.

METHOD: We investigated 834 elderly women from the 2007–2010 follow-up of the German SALIA cohort. Self-reported frequency of depressive symptoms and cognitive performance was evaluated using the CESD-R Scale and the CERAD-Plus test. Modelled climate and air pollution data were assigned to the residential addresses. Semi parametric quasi-Poisson generalized additive regression model adjusted for potential confounding factors were used. Effect modification by season, individual characteristics, and cognition level was investigated. Single and cumulative lag effect up to 10 days was estimated. Because of inverse association relative risk (RR)<1 is considered an adverse risk. RESULTS: We observed that every 5°C reduction in the current day's average temperature was associated with a 16.7 % increase in depression (RR = 0.83, 95% confidence interval (CI): 0.77-0.90, P<0.001). Subgroup analyses showed that women with low socioeconomic conditions (RR = 0.75, 95% CI: 0.64–0. 88, P< 0.001), living in rural areas (RR = 0.80, 95% CI: 0.71– 0.91, P < 0.001), living isolated (RR = 0.76, 95% CI: 0.67-0.86, P < 0.001) and having a low cognitive function (RR = 0.81, 95% CI: 0.73–0.90, P < 0.001) were more vulnerable. Seasonal analysis showed that decrease in temperature during the winter months were more strongly and adversely associated with higher depression than summer months. Sensitivity analysis brings forth that the effect estimates varied by exposure days but remained significant up to lag 0-10 days.

CONCLUSIONS:Low temperature was inversely associated with depression in elderly women. The association is modified by season, individual specific characteristics, and cognitive performance.

Keywords: Depressive symptoms, Cognition, Aging, Ambient Temperature, Cohort

Associations between air pollution, road traffic noise and incidence of dementia in the Danish Nurse Cohort

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BACKGROUND AND AIM: Several studies suggest associations between road traffic noise and incidence of dementia. However, findings are inconsistent when air pollution, a recognized risk factor for dementia, is considered. We investigated associations between air pollution, road traffic noise and incident dementia.

METHOD: We followed 26,461 women from the Danish Nurses Cohort from baseline (1993 or 1999) to their first hospital contact or first prescription of dementia medication whichever came first until 2021 using Danish registers. Annual air pollution (PM2.5 and NO2) and road traffic noise estimates (Lden) were modelled at nurses' residential address using DEHM/UBM/AirGIS and Nord2000 models, respectively. We applied time varying Cox models to estimate associations between 10- year running mean air pollution, noise and incident dementia. Models were adjusted for baselines year, individual lifestyle, socio-economic factors and municipality characteristics.

RESULTS:A total of 1557 incident cases of dementia were during the follow up. Median exposures were 12.18 µg/m³ with interquartile range (IQR) of 5.79 µg/m³ for PM2.5, 16.51 µg/m³ (IQR 8.25µg/m³) for NO2 and 53.2 dB (IQR 9.3 dB) for Lden. We detected moderate associations between dementia incidence and PM2.5, with hazard ratio of 1.35 per IQR and 95% confidence interval (1.20-1.51), or NO2 (1.19; 1.09-1.29) and a weak positive association with Lden (1.04; 0.97-1.13). Associations with NO2 and Lden diminished when adjusting for PM2.5 with hazard ratios of 0.98 (0.86-1.12) and 0.95 (0.88-1.00) respectively.

CONCLUSIONS:Our results shows a weak association between road traffic noise or traffic related pollutants and incident dementia, which may be partially explained by the effects of PM2.5.

Keywords: Air pollution, Noise, Traffic-related, Long-term exposure, Neurodegenerative outcomes

Gender specific differences in house dust and dietary exposures to lead in preschool children

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BACKGROUND AND AIM: Children exposure to lead (Pb) are through microenvironmental environment and dietary food. Our objective was to investigate (1) sex-specific differences in internal Pb exposure based on biomarkers measurements among preschool children in northern Taiwan; (2) external Pb exposure from ingestion and dermal contact route through household dust and dietary food; (3) sexspecific differences in the relationship between internal Pb exposure and external Pb exposure; (4) specific contribution of exposure source for Pb exposure.

METHOD:Internal Pb exposure dose based on hair and fingernails measurement collected from 359 children under 6 years of age living in northern Taiwan between August 2019 to July 2021. The potential non-carcinogenic risk through ingestion and dermal contact from household dust and dietary food were assessed by using the potential risk indicators hazard quotient (HQ) and hazard index (HI). We also assess sex-specific differences in the relationship between internal Pb exposure dose and HQ. Pb concentrations in biomarkers, dietary foods and household dust were analyzed using inductively coupled plasma-mass spectrometry (ICP-MS) and a flame atomic adsorption spectrometry (FAAS). RESULTS:The geometric mean \pm geometric standard deviation Pb concentrations in children's hair and fingernails were 1.28 ± 2.63 and 0.81 ± 2.04 µg/g, respectively. We demonstrated sex-specific differences in hair and fingernail Pb concentrations among preschool children. Hair Pb concentrations in boys were lower than those in girls, whereas fingernail Pb concentrations in boys were higher than those in girls. HQ for ingestion of household dust was significantly correlated with hair Pb concentrations of household dust was the main contributor to non-carcinogenic risk for younger children's exposure to Pb.

CONCLUSIONS: Keeping cleaner residential environment could potentially reduce Pb exposures from ingestion of indoor dust and thus mitigate health risks to preschool children from Pb exposures.

Keywords: Lead, Children, Dust, Dietary food, Risk assessment

The association among organophosphate pesticide exposure, genetic polymorphisms and methylation of paraoxonases I in children with ADHD

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BACKGROUND AND AIM: The present study determines whether changes in paraoxonases I (PON1) DNA methylation levels due to organophosphate pesticide (OP) exposure and genetic polymorphism could increase attention-deficit/hyperactivity disorder (ADHD) risk in children.

METHOD:A total of 181 children participated in this case-control study, including 85 children with ADHD and 96 children as control. Urinary concentrations of OP metabolites, dialkyl phosphate (DAP), including dimethyl alkylphosphate (DM) and diethyl alkylphosphate (DE) were analyzed by using gas chromatography-mass spectrometry (GC-MS). The changes in DNA methylation levels in the proximal promoter region of PON1 were examined by pyrosequencing.

RESULTS:Children with ADHD had lower methylation levels (22 out of 25 CpG sites; 43.14±11.44 % vs. 50.19±13.74 %, p-value<0.05) than the control children. A negative association between OP metabolites and mean methylation levels (β =-0.06, p-value<0.05). The methylation levels exhibited significant difference among 46 PON single nucleotide polymorphisms (SNPs).

CONCLUSIONS: It is warrant to investigate the changes in PON1 methylation and neurobehavioral development in children.

Keywords: Attention deficit hyperactivity disorder, Organophosphate pesticides, Paraoxonases, Methylation

Determining Subpopulations of Children with Multiple Health Outcomes using Unsupervised Clustering and Examining Associations with Prenatal Phthalates

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BACKGROUND AND AIM:An outcome-wide epidemiologic approach may indicate common etiologic mechanisms and lead to better identification of efficient public health interventions. Our objective was to identify clusters of chronic respiratory, obesity-related, and neurodevelopmental outcomes in children and to examine associations between cluster membership and phthalate exposures. METHOD:In three prospective pregnancy cohort studies (ECHO PATHWAYS), we clustered 15 health outcomes for 1092 children. Outcomes included age 8-9 BMI z-score, full-scale IQ, anxiety score, irritability score, depression score, five behavioral problem subscale scores (social, thought, attention, externalizing, and internalizing problem scores), and parent-reported ever asthma, wheeze, allergies, speech problems, and learning disabilities. To form generalizable clusters across study sites, each variable was regressed on study site (n=7), and scaled residuals were clustered using k-means clustering. Logistic WQS regressions with permutation test p-values associated odds of cluster membership with a mixture of 14 late pregnancy maternal urinary phthalate metabolites in full-sample and sex-stratified models.

RESULTS:Three clusters emerged, including a healthy cluster 1 (n=669) with low scores and prevalences of all outcomes; cluster 2 (n=244) with high asthma, wheeze, and allergy frequencies; and cluster 3 (n=179) with relatively high scores for all outcomes. When restricting to boys in the sexstratified analysis, there was a significant positive association (odds ratio = 1.38; p=0.01) between a phthalate mixture with higher weights for MCIOP, MEOHP, MEHHP, MCINP, and MEP and odds of membership in cluster 2 versus the healthy cluster 1.

CONCLUSIONS: These results identified subpopulations of children with co-occurring health outcomes, including relatively high levels of BMI, respiratory, and neurodevelopmental outcomes that may reflect a shared etiologic pathway, and our findings indicate a positive association between primarily higher molecular weight phthalates and the probability of membership in a cluster with high asthma, wheeze,

and allergies. This analysis demonstrates a viable strategy for outcome-wide epidemiology in multistudy pediatric cohorts.

Keywords: Co-infections and co-morbidities, Asthma, Mental health outcomes, Obesity and metabolic disorders, Phthalates

Exposure to polychlorinated biphenyls (PCBs) and cognitive development of pre-school aged children

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BACKGROUND AND AIM: The aim of this study was to assess the effect of prenatal and postnatal exposure to polychlorinated biphenyls (PCBs) on the cognitive development of children at 6 years. METHOD: PCB congeners were analysed in samples of cord blood and blood of 6 years old children from PCB cohort (Eastern Slovakia) using high-resolution gas chromatography. The Wechsler Preschool & Primary Scale of Intelligence (3rd Edition) psychological test was used to assess the cognitive development of children (n=177). Associations between the sum of dioxin-like (DL) and non-dioxin-like (NDL) PCB congeners and verbal (VIQ), performance (PIQ), and full-scale IQ (FSIQ) were analysed using multiple linear regression. The final models were adjusted for maternal education, ethnicity, and HOME scores and model for prenatal exposure was also adjusted for maternal age and parity.

RESULTS:Prenatal exposure to DL PCBs was associated with lower VIQ (β = -1.32 CI95% [-2.51; -0.12]), PIQ (β = -1.91 CI95% [-3.40; -0.42]), and FSIQ (β = -1.50 CI95% [-2.58; -0.42]). Postnatal DL PCB exposure was associated with lower VIQ (β = -1.58 CI95% [-2.82; -0.33]) and FSIQ (β = -1.38 CI95% [-2.48; -0.28]) but not with PIQ. Regarding NDL PCBs, postnatal exposure was associated with lower FSIQ (β = -1.01 CI95% [-1.92; -0.11]) and VIQ (β = -1.27 CI95% [-2.25; -0.30]), however, no significant association was observed for prenatal exposure to NDL PCBs. Analysis of WPPSI-III verbal subtests showed the associations between postnatal NDL and DL PCB exposure and lower scores in the Vocabulary and in the Word Reasoning subtests.

CONCLUSIONS: We found the negative effect of PCB exposure on child's cognitive development particularly visible in the verbal area. Our results suggested that both, prenatal and postnatal exposure to PCBs, may influence the cognitive development of young children, even when the PCB exposure is decreasing over time.

Keywords: Children's environmental health, Endocrine disrupting chemicals, Chemical exposures, Outcomes

OP-366[Exposures » Other (to be specified with keywords in the keywords section)]

Exposures, investigations, and outcomes for children with elevated blood lead reported to Health Protection Teams in England, 2014-2022

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BACKGROUND AND AIM:Lead is a non-threshold contaminant with children being most vulnerable to its effects. In England, children (\leq 16 years) with elevated blood lead are notified via UK Health Security Agency's (UKHSA's) Lead Exposure in Children Surveillance System (LEICSS) to regional Health Protection Teams (HPTs) for management. To date, a detailed review of these cases has not been conducted.

AIM: Describe demographics, settings and potential sources of lead exposure, public health investigations, and clinical outcomes for children with elevated blood lead reported to HPTs for management in England between 2014 and 2022.

METHOD:Data was collected using a lookback and live questionnaire with case managers. Data was extracted from Select Survey, deduplicated, and cleaned and analysed in R studio.

RESULTS: The completion rate for the lookback questionnaire was 74%. Overall, 340 children were reported to HPTs and had a completed questionnaire. Most were aged 1-4 years (53%), male (69%) and lived in the most deprived areas (31%). Ethnicity information was largely missing (61%) but White British was most cited (16%). Paint (43%) and soil (29%) were the most common exposure sources. Pica was recorded in 76% of cases. Where recorded (n=241), the primary exposure setting was domestic (92%) and exposure source was confirmed for 16%. A site visit was conducted for 50% of cases, mostly (87%) by local authority public health staff. Advice was the most common control measure (59%), however, 63% received paediatric/outpatient care. Where recorded (n=99), cases reportedly lived in older (43%), rented (63%) homes (37% renting privately).

CONCLUSIONS:Lead exposure was mostly linked to the domestic environment with those living in the private rented sector being most vulnerable. This sector should be a target for engagement and preventative intervention. Capturing ethnicity data consistently can aid identification of groups disproportionately affected by lead exposure due to the link between ethnicity, deprivation, and housing.

Keywords: lead (Pb) exposures, childhood, inequalities, public health management

Children's exposure to DEHTP, DINCH and DEHA: Results from the Hokkaido Cohort Study

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BACKGROUND AND AIM:Due to legacy phthalates such as di-2-ethylhexyl phthalate regulation, the production and use of phthalate substitutes such as di-2-ethylhexyl terephthalate (DEHTP) and 1,2-cyclohexane dicarboxylic acid diisononyl ester (DINCH) have increased. However, data on human exposure is scarce, particularly in susceptible children. Thus, we investigated alternative plasticizers such as DEHTP, DINCH, and di(2-ethylhexyl) adipate (DEHA) exposure trends in school-aged children. METHOD:Japanese children aged 7 years old from an ongoing perspective Hokkaido birth cohort participants were included in this study. In total 180 urine samples collected from 2012 to 2017 (30 samples/year) were used to quantify 10 metabolites of DEHPT, DINCH, and DEHA using isotope dilution LC-MS/MS. Exposure trends were examined using a linear regression model and estimated daily intake (EDI) was calculated.

RESULTS:DEHTP and DINCH metabolites were detected in more than 90% of the children. The highest concentration was observed in DEHTP metabolite mono(2-ethyl-5-carboxypentyl) terephthalate with a median of 1.36 μ g/L. Among DINCH metabolites cyclohexane-1,2-dicarboxylic acid mono(hydroxy-isononyl) ester showed high median of 0.2 μ g/L. While DEHA metabolite, mono-5-carboxy-2-ethylpentyl adipate was detected in only 2 children. Compared to children in the US, German, and Thailand, Japanese children seem to have lower exposure to DEHTP and DINCH metabolites. In this study period, a 5-fold median increase was observed in 5cx-MEPTP with 2.72 μ g/L in 2017 compared to 0.54 μ g/L in 2012 and all DINCH metabolites showed a 2-fold increase. The maximum EDI in μ g/kg bw/d was 3.47, 3.58 for DEHTP and DINCH respectively were 300 times below tolerable daily intake by EFSA, and the maximum metabolites level also were lower than German Human Biomonitoring reference values.

CONCLUSIONS: Japanese children are increasingly exposed to phthalates substitutes DEHTP and DINCH, which may indicate market changes due to legacy phthalates regulation in Japan. The increasing exposure warrants future biomonitoring studies in a larger and more diverse population.

Keywords: Phthalates alternatives, DINCH, DEHTP, Chemical exposures, children

Patterns of occupational exposure to disinfectants and cleaning products among healthcare workers: the CONSTANCES cohort

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BACKGROUND AND AIM: Epidemiological studies have identified cleaning and disinfecting activities as important risk factors for respiratory health among healthcare workers. Questions remain about specific causal agents associated with higher exposure level within occupations. Clustering methods are useful to better characterize exposures and account for their multidimensional aspects. We aimed to identify occupational exposure patterns to disinfectants and cleaning products (DCPs) using unsupervised clustering methods among healthcare workers.

METHOD:CONSTANCES (https://www.constances.fr/index_EN.php) is a French population-based cohort of >220,000 adults (18-69 years) at inclusion (2012-2020). Among them, 5544 healthcare or medical laboratory workers completed in 2022 a self-questionnaire on their occupation, workplace, cleaning and disinfection activities, including surfaces and materials cleaned, products used (e.g., glutaraldehyde, quaternary ammonium compounds, hydrogen peroxide), their frequency, form, and duration of use. All these categories of variables were used in multiple correspondence analysis, followed by hierarchical agglomerative clustering and k-means algorithms, to identify occupational exposure patterns.

RESULTS: The participants were on average 53 years old, 86% were women, 44% nurses, and 84% used at least one DCPs weekly. Four clusters were identified: cluster 1 (C1, n=2448, 44%) mainly characterized by unexposed nurses (42%) and physicians (29%), C2 (n=349, 6%) mainly characterized by medical laboratory staff (81%) moderately exposed to the main DCPs (chlorine/bleach, alcohol), C3 (n=2220, 40%) mainly characterized by nursing assistants (31%) and nurses (52%) highly exposed to a few DCPs (mainly quaternary ammonium compounds), and C4 (n=527, 10%) mainly characterized by nurses (51%) highly exposed to multiple DCPs including alutaraldehyde, hydrogen peroxide, acids, enzymatic cleaners.

CONCLUSIONS: We identified four patterns of DCPs exposures among healthcare workers. Results suggest that, although nursing jobs are heterogeneous, nurses and nursing assistants are the most highly exposed in terms of frequency and quantity of products. Analyses on the associations between these patterns and asthma outcomes are ongoing.

Keywords: occupational exposure, clustering, healthcare workers, Constances cohort, DCPs

Amyotrophic lateral sclerosis survival and occupational lead exposure in the Danish National Patient Registry

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BACKGROUND AND AIM:Risk factors associated with amyotrophic lateral sclerosis (ALS) survival are not well understood. Lead is a known neurotoxicant, but only few studies have examined its effect on ALS survival. We investigated the relationship between occupational lead (Pb) exposure and ALS survival using the Danish registry system.

METHOD: We identified 750 ALS cases diagnosed between 1982-2009 with full employment history, and at least two ALS diagnoses, one of them being in an inpatient setting. Cases were followed until March 1, 2017, or until censored. We examined Pb exposure as ever/never exposed, based on a Danish job-exposure matrix, and divided cumulative exposure into tertiles. We evaluated survival using Cox proportional hazard models with Pb exposure (no lag, 5-year lag, and 10-year lag), stratified analyses by sex, and adjusted for age, socioeconomic status, marital status, and diagnosis year.

RESULTS:Median survival and age at diagnosis of ALS cases was 23.9 months and 55 years, respectively, and did not differ by sex. Survival was significantly worse for women ever exposed to Pb (no lag hazard ratio (HR): 1.39; 95% CI: 1.04-1.86) compared to non-exposed women, and this was similar with either a 5 or 10 year lag period. HRs were also elevated in tertiles of cumulative exposure, with the ten-year lagged exposure showing an increasing dose-response relation. The HR in tertiles 1, 2, and 3 of exposure were 1.19, 1.35, and 1.49, respectively. No associations were seen among men. CONCLUSIONS:Occupational lead exposure contributed to shorter survival among women with occupational Pb exposure, while no association was seen among men. Our study adds to three others, one of which observed higher HRs among women. The lagged analysis results could suggest some healthy-worker survivor bias among women or that earlier lead exposures before ALS onset are more relevant for survival. Supported by T32ES007069, P30ES000002, and R01ES019188.

Keywords: Heavy metals, occupational exposures, survival

Night shift work and female breast cancer: a two-stage dose-response meta-analysis for the correct risk definition

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BACKGROUND AND AIM: The hypothesis of this study is night shift work exposure can increase the risk of female breast cancer. To validate this hypothesis, the author conducted a two-stage dose-response meta-analysis with improved quality on this topic.

METHOD:The medical librarian searched PubMed, EMBASE, and the Cochrane Library on 30th December 2022. The 8 inclusion criteria were determined and strictly applied to the selection process. RESULTS:Finally, 10 cohort studies (12 cohort reports, total cases: 18086, and total person-years: 7987557) and 16 case-control studies (16 case-control reports, total cases: 17805, and total controls: 21184) were included.The pooled RR of female breast cancer for 1, 10, 20, and 30 years of night shift work exposure was 1.0042 (95% CI 1.0015-1.0069), 1.0428 (95% CI 1.0151-1.0712), 1.0873 (95% CI 1.0303-1.1475), and 1.1338 (95% CI 1.0459-1.2292), respectively. The pooled OR of female breast cancer for 1, 10, 20, and 30 years of night shift work exposure was 1.0279 (95% CI 1.0143-1.0417), 1.3171 (95% CI 1.1530-1.5044), 1.7346 (95% CI 1.3294-2.2633), and 2.2846 (95% CI 1.5328-3.4051), respectively.

CONCLUSIONS: This study (i) strictly applied 8 transparent inclusion criteria, and (ii) thoroughly separated RRs from cohort studies and ORs from case-control studies and synthesized each type of effect estimates separately. In addition, (iii) exposure dose (years of night shift work) was clearly defined in evidence synthesis based on the years of night shift work reported in individual studies. Finally, (iv) the author applied a new two-stage dose-response meta-analysis method reported in recent literature. Therefore, this study will be the best evidence regarding this topic, and the results reported in this study will be the most accurate and up-to-date risk definition for breast cancer according to years of night shift work exposure.

Keywords: Night shift work, Breast cancer, Dose-response meta-analysis, Cohort studies, Casecontrol studies

Investigation of Mask Protection Efficiency and associated Respiratory Deposition in Occupational Aerosol Exposure for Dental Hygienists

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BACKGROUND AND AIM: During the pandemic, there was a great concern among dental hygienists regarding being infected by the aerosol generated from dental cleaning processes. To protect themselves, dental hygienists applied various types and different layers of masks. This research attempted to systematically study the mask protection efficiency of common masks and the associated mask application combinations used by dental hygienists and the associated aerosol lung deposition. METHOD: The test masks were surgical and N95 masks with four often-applied combinations (surgical, N95, 2x surgical, and Surgical + N95). Dental cleaning aerosol was generated by a professional dental ultrasonic scaler working on a dental typodont. The recently developed Mobile Aerosol Lung Deposition Apparatus (MALDA) was applied to acquire experimental data. MALDA consists of a set of 3D-printed human airway replicas and an aerosol particle sizer. With the particle size distributions measured both in the oral airway and TB airways under conditions w/ and w/o mask-wearing, the mask protection efficiency and the aerosol respiratory deposition in the upper airways can be systematically estimated. RESULTS: Experimental data obtained showed that test masks with different combinations could filtrate 87% to 96% (size-averaged) of the aerosol generated from the dental cleaning process. The mask protection efficiency increased as the aerosol size increased. The N95 had the lowest mask protection efficiency shown at the small aerosol size range (70% at 0.5 μ m) compared to all the other mask combinations. The respiratory deposition results showed that the aerosol deposition fraction in the upper airways decreased as the aerosol size increased. Less than 5% of the aerosol larger than 1 µm was found deposited in the human head-to-TB airways.

CONCLUSIONS: Data acquired in this study suggests that 2 layers of surgical masks would be sufficient to provide reasonable protection efficiency against dental cleaning aerosol and significantly reduce aerosol respiratory deposition in the upper airways.

Keywords: Dental cleaning, Aerosol, Mask protection efficiency, Aerosol respiratory deposition

Noise exposure and acute changes to monitored heart rate among electronic-waste recycling workers

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BACKGROUND AND AIM:Globally, about 83% of 53.6 million tons of electronic-waste (e-waste) was landfilled, incinerated, or informally recycled in 2019. Informal recycling workers manually dismantle and sort e-waste, often in hazardous conditions without proper protective equipment. Noise, as one of the hazardous exposures they suffer from, causes hearing loss and increases the risk of adverse cardiovascular events. This analysis evaluated how acute occupational noise as a stressor changes individual's heart rate (HR) during e-waste recycling work.

METHOD: Time-series noise level and HR, both measured at 1-min intervals, were collected in crosssectional studies in Thailand and Chile from 126 adult participants. Equivalent sound level (Leg) and its change from previous minutes (dLeg) were the primary exposures. Outcomes, including HR above baseline, HR elevation (change in magnitude) and HR increase (change in quantity) were calculated using Monte-Carlo simulation. Three mixed-effect time series regression models were fitted respectively to each outcome, controlling for work tasks, time of the day, stress, and demographics. All models assigned participant ID as a random intercept to account for within-person correlation and interpersonal variations. Additionally, the analysis investigated lagged responses up to three minutes. RESULTS: Noise had an immediate effect on HR at 1min resolution. A 10dB increase in Leg was associated with a 5.9 beat per minute increase in HR above baseline, a 5% higher risk of HR elevation, and 6% higher odds of increased HR than previous minute. The concurrent effect of dLeg was nonlinear, with more HR changes when $dLeq \ge 12dB$, and less to no changes otherwise. CONCLUSIONS: Doubling the perceived loudness (dLeq=10dB), not sound energy (dLeq=3dB), induced significant HR changes. This phenomenon supports the theory that perceived noise-induced stress affects HR through neuroendocrine systems. Reducing acute noise exposure for informal e-waste recycling workers is critical to lower the risk of stroke, myocardial infarction, and other cardiovascular diseases.

Keywords: Cardiovascular diseases, Short-term exposure, Occupational exposures

Impact of occupational heat exposure on blood lipids among petrochemical workers: An analysis of 9-year longitudinal data

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BACKGROUND AND AIM: To analyze the impact of occupational heat exposure on dyslipidemia in petrochemical workers and identify susceptible groups.

METHOD:A total of 30,847 workers' occupational health examination data from 2013 to 2021 were collected from two petrochemical plants, including demographic characteristics, occupational exposure history, and testing results of blood lipids including total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and triglyceride (TG) levels. Generalized estimating equations (GEE) model was used to analyze the impact of heat exposure alone or coupled with other occupational hazards (e.g., gasoline) on workers' blood lipids, after adjusting for confounders.

RESULTS:The one-factor exposure model shows that most of the individual occupational hazard were significantly negatively associated with dyslipidemia. The two-factor exposure model showed that heat stress coupled with gasoline (Incidence Rate Ratio, IRR=1.267, 95%CI 1.117-1.437), heat with hydrogen sulfide (IRR=1.324, 95%CI 1.166-1.505) significantly increased the risk of high TC. Stratified analysis revealed that in the model of heat and gasoline double exposure, women (IRR=2.240, 95%CI 1.639-3.062), aged over 35 (IRR=1.317, 95%CI 1.158-1.497), non-smoking (IRR=1.536, 95%CI 1.285-1.836), and non-alcohol drinking (IRR=1.587, 95% CI 1.276-1.973) were more likely to have heat-related high TC. While in the model of heat and hydrogen sulfide double exposure, women (IRR=2.347, 95%CI 1.736-3.173), aged over 35 (IRR=1.385, 95%CI 1.215-1.578), non-smoking (IRR=1.602, 95% CI 1.344-1.911), and non-alcohol drinking (IRR=1.647, 95%CI 1.323-2.051) were also more likely to have heat-related high TC. Heat exposure coupled with nitrogen oxides, sulfur dioxide, benzene, methanol, and carbon monoxide double exposure had no significant impact on dyslipidemia.

CONCLUSIONS: The impact of heat and other petrochemical hazards on blood lipids may be affected by healthy worker effect. Heat exposure combined with gasoline or hydrogen sulfide can significantly increase the risk of dyslipidemia. Health interventions should pay more attention to female workers aged over 35 years without smoking and drinking.

Keywords: Big data, Temperature, Occupational epidemiology, Occupational exposures, Climate

PECHA KUCHA ORAL ABSTRACTS

Association between Temperature and Mental Health Work Loss: Evidence from Santiago, Chile

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BACKGROUND AND AIM: The temperature has been shown to have an impact on mental health-related mortality, hospital admissions, and emergency visits. However, the magnitude of the association with work loss is still being researched. This study aims to assess the relationship between mental health-related medical leaves and daily temperature in the Metropolitan Region of Santiago, Chile. METHOD: Daily maximum temperature and wet bulb global temperature (WBGT) were obtained from a centrally located weather station. Also, the daily maximum temperature for each of the 52 communes of the region was obtained from a 5x5 km grid estimate (CR2met). Individual medical leave authorizations for working-age people were obtained from the National Health Fund (FONASA), which covers 77% of the population. The analysis was performed for the summer (Dec-Feb) of 2018, 2019 and 2020. A Poisson Distributed Lag Non-Linear Model (DLNM) was used at two aggregation levels: 1) time series analysis for the whole region, and 2) case times series at the commune level. Eleven subgroups of mental health-related diagnosis (subgroups of the ICD10 chapter V) were considered. Extreme heat was defined at 35°C (regional extreme heat alert) and excess risks were computed with respect to a baseline of 32°C.

RESULTS:For the time series method, all mental health causes (F00-F99) were significantly associated with WBGT (RR= 1.16; 95% CI: 1.06-1.27), but not with plain ambient temperature. For the case time series design, 3 groups of causes showed a significant association with daily maximum temperature: all mental health causes with 1.13 (1.07-1.20), organic mental disorders (F00-F09) with 1.42 (1.14-1.75), and mood disorders (F30-F39) with 1.17 (1.07-1.28).

CONCLUSIONS: Mental health work absences were associated with daily temperature. Thermal stress indicators and case time series design improved results and should be used in future studies. Authorities and private firms should be aware of this kind of effect to implement appropriate measures.

Keywords: Climate, Temperature, Mental health outcomes

The influence of the weather on adolescent airway inflammation

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BACKGROUND AND AIM:Fraction of exhaled Nitric Oxide (FeNO) is a marker of eosinophilic airway inflammation. We examined the main effects and interactions of low-level short-term air pollutants (AP), temperature and relative humidity (RH) on lung inflammation (FeNO) in adolescents. METHOD:A total of 2042 participants were included from the 15-year follow-up of the GINIPlus and LISA birth cohorts in Munich and Wesel, Germany. Low-level short-term AP exposure was assessed as daily average concentrations of ozone (O3), nitrogen dioxide (NO2) and particulate matter <2.5µm (PM2.5) at 0.2 km spatial resolution. Daily meteorological data (maximum [Tmax], minimum [Tmin] and mean [Tmean] temperatures, and RH) were obtained from the German Weather Service. FeNO measurements were made with a handheld device following published guidelines. General linear models were fitted with Ln(FeNO) as the outcome.

RESULTS:Increased FeNO was associated with a decrease in RH and temperature. The interactive effects between RH and temperature (Tmin p=0.001, Tmax p<0.001, Tmean p=0.001), and air pollutants (NO2 p=0.029, O3 p=0.019) also showed an increase in FeNO. The association was consistently high in the cold season (p<0.050). The effect modification showed females, participants without respiratory conditions and those living in Munich were more sensitive to interactions of RH with temperature and pollutants.

CONCLUSIONS: Weather variables are more closely associated with adolescent lung inflammation than low-level short-term AP.

Keywords: Air pollution, Climate, Temperature, Short-term exposure, Epidemiology

The association between living near wildfire before and during pregnancy and congenital heart disease risk in offspring

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BACKGROUND AND AIM: California wildfires have increased in frequency, duration, and intensity in the past couple of decades and produced air pollutants that have been associated with complications during pregnancy. Congenital heart defect (CHD) is the most common birth defect, which affects approximately 1% of live births. The purpose of this study is to determine the] association between wildfire exposure before and during pregnancy and the odds of CHD in the offspring.

METHOD: This was a retrospective cohort study using the California Office of Statewide Health Planning and Development Linked Birth File and the California Department of Forestry and Fire Protection data between 2007 and 2010. Pregnancies complicated by two most common CHDs were identified by the International Classification of Diseases Clinical Modification, 9th Revision (arterial septal defect (ASD) 745.5 and ventricular septal defect (VSD) 745.4). Pregnancies were considered exposed to wildfire smoke if the mother's primary residence zip code was within 15 miles of the closest edge of a wildfire and was further broken into first, second, and third trimester, or within four weeks before the last menstrual period.

RESULTS:Between 2007 and 2010, 1,904,344 births were analyzed in the study. Among these 38,182 were diagnosed with ASD and 19,383 were diagnosed with VSD. Compared to births without wildfire exposure, those with first, second, and third-trimester exposure were associated with a higher risk of ASD with adjusted risk ratio (aRR) of 1.12 (95% confidence interval (CI): [1.05 - 1.19]), aRR of 1.14 (95% CI: [1.08 - 1.2]) and aRR 1.08 (95% CI: [1.02 - 1.15]), respectively. Pre-pregnancy wildfire exposure was not associated with ASD risk. No significant association was found between prenatal wildfire exposure and VSD risk.

CONCLUSIONS: Wildfire exposure during pregnancy appears to increase the risk of developing arterial septal defect risk but not ventricular septal defect risk in the offspring.

Keywords: wildfire, congenital heart disease, arterial septal defect

Future climate change impacts on child health: An assessment of preterm-births, diarrheal cases and heat-related mortality for 20 African cities

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BACKGROUND AND AIM: Climate risks are known to affect child health. We quantified the impact of climate scenarios on annual heat-related child deaths, child diarrheal disease cases, and preterm births in 20 of the fastest growing cities in Africa.

METHOD: We estimated the impact of the current (2020) and future (2050) high temperatures on three outcomes for child health under 5s (all-cause mortality, diarrhoeal disease incidence, and preterm birth) in 20 African cities, using linear threshold models. From 32 CMIP6 climate models, the data were extracted for each city and three emission scenarios (SSP119, SSP245, SP585). Exposureresponse functions were taken from published meta-analyses. We used daily mean temperature for each day between 2020 and 2050. The SSP2 (middle-of-the-road) population projection was used for future populations and the global burden of disease (GBD) national projections (GBD study 2019) in mortality, diarrheal disease and preterm birth accounted for future health improvement. RESULTS: A significant increase in annual heat-related under-5 mortality over the next 30 years was observed in all scenarios (up to 61% under ssp245, and up to 102% under ssp585) in 2050 compared to 2020, except under SSP119. Heat related deaths were avoided by going from high to low emissions scenarios. Population growth was the largest contributor to changes in heat related mortality compared to changes in climate and all-cause mortality rate. While diarrhoea cases decline in all cities (because of projected improvements in treatment and prevention), preterm birth cases increased between 2-92% under SSP119, 2-200% under 245, and 10-275% under SSP585 by 2050. CONCLUSIONS: Our results indicate that climate change is likely to have a significant impact on child health. Our findings support the need for urgent mitigation and adaptation measures that are focussed on protecting the health of children.

Keywords: Children's environmental health, climate, mortality, temperature variability, temperature extremes

PK-005[Climate » Temperature extremes and variability]

Heat-Wave and Cold-Spell Vulnerability Analysis by Physical and Cognitive Functions: A Prospective Longitudinal Cohort Study in China

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BACKGROUND AND AIM: There is limited evidence regarding the interaction between individual behavioural characteristics and temperature-related premature death. We aimed to investigate the short-term effects of heat-waves and cold-spells on elderly mortality by physical and cognitive functions.

METHOD: We conducted a longitudinal cohort study utilizing the Chinese Longitudinal Healthy Longevity Survey (CLHLS, 2008-2018). Our study population consisted of age groups (>65, >80, and >100 years). Heat-wave events were defined as three or more consecutive days with daily minimum temperature exceeding the 95th percentile (May to September), while cold-spell events were defined as three or more consecutive days with a daily maximum temperature below the 5th percentile (November to March). Demographic and socio-economic data, as well as physical (Activities of Daily Living, ADL; Instrumental Activities of Daily Living, IADL) and cognitive function (Mini-Mental State Examination, MMSE), were also collected. We used time-dependent Cox proportional hazard models, adjusted for possible confounders including age, sex, administrative region, urban or rural residence, co-residence, air pollutants (PM2.5 and ozone), and green and blue space around the residential locations.

RESULTS:We followed 11,903 participants for 64,372.42 person-year (median baseline age: 86.87, 57.43% female). Both the occurrence of heat-wave day (HR: 1.33, 95% CI: 1.09, 1.60) and cold-spell day (HR: 1.28, 95% CI: 1.10, 1.49) were associated with increased premature mortality compared to normal days. High age was a risk factor of heat-wave (HR: 1.05, 95%CI:1.04, 1.06) and cold-spell (HR:1.34, 95%CI:1.13, 1.57). Individuals with severe ADL impairments were the most vulnerable to the short-term effects of heat-waves (HR: 2.13, 95% CI: 1.71, 3.86). Those needing partial help getting dressed were the most vulnerable subgroup to heat waves (HR:5.41, 95% CI:1.58, 18.56). CONCLUSIONS:It is crucial to understand the individual behavioural characteristics contributing to increased or decreased risk for mortality associated with extreme temperature; we found specific disabilities for public health interventions.

Keywords: vulnerability, heat-wave mortality, cold-spell mortality, physical function, cognitive function

Gender and seasonal different effects of temperature in Hand, foot, and mouth disease: A distributed lag non-linear model

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BACKGROUND AND AIM:High temperatures and vulnerabilities in children's health are known, but few studies have been conducted. Hand, foot, and mouth disease (HFMD) is an infectious disease that mainly occurs in children in summer, and the risk may increase due to climate change. This study aimed to evaluate the association between daily apparent temperature (AT) and HFMD in children. METHOD:We collected daily counts of hospital admission for HFMD in young children (0-4 years) living in Seoul, South Korea, from 2015 to 2020. Distributed lag non-linear model (DLNM) with quasi-Poisson was conducted to quantify the effects of daily AT on HFMD. We considered for the lag period to 4, 7, 14, and 21 days. All models adjusted for time trend, day of weeks, and pandemic period (COVID-19). Stratified analysis by gender and season were conducted.

RESULTS:A total of 5,526 counts of hospital admission for HFMD were obtained during the study period. Children's HFMD hospitalizations showed the highest frequency in July. The mean daily (standard deviation (SD)) number of children HFMD hospitalizations and AT (°C) is 2.5 (4.6), 13.2 (11.9), respectively. We found a non-linear association between daily AT and hospital admission for HFMD. In the model considering lag periods 4, 7 and 14, the overall effect was peaking at the 38°C (Relative risk [RR]: 2.20, 95% Confidence intervals [CI]: 1.43, 3.37), 34°C (RR: 2.26, 95% CI: 1.32, 3.86), 33°C (RR: 2.55, 95% CI:1.16, 5.67) of AT as compared to the 50th percentile of AT, respectively. As the lag days increased, there was no association between AT and hospitalization for HFMD. We found significant differences in the stratified analysis by gender and season. CONCLUSIONS:Our findings suggest that increased apparent temperatures are associated with hospital admission for HFMD in children. The shorter the lag period, the stronger the association between AT and hospitalization for HFMD.

Keywords: Children, HFMD, time-series, high temperature, Korea

Disparities in healthcare resources associated with heatwave-related mortality in 7 major cities of South Korea

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BACKGROUND AND AIM: Health equity begins with creating equal opportunities for people with equal needs to access necessary healthcare resources. To address the equity issue in climate change, this study examined the relationship between heatwave-mortality risk and regional disparities in healthcare resource allocation.

METHOD: We collected daily time-series data on mean temperature and all-cause mortality for all 74 districts (shi/gun/gu) in seven metropolitan cities in South Korea from 2011 to 2019, from real-time re-analysis data of Korea Meteorological Office and from National Statistics Office, respectively. Heatwave days were defined as the occurrence of daily mean temperature above the 95th, 97.5th, or 99th percentile of the temperature distribution for two or more consecutive days for each district. Data on district-level healthcare resources were collected from the Korea National Statistics Office during the study period. For data analysis, we first estimated the district-specific heatwave-mortality risk using a distributed lag model and subsequently performed a meta-regression to estimate the association between healthcare resources and heatwave-mortality risk.

RESULTS:We found that higher number of hospital beds per 100,000 people and emergency room utilization rate within the standard time were associated with lower risk of heatwave-related mortality. While stronger association with the number of hospital beds was shown in people aged 0–64 years compared to the elderly (change in RR of -14.1% (95% CI -24.4%, -2.3%) vs. -1.2 % (95% CI - 8.7%, 6.9%) per IQR increase, with definition of heatwave days above the 95th percentile), the association with timely emergency room utilization was more evident in the elderly (change in RR of - 5.4% (95% CI -17.9%, 8.9%) vs. -9.7% (95% CI -17.7%, -1.0%) per IQR increase, with definition of heatwave days above the 97.5th percentile).

CONCLUSIONS: This study provides epidemiological evidence to support public health policy that can address the importance of healthcare resource allocation to reduce heatwave-related mortality.

Keywords: Environmental disparities, Temperature, Mortality

PK-008[Climate » General]

Large Scale Climate teleconnections and Indicators and Impact on human health and well being

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BACKGROUND AND AIM:Large-Scale Climate Indicators (LSCI) describe the intricate connections between the atmosphere, oceans, and continents within specific regions. Prior research has established a correlation between these indicators and atmospheric and climate variations. Despite the significance of climate and health as a research topic, few studies have explored the direct link between these indicators and human health and well-being. The objective of this study is to investigate the LSCI in the Mediterranean region and assess the impact of the most relevant indicators on human health and well-being. Specifically, this study seeks to enhance our understanding of the LSCI and their effect on air pollution and skin temperatures in the Mediterranean region. METHOD:This study gathered data on LSCI, as well as reanalysis data on skin temperature and PM10, over the Mediterranean region from the past two decades. The trends in the datasets were analyzed using Theil and Sen's slope, and correlations between the time series were estimated on both an annual and seasonal basis using the Spearman coefficient.

RESULTS: The study identified four key LSCI that affect the Mediterranean region: the North Atlantic Oscillation (NAO), the Mediterranean Oscillation (MO), the East Atlantic pattern (EA), and the Saharan Oscillation (SaO). These indicators were found to be interrelated, and at both annual and seasonal scales, significant correlations were found between the indicators and PM10 and skin temperatures in the Mediterranean region.

CONCLUSIONS: The study findings suggest that large-scale atmospheric processes partly explain skin temperature, thermal comfort, and the impacts of particulate pollution on human health in the Mediterranean region. Furthermore, there is potential for exploring the relationships between LSCI and climate and environmental extremes. Understanding large-scale atmospheric circulation and its implications in the Mediterranean region would be a significant advancement toward developing a Climate/Health warning system.

Keywords: Large-Scale circulation, climate, health, PM10, Mediterranean

PK-009[Climate » Temperature]

Ambient Temperature and Maternal Hypertensive Disorders in Taiwan

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BACKGROUND AND AIM: Evidence has shown an increased risk of hypertensive disorders (HTDs) in pregnancy associated with extreme temperatures, but whether the association varies over time remains unclear. We investigated the association between exposures to ambient temperature and HTDs in pregnancy by time periods in Taiwan.

METHOD: We conducted a retrospective cohort study using birth register data linked to National Health Insurance claims data. Pregnant women without a diagnosis with hypertension before 20 weeks of gestation from 2006 to 2017 were included and separated into two groups based on their delivery year: 2006-2011 and 2012-2017. We calculated mean air temperatures from conception to 20 weeks of gestation in residing area of each women. Logistic regression models were used to estimate the odds ratio (OR) and 95% confidence interval (95% CI) for the association between of temperature and HTDs in pregnancy defined as gestational hypertension, pre-eclampsia or eclampsia. RESULTS: Over the 12-year period, of 676,242 women included, 21,732 (3.2%) had HTDs in pregnancy. Overall, higher temperature was associated with increased odds of HTDs in pregnancy. The adjusted OR (95% CI) for women in the <5th, 5th-25th, 50th-75th, 75th-95th, and >95th percentiles of mean temperature was 1.03 (0.96-1.10), 0.99 (0.95-1.03), 1.05 (1.01-1.09), 1.07 (1.02-1.11), and 1.17 (1.10-1.25), respectively, as compared with those in the 25th-50th percentile category. Similar results were observed in the 2012-2017 cohort except that an increased risk was also observed in women exposed to very low temperature (<5th vs. 25th-50th percentile, adjusted OR [95%CI], 1.15 [1.05-1.26]). However, no significant association between temperature and HTDs in pregnancy was observed in the 2006-2011 cohort.

CONCLUSIONS: This study suggests that very low and moderately to very high temperatures are associated with increased risk of HTDs in pregnancy in Taiwan, and the association may differ by time periods.

Keywords: Temperature, Temperature extremes, Environmental epidemiology

Exploring the Association between Heat Alerts, Mortality Risk, and Greenspace in Santiago, Chile: A Case Time Series Design

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BACKGROUND AND AIM: In 2022 the regional government of Santiago started issuing public alerts when ambient temperatures exceed certain levels in a central meteorological station. We aim to evaluate the mortality excess risks associated with these alert levels, considering the interaction of greenspace.

METHOD:Data for each of the 52 communes of the Chilean Metropolitan Region was used. The daily maximum temperature was obtained from a 5x5 km grid estimate (CR2met). Normalized Difference Vegetation Index (NDVI) from Moderate-Resolution Imaging Spectroradiometer (MODIS) was used as a proxy for greenspace. Daily all-cause death certificates were obtained from the Department of Statistics and Health Information (DEIS) of the Ministry of Health. A case time series design was performed with a Poisson Distributed Lag Non-Linear Model (DLNM) for the warm season (Oct-Mar) from 2011 to 2021. We defined extreme heat as 35°C (extreme heat alert) and computed excess risks with respect to a baseline of 32°C (no heat alert).

RESULTS:A significant association was found between extreme heat and mortality (RR = 1.13; 95% CI: 1.07-1.19). The association was stronger for the communes with the lowest quartile of NDVI (RR = 1.26; 95% CI: 1.12-1.41), compared to those in the highest quartile (RR = 1.07; 95% CI: 0.96-1.19).

CONCLUSIONS: Heat alerts can be an effective prevention tool for increased mortality risk, but using the same level for all communes imposes different levels of risk in each of them. Alerts at different levels for communes grouped based on vulnerability similarities could reduce these inequalities. Adaptation measures and public health interventions should prioritize communities with less greenspace.

Keywords: Climate, Green space, Mortality, Temperature

Association between high ambient temperatures and road crashes in an Australian city with temperate climate: A time-series study, 2012--2021

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BACKGROUND AND AIM:BACKGROUND: High ambient temperatures are associated with increased morbidity and mortality rates, and some evidence suggests that high temperatures increased the risk of road crashes. However, little is known regarding the burden of road crashes attributable to non-optimal high temperatures in Australia. Therefore, this study examined the effects of high temperatures on road crashes using Adelaide in South Australia as a case study.

METHOD:METHODS: Ten-year daily time-series data on road crashes (n=64,597) and weather during the warm season (October-March) were obtained between 2012 and 2021. A quasi-Poisson distributed lag non-linear model (DLNM) was used to quantify the cumulative effect of high temperatures over the previous five days. The associations and attributable burden at moderate and extreme temperature ranges were computed as relative risks (RR) and attributable fractions.

RESULTS: RESULTS: There was a J-shaped association between high ambient temperatures and the risk of road crashes during the warm season in Adelaide, and pronounced effects were observed with minimum temperatures. The highest risk was observed at lag 1 day and lasting for 5 days. High temperatures were responsible for 0.79% (95%CI: 0.15–1.33%) of road crashes, with moderate high temperatures accounting for most of the burden compared to extreme temperatures (0.55% vs. 0.32%).

CONCLUSIONS: CONCLUSION: In the face of a warming climate, the finding draws the attention of road transport, policy, and public health planners to design preventive plans to reduce the risk of road crashes attributable to high temperatures.

Keywords: High temperature, Road crash, Accident, Climate change, Australia

Attributing the health impacts of the 2009 Victorian, Australia heatwave to climate change

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BACKGROUND AND AIM: In an attempt to understand the contribution of anthropogenic climate change to increasing risk of mortality, we undertook an attribution study of a heat event in 2009. We wished to calculate how many excess heat-related deaths could be attributed to climate change. METHOD: We assessed a heat event in Victoria, Australia (popn. 6.6 million) in 2009 where temperatures were elevated (maximum 20° C higher than the average temperature). Counts of all cause death were obtained from the Australian Bureau of Statistics for 1996-2015. Weather data was obtained for Melbourne, where 75% of the Victoria population resides, from the Bureau of Meteorology. We adopted a heatwave definition of a moving average of three days with a maximum temperature above various intensity thresholds in the 90-99th percentile range.Return periods were calculated and bootstrapped to enable calculation of confidence intervals.

RESULTS: The heatwave mortality association was assessed with a time series Poisson generalised additive model (GAM) to assess the effect of heatwave on mortality. Excess deaths for each heatwave threshold (90-99th percentiles) were calculated using the relative risk obtained from the GAMs. We used event attribution methods to assess anthropogenic forcing's contribution to mortality outcomes, using data from various type of climate models.

CONCLUSIONS: Return periods were calculated and bootstrapped to enable calculation of confidence intervals.

Keywords: Attriburion, heat, health, time series

Temporal change and spatial heterogeneity of the association between ambient temperature and transport accidents mortality in Japan

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BACKGROUND AND AIM: Some studies have demonstrated that ambient temperature was associated with transport accidents mortality, whereas little is known about the temporal variation and spatial heterogeneity in the association. To investigate the temporal change and spatial variation of the short-term association between temperature and transport accidents mortality in Japan from 1972 to 2019. METHOD: We first used time-stratified case-crossover analyses with a distributed lag nonlinear model to estimate the risks of transport accidents mortality associated with temperature for each of the 47 prefectures in Japan. Then, we pooled the estimates to obtain the risk at the country level through multivariate meta-analysis. In addition, we divided the whole time period into five subperiods to explore the temporal variation of the associations, and further fitted the mixed effects meta-regression to identify some climatic, demographic, and socioeconomic factors that may explain spatial heterogeneity.

RESULTS: Ambient mean temperature was positively associated with transport accidents mortality in Japan, with a percent change of 1.47% (95% CI: 1.10%, 1.85%) increase in the mortality per 1°C increases in daily mean temperature. In total, 0.213% (95% CI: 0.170%, 0.255%) of transport accidents mortality was attributable to high temperatures above the 90th percentile. The risks of transport accidents mortality associated with temperature have reduced substantially from 1972 to 2000, whereas it slightly increased from 2000 to 2019. The transport accidents mortality risks were larger in the prefectures with a lower level of development, represented by demographic and socioeconomic characteristics (i.e., total population, the proportion of older people and females, and the number of general hospitals).

CONCLUSIONS:Our study may help to understand the association between temperature and transport accidents in the future and underlying potential mechanisms, which have implications for public health policies for reducing the burden of transport accidents.

PK-014[Climate » Temperature]

Temperature and violence-related Medicaid hospital visits in the United States

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BACKGROUND AND AIM:Plausible behavioral and physiological pathways exist for how short-term temperature increases are associated with violent behavior, including reduced inhibitory control and state anger. A critical equity-focused research gap remains on how temperatures are associated with violent behavior among the poorest and most vulnerable in society. We aimed to comprehensively evaluate associations between temperature and violence-related hospital visits across the United States leveraging Medicaid claims, an insurance program covering low-income and disabled individuals.

METHOD: We used Medicaid claims on violence-related hospitalizations (N=332,293) and a comprehensive record of dry and humid temperature over 14 years (1999–2012). Using a case-crossover design with distributed lag non-linear terms, we examined how ZIP Code-level dry and humid temperature was associated with Medicaid daily violence-related hospital visit rates on each day up to six days after exposure, and how these estimated associations varied by cause (assaults, suicide attempts), sex, age group, climate region, and ZIP Code-level poverty and education.

RESULTS:We found a linear association between temperature and violence-related hospitalizations dominated by contributions from lag days 0-1. For assaults, a 5°C increase was associated with an estimated 2.0% [95%CI:1.4–2.6%] and 1.8% [95%CI:1.3–2.4%] cumulative increase for dry and humid temperature, respectively. For suicide attempts, a 5°C increase was associated with an estimated 5.6% [95%CI:2.6–8.5%] and 2.7% [95%CI:0.1–5.4%] cumulative increase for dry and humid temperature, respectively. Though not statistically different, point-estimate associations were greatest in younger age groups, in the Ohio valley (assaults) and the Southwest (suicide attempts), and in poorest and least educated areas.

CONCLUSIONS:Temperatures were positively associated with higher violence-related hospital visit rates for assaults and suicide attempts among low-income and disabled Americans. As climate change drives temperatures higher, more attention should focus on interventions to promote and enhance control to alleviate detrimental mental health-related consequences.

Keywords: Temperature, climate change, violence, mental health, climate justice

PK-015[Climate » Temperature]

Association between Ambient Temperature and Suicide attempt, Suicide death in Seoul from 2014 to 2019

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BACKGROUND AND AIM:Recent epidemiological studies have shown that short-term exposure to high temperatures increases the risk of suicide attempts and suicide deaths. Suicide attempts and suicide deaths have different characteristics. This difference is also more pronounced in age and gender subgroups. However, few studies have compared the association with temperature between the two. We analyze the difference in how short-term exposure to temperature relates to suicide attempts and suicide deaths, and further focus on subgroup characteristics.

METHOD: From 2014 to 2019, the cases of suicide attempts and cases of suicide deaths in Seoul were classified. Among the cases of suicide attempts, deaths were excluded. We use time-stratified case-crossover design to control temporal trends and seasonality, and combine conditional quasi-Poisson regression models with distributed lag non-linear models to investigate the effects of nonlinear, lagged ambient temperatures on suicide attempts and suicide deaths of primary interests.

RESULTS:During the study period, 35,518 suicide attempts and 13,416 suicide deaths were recorded. 59.4% of suicide attempts were female, and 68.7% of suicide deaths were male. We found associations between temperature and suicide attempts and suicide deaths. For suicide attempts, the highest relative risk (RR) was 1.26 (95% confidence interval (CI): 1.08, 1.46) at 24.4°C compared to a risk of the first percentile mean temperature (-8.5°C) over the lag period of 0–2 days. On the other hand, the RR of suicide death continued to increase, recording 1.69 (95% CI: 1.32, 2.18) at 30.7°C. CONCLUSIONS:An increase in daily mean temperature is significantly associated with an increase in suicide attempts and suicide death. The risk of suicide attempts peaked at 24.4 degrees and then the risk leveled off, but the risk of suicide deaths continued to increase. Our study presents detailed evidence supporting a relationship between suicide attempts, suicide death, and high temperature.

Keywords: Mental health outcomes, Risk assessment, Temperature, Short-term exposure

PK-016[Climate » Other (to be specified with keywords in the keywords section)]

Connecting the Dots: A Framework for Understanding the Complex Interactions between Climate and Health

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BACKGROUND AND AIM:Climate change is one of the most serious global concerns we face today. It has a wide range of effects on human health, from rising rates of infectious diseases to more frequent and severe natural disasters. While numerous studies on the health implications of climate change have been conducted, a comprehensive framework that systematically examines these impacts is lacking. The aim of this study is to provide a framework that would allow for a systematic assessment of the health implications of climate change.

METHOD:MATERIAL-METHODS: The framework was created after conducting a thorough study of the current research on the health effects of climate change. The review aimed to identify the many mechanisms through which climate change affects health, including direct effects like heat stress and extreme weather events, as well as indirect effects like changes in vector-borne diseases and air pollution. The review also identified the groups most sensitive to these effects, such as the elderly, children, and low-income areas.

RESULTS: The framework developed in this study has six major components: (1) identification of climate change's health impacts, (2) assessment of the populations most vulnerable to these impacts, (3) evaluation of the pathways through which climate change affects health, (4) quantification of the health impacts, (5) identification of potential interventions to mitigate these impacts, and (6) evaluation of the effectiveness of these interventions.

CONCLUSIONS: The paradigm created in this study gives a complete way to analyse climate change's health implications. Policymakers, public health authorities, and other stakeholders can use it to identify the most significant health concerns connected with climate change and devise effective actions to address those risks.

Keywords: Climate, outcome, environmental epidemiology
Association Between Meteorological Factors and Emergency Ambulance Dispatch for the Epilepsy Patients: A Case-Crossover Study, Japan

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BACKGROUND AND AIM: It was estimated that there were 45.9 million patients with all-active epilepsy globally and epilepsy is still an important cause of disability. Climate factors are considered to be one of contributing factors to epilepsy seizures. It, however, is still not clear yet. The objective of the study was to investigate the impact of various meteorological factors on the number of ambulance dispatches requested by the epilepsy patients to determine the risk factors for the onset of epileptic seizure.

METHOD:Time-stratified case-crossover design was used to analyze the various meteorological parameters against the number of daily emergency ambulance dispatches requested by epilepsy patients between January 2015 and December 2020 across Japan. Delayed effects of the weather were assessed considering 0 – 7 days lag. Fire and Disaster Management Agency provided the nationwide data of the emergency ambulance dispatch records during the six years of study period. Weather data was obtained from the Japan Meteorological Agency (JMA).

RESULTS:Daily ambulance dispatch for epilepsy patients had a significant relationship with daily mean temperature, sunshine hours, and the atmospheric pressure. Every interquartile range [IQR] decrease in mean temperature, increase in sunshine hours and atmospheric pressure corresponds to 17% increase (odds ratio [OR] 1.177, 95% confidence interval [CI] 1.088 – 1.273), 4% increase (OR 1.04, CI 1.01 – 1.07) and 9.2% increase (OR 1.092, CI 1.04 – 1.14) in number of ambulance dispatches respectively. While considering the lagged effect of the weather, only temperature and sunshine hours were significantly associated with the ambulance dispatches.

CONCLUSIONS: The nationwide study suggests the that lower temperature, higher atmospheric pressure, and longer sunshine duration are highly associated with increase in number of ambulance dispatches for epilepsy patients. Developing an early warning system of weather conditions for epilepsy patients is important, and further studies are needed in considering various meteorological conditions.

Keywords: Exposure assessment, Epidemiology, Temperature

Identifying the critical windows and joint effects of temperature and PM2.5 exposure on small for gestational age

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BACKGROUND AND AIM: The potential critical windows for extreme ambient temperature, air pollution exposure and small for gestational age (SGA) are still unclear, and no study has explored their joint effects on SGA.

METHOD:In a national multi-center prospective cohort, we included 179,761 pairs of mother-infant from 16 counties of 8 provinces in China during 2014-2018. Daily averaged temperature and PM2.5 concentration were matched to the maternal residential address to estimate personal exposure. Extreme temperature exposures were categorized by a series of percentile in each meteorological and geographic division for the entire pregnancy, each trimester and gestational week (GA-week). Generalized linear mixed models (GLMMs) and distributed lag nonlinear models (DLNMs) were used to estimate the whole pregnancy-, trimester-specific, and weekly-specific associations of extreme temperature and PM2.5 exposures with SGA. Combined effects were evaluated with the relative excess risk due to interaction (RERI) and proportion attributable to interaction (AP). RESULTS:We observed that by referring to temperature at the 41st-50th percentile, heat (>90th percentile) exposure during 13th-29th GA-weeks was associated with SGA; odds ratio (OR) and 95%

confidence intervals (CI) was 1.16 (1.06, 1.28). For cold (<=10th percentile), inverse associations were observed during the 1st-8th GA-weeks. PM2.5 exposure during the 2nd-5th and 19th-27th GA-weeks was associated with SGA, with the strongest association in the 2nd GA-week (OR = 1.0017, 95 %CI: 1.0001, 1.0034, for a 10µg/m3 increase). No interactive effects between ambient temperature and PM2.5 on SGA were observed.

CONCLUSIONS:Our findings suggest the weekly susceptibility windows for heat and PM2.5 exposure were primarily the gestational weeks within the 2nd trimester, therefore, corresponding protective measures should be conveyed to pregnant women during routine prenatal visits to reduce exposures. Grants: National Key R&D Program of China (2018YFA0606200), National Natural Science Foundation of China (42075178, 42175183), and Guangdong Basic and Applied Basic Research Foundation (2021A1515011947).

Keywords: Environmental epidemiology, Birth outcomes, Temperature extremes, Particulate matter

Effect modification of the association between high temperature and Out-of-hospital cardiac arrest (OHCA) risk by PM_{2.5} in Japan

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BACKGROUND AND AIM: Out-of-hospital cardiac arrest (OHCA) is a leading cause of cardiovascular mortality worldwide and it can be influenced by the underlying health status and ambient factors. Though several studies have examined the associations of OHCA with air temperature and $PM_{2.5}$, the effect of interaction between the two ambient exposures on OHCA has received insufficient attention. The objective of this study is to investigate the effect modification of the association between temperature and OHCA risk by different PM2.5 levels in Japan. Daily data on OHCAs, mean temperature and PM_{2.5} were obtained from all 47 prefectures of Japan between 2012 and 2019. METHOD: The study applied a two-stage design: Firstly, a time-stratified case-crossover design was applied to estimate the PM2.5-stratified temperature-mortality associations in each prefecture. A distributed lag non-linear model was specified to estimate the temperature-OHCA risk function according to the PM2.5 levels categorized into high and low using the 75th percentile of the 4-day moving average (lag 0-3) as a cut-off level. Secondly, a multivariate meta-analysis was used to pool the prefecture-specific associations. The relative risks (RRs) for heat [99th percentile vs. minimum morbidity percentile (MMP)] were compared at different PM2.5 levels to examine effect modification. RESULTS: In total, 948894 OHCA cases were included in the final analysis. A U-shaped relationship was found between temperature and OHCA morbidity for the pooled overall cumulative association without significant heterogeneity between the 47 prefectures (I^2 =19.3%; p=0.03), and MMP was identified as the 88th percentile. The overall pooled RR for heat was 1.04 (95% CI: 1.02-1.06) at a high PM2.5 level, which was significantly higher than the RR at a low PM2.5 level [1.00 (95% CI:0.99-1.02)].

CONCLUSIONS: Findings from this study suggested that high PM2.5 concentrations could enhance the effects of heat on OHCA morbidity.

Keywords: Temperature, Particulate matter

Aircraft noise and cardiovascular morbidity and mortality near Heathrow Airport: a casecrossover study

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BACKGROUND AND AIM:Aircraft noise causes annoyance and sleep disturbance and there is some evidence of associations between long-term exposures and cardiovascular disease (CVD), but only one previous study on short-term associations. We aimed to investigate associations between previous day aircraft noise and cardiovascular events in a population of 6.3 million residing near Heathrow Airport, using a case-crossover design and exposure data for different times of day and night. METHOD:Outcome data were all recorded hospitalisations (n=442,442) and deaths (n=49,443) in 2014-2018 due to CVD, obtained from national administrative data. Daily aircraft noise levels for eight time periods across the 24-hour period were modelled using the Aviation Environmental Design Tool (AEDT), version 3b. Statistical analyses used conditional logistic regression to estimate ORs, with adjustment for PM2.5 concentration, temperature and holidays. We examined effect modification by age-sex, ethnicity, deprivation and season as well as noise variability (assessed by stratifying by high/low coefficient of variation).

RESULTS:We estimated an increase in risk for 10dB increment in noise during the previous evening (Leve OR = 1.004, 95% CI 1.000-1.008), particularly from 22:00-23:00h (OR=1.007, 95% CI 1.000-1.013) and the early morning hours 04:30-06:00h (OR=1.012, 95% CI 1.003-1.022) for all CVD admissions, but no significant associations with day-time noise. There was effect modification by age-sex, ethnicity, deprivation and season, with higher risks in men older than 65 years, those of Black ethnicity, more deprived areas, and in winter. There was some suggestion that high noise variability at night was associated with higher risks.

CONCLUSIONS:Our findings are consistent with proposed mechanisms for short-term impacts of aircraft noise at night on CVD from experimental studies, including sleep disturbance, increases in blood pressure and stress hormone levels and impaired endothelial function.

Keywords: Noise, Cardiovascular diseases, Environmental epidemiology, Socio-economic factors (non-chemical stressors)

Impact of combined exposure to multiple air pollutants on breast cancer risk using bayesian profil regression

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BACKGROUND AND AIM: The general population is continuously exposed to multiple and correlated air pollutants. To date, very few studies has assessed the impact of multiple exposures to air pollutants on breast cancer risk. To address this issue, specific statistical approaches are needed. Our objective is to estimate the association between the joint exposure to 8 air pollutants (benzo(a)oyrene, cadmium, dioxins, nitrogen dioxide, ozone, polychlorinated biphenyls, particulate matter and fine particles) and breast cancer risk.

METHOD: We use a case-control study nested within the French E3N cohort, involving 5222 incident breast cancer cases and 5222 matched controls. For each woman, an average annual exposure to the pollutants was estimated from 1990 to 2011. Two different statistical approaches were compared. The first approach consists of grouping individuals according to their exposure to pollutants and then applying conditional logistic regression. The second method consists of using the Bayesian Profile Regression (BPR) model. In both methods, odds ratios(ORs) and their 95% confidence(CI) / credible(CrI) intervals were estimated.

RESULTS: In both approaches, 9 clusters were identified, many similar clusters in terms of exposure levels were observed, the cluster characterised by low exposures to all pollutants, except ozone was taken as reference. A consistent increase in breast cancer risk compared to the reference cluster was observed for 3 clusters in the first approach, and for 2 clusters in the second approach. The highest estimated effect is observed for the cluster represented by high exposure to all pollutants except ozone in both approaches (first approach: OR=2.25, CI=(1.59,3.19); second approach: OR=1.39, CrI=(1.06,1.83)).

CONCLUSIONS: This is the first study assessing the effect of exposure to a mixture of 8 air pollutants

on breast cancer risk, using two approaches. The results show evidence of a positive joint effect of exposure to high levels of all pollutants (except ozone) on the risk of breast cancer.

Keywords: Environmental epidemiology, Long-term exposure, Multi-pollutant, Modeling, Outcomes

PK-022[Air pollution » Traffic-related]

Association between air pollution and traffic injuries in Kaohsiung, a motorcycle-dominant city in Taiwan

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BACKGROUND AND AIM:Air pollution and road traffic injuries are two major public health concerns that cause significant mortality and morbidity worldwide. Air pollution can influence traffic safety through factors such as reduced visibility and impaired driving performance. However, few current studies have examined the association between air pollution and road traffic injuries, and even fewer studies have focused on locations where traffic is dominated by motorcycles, which expose users to higher levels of PM exposure. Therefore, this study aims to explore two research questions concerning the associations between traffic accidents and air pollution and the susceptibility of motorcycle users who have direct exposure to the external road environment.

METHOD: This study employed distributed lag non-linear models, incorporating non-linearity and distributed lag effects to examine bi-dimensional exposure-lag-response associations between traffic incidents and PM10 concentration. The models were stratified by the mode of transportation involved in traffic incidents for sub-group analysis. This study calculated the relative risks with 95% confidence intervals of specific PM10 concentrations at the 50th, 75th, 90th, 95th, and 99th percentiles, with respect to the reference PM10 concentration corresponding to the minimum number of traffic incidents, i.e., $8.3 \mu g/m3$.

RESULTS: The results reveal alarming relative risks associated with increased PM10 concentration. The cumulated relative risks can reach up to 1.34 at 44.5 μ g/m3 (50 percentiles), 1.57 at 77.6 μ g/m3 (75 percentiles), 1.62 at 86.6 μ g/m3 (95 percentiles), and 1.82 at 108.5 μ g/m3 (99 percentiles). These indicate the persistent and extended lagged effects of PM10 on traffic safety. Moreover, motorcycle users exhibit significantly higher relative risks than car users at various levels of PM10 concentration. CONCLUSIONS: The study highlights the need for policymakers to address the issue of air pollution in the context of road safety. Policymakers should also consider the risks associated with motorcycle use.

Keywords: Built environment, Particulate matter, Incidence

Disparity in Ambient PM2.5 Air Pollution Exposure and Attributable Health Risk among Indian Sub-population

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BACKGROUND AND AIM:Long-term exposure to air pollution is one of the major public health burden. Studies from developed countries are emerging that show evidence of unequal distribution of exposure among the sub-populations, where minorities and poor are most affected. No such study exists in developing countries, especially India, home to one-sixth of the world's population. Here we examine the disparity in ambient PM2.5 exposure and associated health risk exposure among Indian subpopulations.

METHOD:Using Atkinson Index (AI), we quantify exposure disparity among population groups (15-54 years) by education, wealth, occupation, ethnicity, and household parameters for multiple spatial units (state, district, urban vs rural areas). We use satellite-derived ambient PM2.5 exposure data at 1 km spatial scale and health and socio-demographic data from the fourth and fifth rounds of the National Family Health Survey (NFHS) for the analysis. We further use generalized linear model (GLM) stratified by age, sex, lifestyle, and various socio-demographic covariates to estimate the population-attributable fraction (PAF) for the sub-groups.

RESULTS: Exposure disparity is found to be higher in rural regions and in the districts belonging to central and southern states as compared to the Indo-Gangetic Plain. Significant disparity is found across the wealth and education groups, where the impecunious and working classes are comparatively more exposed. We find higher PAF (5-10%) among less-privileged (minorities, poor, uneducated, working class) sub-populations. The degree of disparity and PAF reduced among the sub-groups between NFHS-4 (2015-2016) to NFHS-5 (2019-2021).

CONCLUSIONS:Results show that exposure disparity was higher in the low and high SDI states, and deprived sub-populations are at higher exposure risk in India. However, disparity reduced in recent years, which mirrored the recent improvement in air quality in India. Policies need to be framed to protect the vulnerable sub-groups and the disparity needs to be accounted for in the burden of disease study.

Keywords: disparity, PAF, health burden, environmental justice.

Effects of PM2.5 on acute respiratory infection among under 5y children in India moderated by micronutrient intake

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BACKGROUND AND AIM:Oxidative stress mediated inflammation is the most explained physiological mechanism for air pollution related health effects, particularly related to the lung. If so, a diet in antioxidant rich foods may moderate this effect on health from air pollution. The objective of this study was to investigate the moderating influence of micronutrient intake on the effect of air pollution on acute respiratory infection (ARI) in under 5y children.

METHOD:A triangulated dataset of the National Family Health Survey-4, (NFHS4) and food expenditure (National Sample Survey, NSS68) survey in India, that was statistically matched using the hot deck method along with satellite driven PM2.5 exposure data was analysed. The effect moderation of the impact of air pollution on ARI by per capita micronutrient (antioxidant) intake was explored by logistic regression with interaction.

RESULTS:The association between PM2.5 and ARI was modified by several nutrients, including vitamin C, vitamin B9, vitamin B2, zinc, and selenium. Specifically, for every $10\mu g/m3$ increase in PM2.5 exposure, the odds ratio (OR) of ARI was 1.15 (95% CI 1.14-1.17) when daily vitamin C intake greater than 65mg, against 1.18 (95% CI: 1.18-1.19) when the daily intake was less than 65mg. Similarly, for every $10\mu g/m3$ increase in PM2.5 exposure, the OR of ARI was 1.17 (95% CI 1.16-1.18) with a daily selenium intake greater than 115 μ g, compared to 1.19 (95% CI 1.18-1.19) when less than 115 μ g. Similar results were observed for higher intake of other nutrients, with absolute risk reduction ranging from 2 to 6 percentage points.

CONCLUSIONS: Our findings suggest that higher intake of antioxidant rich foods such as fruits and nuts may reduce the risk of ARI associated with PM2.5 exposure. Further research is needed to confirm these findings and determine the optimal intake of these nutrients to provide protection against effects of PM2.5 on ARI.

Keywords: Acute respiratory infection, Particulate matter, Food/nutrition

PK-026[Neurologic and mental health outcomes » Other (to be specified with keywords in the keywords section)]

Air pollution and epilepsy diagnosis at a first seizure clinic in The Netherlands: A case-control study

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BACKGROUND AND AIM:Increasing evidence suggests that exposure to air pollution is linked to various neurological disorders, although little is known about its association with the development and diagnosis of epilepsy. This study aimed to evaluate the association between exposure to ambient air pollutants and the likelihood of receiving an epilepsy diagnosis in Dutch children. METHOD:A population-based case-control study was conducted among children presenting to the first seizure clinic at the primary children's hospital in Utrecht, The Netherlands. Children were recruited from 1 January 2008 to 31 May 2021 and were assigned to either cases (i.e., diagnosed with epilepsy, n = 402) or controls (n = 743) based on the findings of (at least) one-year diagnostic follow-up. Levels of ambient air pollution (nitrogen dioxide [NO2], ozone [O3], particulate matter with aerodynamic diameter <10 μ m [PM10] and <2.5 μ m [PM2.5]) were assigned for the year of presentation at the residences of participants based on EU-wide air pollution metrics. After adjusting for common confounders, logistic regression models were applied to calculate odds ratios (ORs) with 95% confidence intervals (CIs) to evaluate the association between air pollution and receiving an epilepsy diagnosis. Subgroup analysis was performed to compare the associations across different epilepsy aetiologies.

RESULTS:Overall, no association between ambient air pollution and an epilepsy diagnosis was observed, including PM2.5 (OR: 0.99, 95% CI: 0.94, 1.04) and NO2 (OR: 1.01, 95% CI: 0.98, 1.03). Subgroup analysis was suggestive but ultimately underpowered to draw any meaningful conclusions. CONCLUSIONS:In a case-control study of children presenting to a first seizure clinic, we report no association between exposure to ambient air pollutants and a diagnosis of epilepsy. Additional work, including a longitudinal evaluation of air pollutants, a closer examination of epilepsy aetiologies, and a wider, community-based approach will be needed to further explore these findings.

Keywords: Epilepsy, childhood epilepsy, ambient air pollution

Metabolomic signatures following long-term exposure to PM10 and NO2 in the CODA cohort

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BACKGROUND AND AIM:Long-term exposure to air pollution can increase the risk of respiratory diseases and adversely affect lung functions. The potential of metabolomics to identify biomarkers linked to respiratory outcomes and environmental exposure is becoming increasingly apparent. However, a mechanistic understanding of the affected metabolic pathways is lacking and literature on long-term exposure to air pollution on the metabolome is limited. Therefore, this study aimed to elucidate the unique plasma metabolite response related to long-term PM10 or NO2 exposure. METHOD:We estimated the annual average concentrations of PM10 and NO2 at each participant's residential address using a spatial prediction model. We performed LC-MS/MS analysis based on targeted metabolic profiling of plasma sample data from 192 participants enrolled in the COPD in Dusty Area (CODA) cohort to identify the targeted metabolites (sphingolipids or amino acids) associated with long-term exposure to PM10 and NO2. A multiple linear regression model after adjusting and correcting for multiple testing was then used.

RESULTS:The average measured concentrations of PM10 and NO2 were 43.98 μ g/m3 and 13.43 ppb, respectively. Among the evaluated plasma sphingolipids, three specific sphingomyelins (SMs), SM(d18:0/18:0), SM(d18:0/18:1), and SM(d18:0/24:1) were significantly associated with PM10 [β (95% CI)= 0.0225 (0.003, 0.042); 0.0323 (0.014, 0.051); 0.0264 (0.006, 0.047), respectively]. Meanwhile, Cer(d18:0/24:0) was negatively associated with NO2 exposure [β (95% CI)= - 0.0356 (- 0.059, - 0.012)]. However, there was no significant correlation between any of the amino acids and long-term PM10 or NO2 exposure.

CONCLUSIONS: This study identified significant associations between sphingolipid and amino acid metabolites and long-term PM10 and NO2 exposure.

Keywords: PM10, NO2, metabolomics, sphingolipid, amino acid

PK-028[Air pollution » Particulate matter]

Long term PM2.5 exposure and memory functions in northern Sweden

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BACKGROUND AND AIM: Growing evidence indicates that air pollution can have a negative impact on cognitive functions. The aim of this study was to investigate long- term PM2.5 exposure in association with semantic- and episodic memory functions.

METHOD:Data from 1732 participants (>55 years of age), were obtained from a prospective cohort study in northern Sweden. Composite z-scores from cognitive testing were used as measures of episodic- and semantic memory. Estimates of annual mean PM2.5 concentrations at the residential address at baseline were obtained from a dispersion-model. General linear models were used to specify repeated measures models. Using the difference between assessments at baseline and subsequent test-waves, repeated measures models were used to investigate the rate of change of memory functions over the 15 year follow up period. The fully adjusted models were adjusted for age, sex, education, APOE- ϵ 4 status, and smoking habits.

RESULTS:A positive association was found between PM2.5 exposure and semantic memory ($\beta = 0.08^*$ 95% CI: 0.02, 0.15), i.e. increased exposure was associated with better semantic memory. In addition, an interaction between PM2.5 and age ($\beta = 0.01^*$ 95% CI 0.00, 0.01) was found for semantic memory. When stratifying the sample by age the association persisted only in the younger group (55-70 years) ($\beta = 0.08^*$ 95% CI: 0.00, 0.16). No associations were found between PM2.5 and any other outcome.

CONCLUSIONS:: It is unlikely that exposure to air pollution would improve semantic memory. Instead, these results could be explained by socioeconomic factors, or survival effects in the study sample.

Keywords: semantic memory, episodic memory, cognitive functions

Air pollution exposures and brain cortical thinning in adults: A longitudinal neuroimaging study

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BACKGROUND AND AIM:Long-term exposure to air pollutants is associated with higher risk of neurodegenerative and Alzheimer's diseases. We conducted a longitudinal study to investigate the association between long-term exposure to air pollution and changes in neuroimaging markers. METHOD:This was based on a prospective cohort of adults residing in four cities in the Republic of Korea. Long-term concentrations of particulate matter with aerodynamic diameters of $\leq 10 \ \mu m$ (PM10) and $\leq 2.5 \ \mu m$ (PM2.5) and nitrogen dioxide (NO2) at residential addresses were estimated. Whole-brain mean, regional cortical thicknesses, and subcortical volumes were obtained by analyzing brain 3T magnetic resonance images at baseline and 3-year follow-up, respectively. Linear mixed effects models were constructed to examine the associations between the air pollutants and the brain MRI markers, adjusting for covariates.

RESULTS:A total of 310 individuals were included. A 10-ug/m3 increase in PM10 was associated with reduced whole-brain mean [$\beta = -0.035$, standard error (SE] = 0.010; P < 0.001), frontal ($\beta = -0.045$, SE = 0.012; P < 0.001), parietal ($\beta = -0.043$, SE = 0.011; P < 0.001), temporal, ($\beta = -0.030$, SE = 0.13; P = 0.021), cingulate ($\beta = -0.031$, SE = 0.15; P = 0.041), and insula lobes ($\beta = -0.043$, SE = 0.020; P = 0.028). A 10-ppb increase in NO2 was associated with reduced whole-brain mean ($\beta = -0.015$, SE = 0.005; P = 0.002), frontal ($\beta = -0.021$, SE = 0.006; P = 0.001), parietal ($\beta = -0.018$, SE = 0.006; P = 0.001), and cingulate lobes ($\beta = -0.017$, SE = 0.008; P = 0.031). Subcortical structures associated with the air pollutant included thalamus. There were no significant associations between PM2.5 and changes in brain cortical thickness and subcortical volume. CONCLUSIONS:The findings suggest that long-term exposures to PM10 and NO2 may lead to cortical thinning in adults.

Keywords: Particulate matter, Neuroimaging, brain cortical thickness, cognitive function, nitrogen dioxide

Association between Ambient BTEX Mixture and Neurological Hospitalizations: A Multicity Time-Series Study in Taiwan

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BACKGROUND AND AIM: The collective term BTEX refers to a hazardous chemical mixture of benzene, toluene, ethylbenzene, and xylenes, is considered hazardous, and their potential effects on neurological health have not been comprehensively assessed. Our study aims to investigate the relationship between exposure to BTEX and hospital admissions for neurological diseases. METHOD: A multicity time-series study was conducted in five major Taiwanese cities, where daily hospital admission records for nervous system diseases from January 1, 2016, to December 31, 2017, were collected from the National Health Insurance Research Database. The concentrations of ambient BTEX and criteria pollutants, along with weather factors, were measured at Photochemical Assessment Monitoring Stations. City-specific effect estimates for BTEX were calculated using a Poisson generalized additive model (GAM) and weighted quantile sum regression, followed by a random-effects meta-analysis to pool the estimates.

RESULTS:During the study period, an average of 68 neurological hospitalizations per day were recorded. The BTEX mixture concentrations had a daily mean of 22.5 μ g/m3, with toluene (13.6 μ g/m3) and xylene (5.8 μ g/m3) being the predominant chemicals. Our analysis revealed that neurological hospitalizations increased by 1.6% (95% CI: 0.6%–2.6%) on average for every interquartile range (15.8 μ g/m3) increase in BTEX at lag 0, as estimated using a GAM model. Additionally, a quartile increase in the weighted sum of BTEX exposure was associated with a 1.7% (95% CI: 0.6%–2.8%) increase in daily neurological hospitalizations.

CONCLUSIONS:Our study provides evidence of a strong association between BTEX exposure and neurological hospitalizations in Taiwan, with toluene and xylene identified as the key contributors to this adverse health effect. These findings underscore the urgent need for more focused public health interventions aimed at reducing exposure to these hazardous chemicals in the environment.

Keywords: BTEX mixture, Multicity time-series study, Neurological hospitalizations

Longitudinal associations between ambient PM2.5 exposure and lipid levels in two Indian cities

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BACKGROUND AND AIM: Exposure to PM2.5 and elevated lipids are both established risk factors for cardiometabolic disorders. PM2.5 has been hypothesised to cause elevated lipid levels through systemic inflammation, however, seldom studied in low- and middle-income countries such as India with high levels of PM2.5 and populations with unique lipid profiles. We investigated associations between longitudinally measured ambient PM2.5 exposure and serum lipid levels [total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL-C), low density lipoprotein (LDL-C)] in an adult population based representative cohort in two metropolitan cities of north and south India. METHOD: We conducted a longitudinal non-linear mixed effects analysis in 11,649 participants between 2010 and 2017 in Chennai and Delhi. Exposure to PM2.5 was assessed using daily average PM2.5 predictions at 1kmx1km grids from a hybrid spatiotemporal model. Generalized additive models were used to examine the association between monthly and annual average exposure to ambient PM2.5 concentrations and lipid levels after adjusting for residential and neighbourhood level confounders.

RESULTS: Average annual averages of PM2.5 were 103 [SD: 15.5] and 40 [SD: 5] μ g/m3 in Delhi and Chennai, respectively, with minimal changes over time. HDL-C levels were negatively associated with long-term ambient PM2.5 exposures in Delhi but not in Chennai. An IQR [90,120 μ g/m3] increase in annual exposures of PM2.5 was associated with a decrease of 3mg/dL in HDL-C in Delhi. LDL-C and TC were positively associated with annual exposure in both cities, for instance increase in 4mg/dL of LDL-C and TC with 10 μ g/m3 increase in PM2.5 above mean in Chennai. Younger and physically active people had stronger associations in highly polluted settings.

CONCLUSIONS: Exposure to ambient PM2.5 was associated with lipid parameters in both cities, although specifics differed. Such evidence on association between PM2.5 exposure and cardiovascular risk factors are crucial for public health interventions and policy advocacy.

PK-032[Air pollution » Other (to be specified with keywords in the keywords section)]

Economic evaluation of the costs and benefits of air pollution control: a systematic review

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BACKGROUND AND AIM: Air pollution poses a significant public health challenge globally. Although there exists broad mitigation policies, an understanding for the economic consequences is lacking. We systematically reviewed the economic evidence of costs and benefits of these interventions. METHOD: We searched PubMed, Scopus, Cochrane Library, Embase and CEA registry databases for studies that assessed the costs and health benefits of control strategies aimed at reducing air pollution without limitations on study design, region, or time. Evidence was narratively summarised based on principle economic evaluation measurements including net benefits and benefit-cost ratios. RESULTS:96 studies were included in this review, with most studies from China (n=24) and US (n=21). Almost all studies adopted a risk assessment approach by using dose-response parameters to model health outcomes from pollution exposure. The impact of particle matter on all-cause mortality was the most widely assessed pair of exposure-effects relationship (n=42). Overall, 70 studies reported that the intervention was good value for money. More studies assessed the value of outdoor interventions to improve ambient air quality, and 54 out of 67 of which reported positive outcomes. 13 out of 20 studies found similar results for indoor interventions. Commonly employed control methodologies were regulatory, fiscal or end-of-pipe. Subgroup analysis across intervention types and control methodologies showed that climate change polices assessing health co-benefits generally reported positive outcomes (n=9). In addition, we found that studies which adopted a broader social framework of benefits (n=26), including those to the environment, ecology and society reported positive or partially positive evidence. Despite these results, studies also highlighted some policy flaws with regards to equity, optimization, and uncertainties.

CONCLUSIONS: Overall, we found broad economic support across various control strategies with more than 70% of the interventions reporting good value for money. However, future air pollution control designs also need to address some of its current existing limitations.

Keywords: air pollution, policy

Long-term exposure to air pollution and incidence of Parkinson's disease: a Danish nationwide administrative cohort study

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BACKGROUND AND AIM: Exposure to air pollution has been linked to the incidence of Parkinson's disease (PD); however, evidence varies, in part due to diagnostic validity challenges. Here, we examined the association between long-term exposure to air pollutants and PD incidence in a nationwide administrative cohort.

METHOD: We followed 3,035,206 subjects aged \geq 30 years and residing in Denmark on 01/01/2000 until 31/12/2018. We defined PD incidence as either the first hospital contact (outpatient or inpatient admission) for PD or redeemed prescription of anti-PD medication, whichever came first, as recorded in the Danish National Patient Registry or Prescription Registry, respectively. We assessed annual mean air pollution exposure concentration level at participant residence at baseline using the European-wide ELAPSE-project hybrid land-use regression model (fine particulate matter [PM_{2.5}], nitrogen dioxide [NO₂], ozone [O₃ maximum running 8-hour warm-season average], black carbon [BC]) rendered at 0.1x0.1 km. We used Cox proportional hazard models adjusted for individual age, sex, education, occupation, immigration, and marital status, as well as individual (household) and area (neighbourhood) level income; further indirectly adjusted for individual body mass index (BMI) and smoking status.

RESULTS:During a mean follow-up of 15.8 years, 107,238 participants (mean baseline age: 56.9 years) developed PD. Median (interquartile range) levels of PM_{2.5}, NO₂, O₃, and BC were 12.34 (1.96), 18.71 (10.27), 81.16 (4.28) μ g/m³, and 0.92 (0.49) $\times 10^{-5}$ /m, respectively. The hazard ratios (HR) (95% confidence intervals) for association between air pollutants and PD incidence were: 1.05 (1.02, 1.08) per 5 μ g/m³ of PM_{2.5}; 1.03 (1.01, 1.04) per 10 μ g/m³ of NO₂; 1.02 (1.00, 1.04) per 0.5 $\times 10^{-5}$ /m of BC, and; 0.99 (0.97, 1.02) per 10 μ g/m³ of O₃. These HRs were robust when indirectly adjusting for BMI and smoking status.

CONCLUSIONS: In our nationwide study, we find that long-term exposure to pollutants PM2.5, NO2, and BC are associated with valid ascertainment of PD incidence.

Keywords: air pollution, traffic-related, long-term exposure, neurodegenerative outcomes, incidence

PK-034[Exposures » Water quality]

Assessing access to and performance of community water fluoridation in New Zealand: exposure assessment for a national retrospective cohort study

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BACKGROUND AND AIM: Background and AIMS: Community water fluoridation (CWF) has proven oral health benefits. Preliminary analyses of water suppliers in New Zealand show that fluoride targets are only achieved 54.1% of the time. This project aims to conduct an exposure assessment to assess the access to and performance of CWF for different communities in New Zealand. The current exposure assessment will be used in a retrospective cohort study investigating the association between CWF and oral health and neurodevelopment outcomes.

METHOD: METHODS: Fluoride levels in municipal drinking water supplies were retrieved for all fluoridated supplies in New Zealand. Fluoride levels will be linked with the spatial boundaries of each community water supply. Data on community demographics of each community water supply were retrieved from census data and will be spatially joined with water supply boundaries.

RESULTS: RESULTS: The exposure assessment will provide insights into the inequities in access to and performance of CWF. The exposure assessment will be used to assess the impact of CWF on children's oral health outcomes and neurodevelopmental outcomes using a powerful individual-level database of routinely collected government information called the Integrated Data Infrastructure (IDI) in New Zealand. A cohort of all babies born 2009-2021 (13 years) (~700,000 births) have been identified in the IDI.

CONCLUSIONS:CONCLUSIONS: The exposure assessment using actual fluoride levels enables an assessment of the performance of CWF across New Zealand. Actual fluoride levels also enable the assessment of dose-response relationships between fluoride in drinking and key oral health and neurodevelopmental outcomes. The IDI is a powerful, national-level database that can facilitate large retrospective cohort studies at limited cost. This research is funded by the Ministry of Health's Oral health Research Fund.

Keywords: water quality, fluoride, exposure assessment, environmental epidemiology

Long-term air pollution exposure and tumors of the central nervous system - a pooled analysis of six European cohorts

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BACKGROUND AND AIM:Risk factors for malignant tumors of the central nervous system (CNS) are largely unknown. We investigated the association between long-term exposure to NO2, PM2.5, BC, ozone (O3), and eight elemental components of PM2.5 and the risk of CNS tumors in the Effects of Low-level Air Pollution: a Study in Europe (ELAPSE).

METHOD: We pooled six European cohorts (N = 302,493) and assessed the association between residential exposure to nitrogen dioxide (NO2), fine particles (PM2.5), black carbon (BC), ozone (O3) and eight elemental components of PM2.5 (copper, iron, potassium, nickel, sulfur, silicon, vanadium, and zinc) and malignant intracranial CNS tumors defined according to the International Classification of Diseases ICD-9/ICD-10 codes 192.1/C70.0, 191.0–191.9/C71.0–C71.9, 192.0/C72.2–C72.5. We applied Cox proportional hazards models adjusting for potential confounders at the individual and area-level.

RESULTS:During 5,497,514 person-years of follow-up (average 18.2 years), we observed 623 malignant CNS tumors. The results of the fully adjusted linear analyses showed a hazard ratio (95% confidence interval) of 1.07 (0.95, 1.21) per 10 μ g/m³ NO2, 1.17 (0.96, 1.41) per 5 μ g/m³ PM2.5, 1.10 (0.97, 1.25) per 0.5 10-5m-1 BC, and 0.99 (0.84, 1.17) per 10 μ g/m³ O3.

CONCLUSIONS: We observed indications of an association between exposure to NO2, PM2.5, and BC and tumors of the CNS. The PM elements were not consistently associated with CNS tumor incidence.

Keywords: Particulate matter, Particle components, Long-term exposure, Cancer and cancer precursors

Free radicals by-products of air pollution in Australian households

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BACKGROUND AND AIM: The association between air pollution and adverse health outcomes has been extensively studied, but the causal mechanism is still in discovery. Emerging evidence proposes environmentally persistent free radicals (EPFRs) as the missing connection between air pollution and detrimental health impacts. Our study aims to assess the presence of environmentally persistent free radicals in household dust and discover which household characteristics are predictive of EPFRs. METHOD: This study recruited 24 participants previously enrolled in the Early Life Lung Function cohort. Household characteristics were measured through an online survey and confirmed through researcher observation. Dust was collected from the vacuum and EPFRs concentration were measured by electromagnetic resonance spin. Home visits were in winter and summer to assess seasonal differences. One household was lost to follow-up, resulting in 47 observations in total. Regression random forest was performed to ascertain which household characteristics predict concentration of EPFRs.

RESULTS: Household smoking was an important predictor of EPFRs concentration. In addition, characteristics of the home, such as the age of the house and the type of garage were found to be important. These household characteristics may suggest the penetration of outdoor air, potentially justifying the importance of indoor NO2 and PM2.5 concentration in predicting EPFRs concentration. Frequency of cleaning surfaces around the house, type of cooling method used in child's bedroom and season of the home visits also demonstrated to be important predictors of EPFRs concentration in Australian homes.

CONCLUSIONS: These findings are important in understanding which household factors are linked to harmful air pollutant by-products in Australian homes. With such understanding, changes in household behaviours and home ventilation standards can be made to improve air quality in homes, ultimately protecting the population from adverse respiratory health outcomes.

Keywords: Particulate matter, Other (Environmental Persistent Free Radicals), Environmental epidemiology

Investigation of personal air pollution and respiratory diseases: a systematic review

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BACKGROUND AND AIM: Evidence is well established on the effects of ambient air pollution on respiratory diseases. In contrast, research using personal air monitors (PAMs) to investigate personal air pollution exposure on respiratory outcomes is slowly emerging. This systematic review was conducted to summarize latest scientific progress and knowledge gaps in this research area. METHOD: We followed PRISMA guidelines in conducting and reporting this review. Literature was searched using PubMed for studies that adopted PAMs to study major respiratory diseases (including COPD, chronic cough, bronchiectasis, chronic bronchitis, asthma, cystic fibrosis, and idiopathic pulmonary fibrosis) between January 2017 and March 2023. Screening, data extraction, assessment of risk of bias as well as overall quality of evidence were subsequently conducted. RESULTS: Twenty-four papers were included, 17 from high-income countries, six from China, and one from India. Eighteen (75%) studies were in longitudinal design; three were cross-sectional, two were randomized controlled trials and one case-control study. 12 studies each focused on asthma and COPD respectively. Thirteen studies used portable PAMs, with a mean exposure period of 30 days and a mean study sample of 72 individuals, comparing to 67 days and 110 individuals in studies using fixed PAMs. The most investigated pollutant was PM2.5. Mean PM2.5 exposure ranged from 3.3 to 133.9 µg/m3. Majority of studies found that increased personal exposure to PM2.5 was associated with deterioration of COPD, but its association with asthma was less clear. CONCLUSIONS: This is the first review summarizing studies of personal air pollution exposure and

respiratory diseases. Current evidence is only drawn from studies in COPD and asthma, with results for the latter being inconsistent. To inform future research, we highlighted opportunities and practical challenges in using PAMs for studying respiratory diseases.

We acknowledge support from National Institute for Health Research (NIHR) Health Protection Research Unit in Environmental Exposures and Health at UoL.

Keywords: air pollution, personal monitor, respiratory outcomes

Ambient air pollution and serum cardiometabolic proteome in young adults with obesity history

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BACKGROUND AND AIM: Current evidence of air pollution exposure and blood proteomic markers is mostly based on a small number of markers (such as TNF-a, IL6, CRP and fibrinogen) cross-sectionally and have demonstrated mixed results. In this study, we aim to investigate proteomic biomarkers involved in cardiometabolic disease onset for their associations with air pollution exposure. METHOD: In a cohort of young adults with a history of obesity in childhood, serum levels of 384 cardiometabolic-related proteins were measured by Olink Cardiometabolic Explore panel based on Proximity Extension Assay at baseline (N = 132, age: 19.4 ± 1.3 years) and follow-up (N = 86, age: 24.0 ± 0.8 years). Exposure to air pollutants including PM2.5, PM10, NO2 and O3 were estimated at 1-month and 1-year average before baseline visit, respectively. Marginal linear models using generalized estimating equation were used to estimate the associations between air pollution exposure and the proteome, controlling for covariates. Over representative analysis (ORA) and Ingenuity Pathway Analysis (IPA) were conducted to assess enriched pathways, identify diseases and biofunctions based on associations of proteome and air pollutants, respectively. RESULTS: We found that air pollution exposures were associated with the cardiometabolic proteome. For example, 1-month NO₂, 1-month PM_{2.5} and 1-year PM10 air pollution were significantly associated with IL-1 receptor like-1 (IL1RL1), plasminogen activator (TLAT) and Amyloid-like protein 1 (APLP1) after accounting for multiple-testing (false-discovery rate, FDR < 0.05). ORA using Gene Ontology found enriched pathways of collagen-containing extracellular matrix, exogenous protein binding and insulin like growth factor binding (FDR < 10E-5). IPA identified significant activation of blood platelets, angiogenesis, and immune response of cells as significantly enriched diseases and functions associated with air pollutant exposures (Z-score > 2, FDR < 10E-3).

CONCLUSIONS: Ambient air pollution exposure perturbated the cardiometabolic proteome related to cell signaling, immune responses, and inflammation.

Keywords: Air pollution; Biomarkers of exposure; Proteomics; Obesity and metabolic disorders

Detection of four endocrine disruptors - Methyl Paraben, 2,4-Dichlorophenoxyacetic acid, mono-Butyl Phthalate, and Bisphenol-A among Filipino women

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BACKGROUND AND AIM: Endocrine-disrupting chemicals (EDCs) are environmental pollutants from household and industrial items that can be a source of exposure via oral and dermal routes. Exposure to EDCs has been associated with reproductive disorders namely uterine myoma, endometriosis, and polycystic ovarian syndrome (PCOS). It is also associated with diseases like diabetes, hypertension complicating pregnancy leading to negative maternal and fetal outcomes. In this report, we present prevalent exposure to possible EDC-containing items among Filipino women and detection of four EDCs in their urine samples.

METHOD: Women (18-49 years of age) attending the Philippine General Hospital Department of Obstetrics-Gynecology clinic were surveyed for their exposure to EDC in their workplaces, households, and use of personal care products. Using Ultra-Performance Liquid Chromatography-Quadrupole Timeof-Flight (UPLC-QTOF) spectrometry, 169 urine samples from potentially exposed pregnant and nonpregnant women were tested for the presence of four EDCs - Methyl Paraben (MP), 2,4-Dichlorophenoxyacetic acid, mono-Butyl Phthalate (MBP), and Bisphenol-A (BPA).

RESULTS:Phthalate (MBP) was detected in 99.36% (155 of 156) urine samples both for exposed and unexposed respondents. Average MP concentrations (ng/mL) were higher among non-pregnant individuals exposed to shampoos (10.57), lotions (10.56), cosmetics (9.98), nail polish (16.24), and other cleaning solvents (9.4), while MP concentrations were higher for pregnant individuals exposed to vaginal wash (6.78), bleach (31.92) and fragrances (8.46). This is similar to the higher average 2,4-dichlorophenoxyacetic acid concentrations among non-pregnant women (4.00) in general compared to non-pregnant women (3.24). Lastly, minimal BPA concentrations were detected from urine samples of exposed and unexposed pregnant and non-pregnant participants.

CONCLUSIONS:Non-pregnant women showed more exposure to certain EDC-containing products with high detection of MBP and MP while pregnant women had high detection of MP. Exposure and detection of EDC concentrations between pregnant and non-pregnant individuals vary and need further research.

Keywords: Endocrine disrupting chemicals, Phthalates, exposure, women

Aircraft noise and cardiometabolic biomarkers: a cross-sectional and long-term analysis in the UK Biobank cohort, 2006-2022

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BACKGROUND AND AIM:Despite increasing evidence of environmental noise impacting cardiometabolic health with good biological plausibility, there are limited population-based studies investigating biomarkers of cardiometabolic risk. We investigate associations of aircraft noise exposure in 2006 around four major UK airports (Heathrow, Gatwick, Manchester, and Birmingham) with cardiometabolic biomarkers in the UK Biobank cohort during 2006-2022.

METHOD:Of 502,651 individuals (aged 40-69 years) recruited into the UK Biobank cohort, ~105,000 resided near the four airports. Modelled annual average aircraft noise (exposure) was provided by the Civil Aviation Authority for Lden (average noise over 24 hours penalty weighted for evening and night noise) and Lnight (night noise). Outcomes were biomarkers of cardiovascular risk: pulse wave arterial stiffness and reflection index (PWASI, PWRI), pulse rate (PR) and white blood cell count (WBC); and metabolic risk: body mass index (BMI), triglycerides (TG), glycated haemoglobin (GH) and high-density lipoprotein (HDL). We specified multivariable linear models for cross-sectional analyses and mixed effect models for long-term analyses, adjusted for sociodemographic, clinical, and environmental covariates including ambient nitrogen dioxide (NO2).

RESULTS:Per 5dB increment in Lden, cross-sectional findings found 12.4% (-0.124; 95%CI: -0.175, -0.073) and 64% (-0.643; -1.023, -0.263) reduction in PWASI and PWRI, with PWASI reduction in UKB having been previously linked to increased risk of cardiovascular events. There was a 20.3% (0.203; 0.032, 0.374) and 9.4% (0.094; 0.065, 0.124) increase in PR and WBC, also a 7% (0.070; 0.008, 0.133), 4.8% (0.048; 0.035, 0.061) and 28.3% (0.283; 0.190, 0.375) increase in BMI, TG, and GH respectively, with a 1.5% (-0.015; -0.020, -0.010) reduction in HDL. Findings of long-term analyses were consistent with cross-sectional findings. Similar findings were obtained for Lnight. CONCLUSIONS:This is the largest population-based study to date, finding associations between aircraft noise exposure around major UK airports and adverse cardiometabolic biomarker profiles, with major public health implications.

Keywords: built environment, noise, cardiovascular diseases, obesity and metabolic disorders, exposure assessment-biomarkers of exposure

Plasma levels of per- and polyfluoroalkyl substances and circulating extracellular vesicle and particle microRNAs during pregnancy: A pilot study

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BACKGROUND AND AIM:Per- and polyfluoroalkyl substances (PFAS) have been associated with adverse health impacts for both mother and child. Extracellular vesicle and particle microRNAs (EVP miRNAs) facilitate maternal-fetal communication during pregnancy and have been associated with pregnancy complications and adverse birth outcomes. However, little is known about the impacts of PFAS on circulating EVP miRNAs during pregnancy.

METHOD: We conducted a pilot study of 50 participants from the New Hampshire Birth Cohort Study. Seven PFAS and 798 EVP miRNAs were measured in maternal plasma samples collected at approximately 28 weeks gestation. Statistical analyses focused on 4 PFAS and 142 EVP miRNAs that were above limits of detection for \geq 60% of participants. A principal component analysis was conducted for the EVP miRNA data. The top 2 principal components (PCs) explained >90% of variance in the data and were retained for downstream analyses. Associations between each PFAS exposure and miRNA PC were evaluated using linear regression, adjusting for parity, educational attainment, and gestational age at blood collection.

RESULTS:A suggestive inverse association was identified between PFOA and PC2 (P < 0.1). In posthoc analyses, associations between PFOA and the top three miRNAs loading onto PC2 (hsa-miR-451a, hsa-miR-223-3p, and hsa-miR-150-5p) were assessed. A positive and statistically significant association was observed between PFOA and hsa-miR-451a (beta=0.50; 95% CI=0.17, 0.83; Bonferroni P-value = 0.012), which had the largest loading for PC2.

CONCLUSIONS:PFOA was positively associated with hsa-miR-451a levels in circulating EVPs during pregnancy. Higher circulating levels of this placenta-expressed miRNA has been associated with gestational diabetes, fetal growth restriction, and poor cognitive development in infants. This pilot study provides support for conducting larger studies that employ environmental mixture modeling approaches to investigate joint impacts of multiple PFAS on circulating EVP miRNAs during pregnancy and downstream effects on maternal and child health.

Keywords: Chemical exposures, Endocrine disrupting chemicals, PFAS

Phthalates and anogenital distance: phthalates in maternal urine vs. placental tissue, by tissue type, by timepoint, and by genital measure

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BACKGROUND AND AIM:Phthalates in placental tissue and in maternal urine are not widely correlated, complicating inferences on associations between prenatal phthalate exposure and adverse health outcomes. Given that the placenta is more proximal to the fetus, we hypothesized that phthalates in placenta tissue vs. maternal urine may be more predictive of newborn anogenital distance (AGD)--an anti-androgenic effect previously established in humans and in rodents.

METHOD: Placental tissue samples were collected from 33 male pregnancies enrolled in TIDES at the University of California, San Francisco. AGD (anus-penis[AP] and anus-scrotum[AS]) were obtained on all males and transformed to a z-score. 12 phthalates were measured in maternal urine in 3 trimesters, and in two types of term placental tissue - chorion frondosum plus villi(CF) and chorion smooth with no villi(CS). Generalized linear models were used to generate adjusted R2 values comparing models with combinations of phthalate metabolites, tissue types, trimester of urine sample, and type of genital measure. R2 values were sorted to identify models with best fit. Models were adjusted for confounders (maternal age, BMI, race, marital status, and infant age at AGD exam). RESULTS: The adjusted R2 is 0.41 for AGD-AP and 0.39 for AGD-AS of models with confounders only. Models including individual phthalates were predictive of AGD-AP (avg R2 0.54 SD 0.09), and AGD-AS (avg R2 0.45 SD 0.06). AGD-AP was predicted by phthalates measured in both placental tissue (CF) and in maternal urine (2nd trimester) and by MEHP (R2 0.69). AGD-AS was more often predicted by phthalates in urine (1st trimester) and specifically by MCMHP, a metabolite of MEHP (R2 0.60). CONCLUSIONS: Our results show that (1) placental and urinary phthalate metabolites were both improved model fit on newborn male genital size; (2) there may be important distinctions in phthalate associations with AGD-scrotum and AGD-penis by trimester and by method of measuring exposure.

Keywords: phthalates, anogenital distance, placenta

The effect of exposure to Polycyclic aromatic hydrocarbons on amnestic mild cognitive impairment and Alzheimer's disease: A matched case-control study

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BACKGROUND AND AIM:Previous studies have suggested the neurotoxicity of polycyclic aromatic hydrocarbons (PAHs). However, the effect of exposure to PAHs on neurodegeneration is still unclear. Therefore, this study aimed to investigate the association of urinary levels of PAH metabolites with amnestic mild cognitive impairment (aMCI) and Alzheimer's disease (AD).

METHOD:Patients with aMCI (n=212) and AD (n=267) were recruited from a university-based hospital in 2014-2019 in Seoul, Korea. Four cognitively normal controls for each aMCI patient (n=848) and AD (n=1,068) were randomly selected via frequency matching based on sex, age group (<65 or \geq 65-year-old), and education level (\leq 9 or >9 years). Urinary levels of 1-hydroxypyrene (1-OHP), 2-naphthol (2-NAP), 1-hydroxyphenanthrene (1-OHPhe), and 2-hydroxyfluorene (2-OHFlu) were measured. A conditional logistic regression model was used, adjusting for potential confounders. RESULTS:The geometric means (GMs) of the urinary 1-OHP and 2-NAP levels were significantly higher in aMCI than in it controls (0.08 vs 0.04 µg/L and 0.54 vs 0.20 µg/L, respectively; P<0.05). AD had a higher GMs of the urinary 1-OHP and 2-NAP levels than in it controls (0.06 vs 0.04 µg/L and 0.46 vs 0.20 µg/L, respectively; P<0.05). Each 1-unit increase in log-transformed levels of urinary 1-OHP (odds ratio [OR], 1.15; 95% confidence interval [CI], 1.05–1.26) and 2-NAP (OR, 1.11; 95% CI, 1.05–1.19) was associated with the risk of aMCI. Each 1-unit increase in log-transformed levels of urinary 1-OHP (OR, 1.16; 95% CI, 1.07–1.26) and 2-NAP (OR, 1.13; 95% CI, 1.07–1.19) was associated with the risk of AD.

CONCLUSIONS: We revealed that urinary 1-OHP and 2-NAP levels were associated with the risks of aMCI and AD. These findings suggest that the neurological effect of PAHs exposure, with regard to cognitive function and increased risk of neurodegenerative disorders such as aMCI and AD.

Keywords: Polycyclic aromatic hydrocarbons, amnestic mild cognitive impairment, Alzheimer's disease, 1-hydroxypyrene, 2-naphthol

Is racial residential segregation an important but overlooked confounder in air pollution studies? Evidence from six US-based prospective cohorts

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BACKGROUND AND AIM:Racial residential segregation (RRS) has emerged as a potentially important factor in air pollution epidemiology studies, but research examining its association with air pollution, independent of neighborhood socioeconomic status (NSES), is lacking. A better understanding of the relationship between RRS and air pollution can offer valuable insights into a factor that may need to be considered when quantifying air pollution-related health burden.

METHOD: We compiled data from six large cohorts, restricting to Black and White participants residing in urban tracts, to examine associations between RRS, NSES, and individual air pollution exposure. Cohorts included the Multi-Ethnic Study of Atherosclerosis (n=4,889), Reasons for Geographic and Racial Differences in Stroke (n=24,498), Cardiovascular Health Study (n=3,911), Health Professionals Follow-up Study (n=33,675), Nurses' Health Study I (n = 91,319) and Nurses' Health Study II (n=74,620). We used decennial census data to derive a NSES index and a spatial RRS measure (divergence) for participants' residing census tracts, and national spatiotemporal models to estimate individual PM2.5 and NO2 exposures at participants' residential addresses. To pool effect sizes across adjusted cohort-specific multilevel models we fit random-effects meta-analysis models using a DerSimonian-Laird estimator. Effect estimates can be interpreted as the percent change in logged air pollution values for a unit increase in segregation.

RESULTS:A quartile-increase in divergence (more segregation) was associated with 2.73% higher individual PM2.5 exposure (95%CI: 1.34, 4.12) and 10.26% higher NO2 exposure (95%CI: 6.80, 12.71). This association remained after fitting subsequent models that simultaneously adjust for NSES (PM2.5= 2.46, 95%CI: 0.80, 4.11; NO2= 9.51, 95%CI: 5.59 13.43), suggesting the association between the social environment and air pollution is not sufficiently explained by NSES alone. CONCLUSIONS:Our findings suggest that failing to additionally account for RRS in air pollution-health associations may result in biased effect estimates that can undermine current efforts to isolate the health impacts of air pollution.

Keywords: Air pollution, Socio-economic factors, Environmental justice, Epidemiology

PK-045[Chemical exposures » Heavy metals]

Timing of Lead Exposure and Age at Death

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BACKGROUND AND AIM: To assess the association between lead exposure at different life stages and age at death.

METHOD: Adult tooth and bone post-mortem samples from 208 donors to the University of Tennessee, Knoxville, Donated Skeletal Collection were analyzed for lead. Bone measurements, reflecting exposure in the decades preceding death, were assessed by portable X-Ray Fluorescence; lead in tooth enamel and cementum was measured using Laser Ablation-Inductively Coupled Plasma Mass Spectrometry. Lead in enamel reflects exposure in early childhood, and lead in cementum throughout adulthood. We used linear regression models to test lead-age at death associations. RESULTS: The average age at death of the donors was 72.5 years (sd=10.5; range: 46-97). The majority of the cohort was female (63.6%) and white (97.3%), and 49.0% had at least some college education. Pearson correlations between lead measures ranged from 0.24 to 0.57. A one sd (measured in ppm for each) higher lead exposure in enamel (childhood, n=123; mean=86.38, sd=86.18), cementum (adulthood, n = 110; mean=50.56, sd=31.53), and tibia bone (later life, n = 100198; mean=24.58, sd= 16.06) were associated with a -0.8 (95% CI: -1.75, 0.16), -1.59 (95% CI: -2.52, -0.66), and -1.52 (95% CI: -2.68, -0.36) year difference in age at death, respectively, after adjusting for year of birth, sex, social race, and childhood socioeconomic status. Among the 110 donors with all three lead measurements, only adulthood exposure (cementum) remained significantly associated with age at death (β = -1.79, 95% CI: -2.80, -0.78) after additionally adjusting for exposure at earlier time points.

CONCLUSIONS: Results suggest that higher lead exposure is associated with an earlier age at death, with adulthood as the life period of most relevance. However, differences between people in bone turnover in later life could have made the bone lead measures less reliable and contributed to a lack of association with that measure.

Keywords: Lead, mortality, life course

PK-046[Reproductive outcomes » Female reproductive outcomes]

Mixtures of phenol and phthalate urinary biomarkers in relation to the ovarian reserve among women attending a fertility clinic

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BACKGROUND AND AIM:Although prior studies have found associations of the ovarian reserve with urinary concentrations of some individual phenols and phthalate metabolites, little is known about the potential associations of these chemicals as a mixture with the ovarian reserve. METHOD:We prospectively investigated whether mixtures of four urinary phenols (bisphenol A, butylparaben, methylparaben, propylparaben) and eight metabolites of five phthalate diesters including di(2-ethylhexyl) phthalate were associated with markers of the ovarian reserve among 271 women attending a fertility center who enrolled in the Environment and Reproductive Health study (2004-2017). The analysis was restricted to one outcome per study participant using the closest outcome after the last exposure assessment. Ovarian reserve markers included lower antral follicle count (AFC) defined as AFC < 7, circulating serum levels of day 3 follicle stimulating hormone (FSH) assessed by immunoassays, and diminished ovarian reserve (DOR) defined as either AFC < 7, FSH > 10 UI/L or primary infertility diagnosis of DOR. We applied Bayesian Kernel Machine Regression (BKMR) and quantile g-computation to estimate the joint effects of the chemical exposure biomarker mixture on the markers of the ovarian reserve while adjusting for confounders.

RESULTS: Among all 271 women, 738 urine samples were collected. In quantile g-computation models, a quartile increase in the exposure biomarkers mixture was not significantly associated with lower AFC (OR = 1.10, 95% CI = 0.52, 2.30), day 3 FSH levels (Beta = 0.30, 95% CI = -0.32, 0.93) or DOR (OR = 1.02, 95% CI = 0.52, 2.05). Similarly, BKMR did not show any evidence of associations between the mixture and any of the studied outcomes, or interactions between chemicals.

CONCLUSIONS: Despite the lack of associations, further research among other cohorts of women would provide important information given the scarce literature on mixtures of phenols and phthalates in relation to the ovarian reserve in women.

Keywords: Mixtures, Female reproductive outcomes, Phenols, Phthalates.

Urine Antimony and Risk of Cardiovascular Disease

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BACKGROUND AND AIM: To assess the association between urine antimony and incident cardiovascular illness among never smokers in a prospective case-cohort study.

METHOD: The Danish National Patients Registry was used to identify N=809 cases of acute myocardial infarction (AMI), N=958 of heart failure, and N=534 stroke; among n=19,394 never-smoking adults (ages 50-64 years) enrolled in the Danish Diet, Cancer and Health (DCH) cohort between 1993-1997. A subcohort of 600 men and 600 women was randomly selected. Antimony concentrations were measured in spot urine samples collected upon enrollment into the cohort. A case-cohort approach and Cox proportional hazard models was used to estimate adjusted hazard ratios (aHR) for each incident cardiovascular disease outcome associated with urine antimony, statistically adjusted for creatinine.

RESULTS:Median urinary antimony concentration was 0.05 μ g/L (25-75th percentile= 0.02-0.09) in the DCH subcohort. Higher urinary antimony concentrations were positively associated with higher rates of AMI, heart failure, and stroke (aHR= 1.52; 95%CI= 1.12, 2.08, aHR=1.58; 95% CI= 1.15, 2.18, and aHR= 1.29; 95%CI= 0.90,1.85, respectively, comparing participants in the highest (0.09-2.80 μ g/L) with the lowest quartile (<0.02 μ g/L) of antimony). Creatinine standardized results were not materially different. Results did not differ significantly by sex.

CONCLUSIONS: In this population-based Danish cohort, low levels of urine antimony - believed to reflect environmental exposures - were associated with higher rates of incident AMI, heart failure, and perhaps stroke.

Keywords: cardiovascular diseases, exposures, heavy metal
PK-048[Other » Other (to be specified with keywords in the keywords section)]

Disparities in Environmental Health: Findings From a Community Needs Assessment

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BACKGROUND AND AIM: The purpose of the study was to identify environmental health concerns impacting communities in a midwestern city and to identify gaps in community knowledge of environmental health concerns. The extent to which communities understand epigenetics and how it relates to environmental health problems was investigated.

METHOD:An anonymous online community needs assessment survey was created. A comprehensive literature review and expert panel aided in survey creation. This panel consisted of one health educator, one community needs assessment expert, one environmental epidemiologist, one environmental health physician, and multiple environmental health community member advocates. The survey was distributed through various social media platforms and local events. REDCap software and SPSS statistical software package were used for data collection and data analysis, respectively. RESULTS:The results assessed how location, such as zip code, can play a role in environmental health knowledge and help-seeking behaviors. The study also focused on communities' familiarity about epigenetics and perceived barriers for resources. These results can provide an understanding of how to better address environmental exposures and resource barriers to improve the health of underserved communities.

CONCLUSIONS: The study is significant for its potential to improve the well-being of underserved communities. It may help to understand communities' knowledge about possible environmental health risks and what resources they perceive as needed to deal with those concerns. Findings can help identify the health impact of exposures and barriers communities face when obtaining resources to address the exposures and health-related issues. It is vital that communities are aware of possible exposures as well as resources available to address these environmental concerns. Thus, future research should continue to address gaps in current knowledge to better direct research and community projects.

Keywords: Community outreach, Environmental disparities, Environmental epidemiology, Exposures, Mental health outcomes

PK-049[Cancer and cancer-precursors » Other (to be specified with keywords in the keywords section)]

The association between hepatic viral infections and cancers: A cross-sectional study in the Taiwan adult population

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BACKGROUND AND AIM: Hepatitis B and C viruses are diseases of global public health concern known to be associated with liver cancer. A few recent studies reveal associations between hepatic viral infections and extrahepatic cancers, however, limited by insufficient control of likely confounding variables. This study was set to explore the associations between hepatitis B and C viruses and cancer at baseline in the Taiwan biobank database while controlling for a wide range of confounding variables. METHOD: In a cross-sectional study of adults aged over 30 years, we compared the distribution of demographic factors, lifestyle, and comorbidities between viral and non-viral hepatic groups using the chi-square test. Univariate and multivariate logistic regressions were performed to observe the associations between hepatitis B and C viral infections and cancer by estimating the odds ratio (OR) and 95% confidence interval (CI). The multivariate regression made adjustments for sociodemographic factors, lifestyle, and comorbidities.

RESULTS:In the database, 2,955 participants were identified as having HCV infection, 15,305 as having HBV infection, and 140,108 as the non-viral group. HBV infection was associated with an increased likelihood of liver cancer (adjusted OR (aOR) =7.09, 95% CI=3.48-14.44, P<0.001), and ovarian cancer (aOR=3.86, 95% CI=1.68-8.88, P=0.002). HCV infection was observed to increase the likelihood of liver cancer (aOR=4.69, 95% CI=1.34-16.36, P=0.015), ovarian cancer (aOR=5.19, 95% CI=1.17-22.97, P=0.030), and kidney cancer (aOR=10.27, 95% CI=2.06-52.25 P=0.005). CONCLUSIONS:Our findings suggest that hepatic viral infections are associated with intra and extrahepatic cancers. However, being cross-sectional in nature, causal inferences cannot be made. A longitudinal study is recommended to further investigate causality in these associations.

Keywords: Cancer and cancer precursors, Infectious diseases, Risk assessment

Changes in school mitigation strategies and disease transmission within an independent school in New York City

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BACKGROUND AND AIM:During the COVID-19 pandemic, governments have implemented a range of public health measures including school closures to slow the spread of SARS-CoV-2. School closures, in particular, can have immediate and long-lasting impacts on child development and educational attainment thus it is important to understand the role of the built environment and mitigation strategies within schools play in respiratory disease transmission.

METHOD: This presentation will report the results of a compartmental model that looks at the association between within-school risk of transmission, within-school mitigation strategies, and community-level transmission. During the 2021-2022 school year, infection-control strategies and active and passive SARS-CoV-2 testing strategies were employed at an independent school in NYC. In Spring 2022, infection-control strategies were removed. On March 7th, 2022 the independent school went from mandator masks to masks optional and removed the test-to stay requirement on May 15th, 2022. We present these data alongside the NYC community-level transmission data to understand the statistical relationship between community spread and within-school infection control. RESULTS:During the 2021-2022 school year, 56% and 51% of staff (n=231) and students (n=1,145)

RESULTS:During the 2021-2022 school year, 56% and 51% of staff (n=231) and students (n=1,145) were infected, respectively. Following these policy changes, infection rates within the school increased relative to NYC. Twenty-eight percent occurred after the mask option but with test to stay; 23% occurred after the mask option without the test to stay. School infections peaked 2 weeks after the test to stay program was removed, with 7.5% of the school infected.

CONCLUSIONS: We observed 53% of students and staff tested positive for SARS-CoV-2 over the school year; however, in-school transmission was rare prior to the mask optional and removal of test-to-stay policies. Moving forward as the variability within the community spread, it is important to maintain policies to prevent within-school transmission and keep children healthy and in school.

Keywords: School health, disease transmission, mitigation

PK-051[Chemical exposures » Phenols]

Urinary bisphenol analogues and prevalence of metabolic syndrome among adults in Southern China

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BACKGROUND AND AIM: Evidence suggests exposure to bisphenol A (BPA) can influence metabolic syndrome (MetS) and other health risk in adults. To avoid the adverse health effect, kinds of bisphenol analogues are used to replace BPA such as bisphenol E, F, and S etc. However, their health effect such as MetS are unknown.

METHOD: This is a cross-sectional with 1,165 adults recruited in 2013 from Southern China. Modified Adult Treatment Panel III criteria were used to identify the cases of MetS. Concentrations of urinary bisphenol analogues were assessed using high-performance liquid chromatography-tandem mass spectrometry, and they were categorized into three subgroups by below the limit of detection (LOD) and median of detectable value (low, middle, and high) to obtain the adjusted odds ratios (OR) and 95% CI using logistic regression model.

RESULTS: Eight analogues of bisphenol A were analyzed from urine samples. BPF and BPAF selected to do further analysis because their detections were above 50%. Their detection rates were 72.6% and 52.4%, range were LOD to 85.4 μ g/L and LOD to 0.3040, respectively. The prevalence of metabolic syndrome was 3.3% of all participants. There was no significant association between BPF, BPAF and prevalence of MetS.

CONCLUSIONS: No association was observed between bisphenol analogues and MetS prevalence.

Keywords: Phenols, Obesity and metabolic disorders

Countrywide analysis of heat- and cold-related mortality trends in the Czech Republic: growing inequalities under recent climate warming

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BACKGROUND AND AIM:As some population subgroups are more susceptible to nonoptimal temperatures, it can be assumed that recent climate warming amplifies these inequalities. However, little is known about trends in temperature mortality associations among the most vulnerable subgroups, especially in the areas of central and eastern Europe, which are considered major climatic hotspot in terms of heatwave exposure. Thus, we aimed to assess trends in temperature-related mortality in the Czech Republic by sex, age, and cause of death and to quantify the temporal evolution of possible inequalities.

METHOD: We collected daily time series of all-cause (1987-2019) and cause-specific (1994-2019) mortality by sex and age category and daily mean 2-meter temperatures for each region of the Czech Republic. We applied a quasi-Poisson regression model to estimate the trends in region-specific temperature-mortality associations, with distributed lag non-linear models (DLNM) and multivariate random-effects meta-analysis to derive average associations across the country. We then calculated mortality attributable to nonoptimal temperatures and implemented the indicator of sex-, and age-dependent inequalities.

RESULTS:We observed a similar risk of mortality due to cold temperatures for men and women. Conversely, for warm temperatures, a higher risk was observed for women. Results by age showed a clear pattern of increasing risk due to non-optimum temperatures with increasing age category. The RR related to cold was considerably attenuated in most of the studied subgroups during the study period, whereas a significant increase in the RR associated with heat was seen in the overall population, in women, in the age category 90+ years, and with respect to respiratory causes. Moreover, underlying sex-, and age-dependent inequalities experienced significant growth. CONCLUSIONS:Our findings suggest ongoing adaptation to cold temperatures. Mal/adaptation to hot temperatures occurred unequally among population subgroups and resulted in growing inequalities between the sexes and among age categories.

Keywords: Climate, Temperature, Temperature extremes, Mortality, Short-term exposure

Ambient pm2.5 and thyroid hormones in pregnant women in Puerto Rico

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BACKGROUND AND AIM: Maternal thyroid hormones are important determinants of fetal neurodevelopment, particularly in early pregnancy stages when the fetal thyroid does not produce hormones. Air pollution has been linked with neurodevelopmental disorders in infancy and childhood, but it remains unclear whether this may be due to air pollution-related perturbations in the maternal thyroid hormone axis.

METHOD:We investigated associations between 30-day moving average PM2.5 and maternal thyroid hormone levels in a cohort of 1,117 pregnant women between the ages of 18 and 41 in Puerto Rico. Analytes included thyroid stimulating hormone (TSH), triiodothyronine (T3), and free thyroxine (FT4)] We generated individual PM2.5 estimates using inverse-distance weighting of EPA Air Quality System from 13 monitors. We used generalized estimating equations to account for repeated measures, and we performed mediation analyses to examine whether effects of PM on T3 were mediated through TSH. All models were adjusted for fetal gestational age, parity, history of adverse pregnancy outcomes, maternal demographics (i.e., age, race) socioeconomic status, exercise, BMI, and seasonality.

RESULTS:Mean PM2.5 exposure was 8.7ug/m3 over the study period. A 10ug/m3 increase in 30-day moving average PM2.5 was associated with a decrease in log-transformed TSH and T3 of 25.1% (95% CI: -38.7,-8.4) and 34.2% (95% CI: -41.7,-25.8), respectively. The same exposure was associated with a decrease in continuous FT4 of 0.141ng/dL (95% CI: -0.178,-0.104). A monotonic dose response relationship was also observed in quintile analyses for T3 and FT4, with the highest quintile of exposure associated with hormone decreases of 34.1% (95% CI:-46.5, -18.8, p-trend <0.001) and a decrease in FT4 of 0.178 ng/dL (95% CI: -0.245, -0.111, p-trend < 0.001), respectively. CONCLUSIONS:We observed significant perturbations in thyroid hormone levels associated with ambient PM2.5 exposure. This may help explain mechanisms by which ambient air pollution impacts fetal neurological health and development.

Keywords: Ambient pm2.5, thyroid hormones, pregnant women, Puerto Rico

Ambient PM2.5 exposure and progesterone levels in pregnant women in Puerto Rico

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BACKGROUND AND AIM:Decreased levels of progesterone and increased levels of corticotropinreleasing hormone (CRH) during pregnancy are associated with risk of miscarriage and adverse fetal outcomes. Previous studies have found associations between long-term exposure to PM2.5 and reduced progesterone. However, none have examined effects of shorter-term exposures during pregnancy, or the potential mediating role of CRH.

METHOD: We investigated the associations between PM2.5 exposure and maternal levels of progesterone and CRH in a cohort of 1,117 women between 18-41 years old living in Puerto Rico. We obtained exposure estimates from Environmental Protection Agency Air Quality System data, and assigned individual 30-day moving averages for dates prior to each study visit using inverse distance weighting. Hormone levels were analyzed in blood collected during the first and third trimester. We evaluated the association using generalized estimating equation models adjusted for gestational age at the time of blood draw, parity, history of adverse pregnancy outcomes, maternal demographics (i.e., age, race), socioeconomic status (i.e., education, employment status, income, marital status), exercise habits, pre-pregnancy body mass index, and seasonality.

RESULTS:Mean 30-day moving average PM2.5 exposure was 8.7ug/m3. For visits one and three, mean progesterone levels were 45.0 and 86.6ng/mL, respectively. A 10ug/m3 higher level of PM2.5 exposure was associated with a 31.9% lower level of progesterone (95% CI: -39.2,-23.6). A statistically significant and monotonic exposure-response relationship was observed in quintile analyses (p-trend <0.001). Mediation analysis suggested that 65.5% (p<0.001) of the association with progesterone is mediated through CRH.

CONCLUSIONS: Higher short-term exposure to PM2.5 may be associated with lower progesterone levels in pregnancy. The relationship between PM2.5 and progesterone may be mediated by CRH.

Keywords: Ambient PM2.5, progesterone, pregnant women, Puerto Rico

The mediating role of phthalate metabolites on dietary inflammatory index and prostatic enlargement in Taiwanese adults

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BACKGROUND AND AIM:Accumulating evidence suggests that acute and chronic inflammation may contribute to the development of prostate enlargement. Diet is a critical modifiable target for chronic disease prevention and the fundamental mechanism has been associated with potential pro- or antiinflammatory properties of the dietary pattern or dietary components. Diet is also a primary source of phthalate exposure, but prior studies exploring associations of dietary patterns, inflammation and phthalate exposure on prostate enlargement are limited.

METHOD: We evaluated the associations between dietary patterns and urinary phthalate metabolites among a subset of benign prostatic hyperplasia (BPH) men participating in the Southern Taiwan Elderly Health (STEH) Cohort Study. 251 BPH patients were recruited from urology clinic in southern Taiwan during 2015-2017. Dietary inflammatory indexes, including empirical dietary inflammatory index (EDII) and dietary inflammatory index (DII), were calculated based on self-reported food frequency questionnaire (FFQ). 13 phthalate metabolites in urine and 3 oxidative stress markers in serum were analyzed using a high-performance liquid chromatograph coupled with tandem mass spectrometry.

RESULTS: We fit multivariable linear regression models to estimate the cross-sectional associations and potential interactions after we adjusted for confounders. Large-sized prostate group showed the higher score of EDII and higher phthalate metabolites, including MMP, MEP, MiBP, MnBP, and MEHP. Prostate volume, iNOS, and 8-OHdG were positively associated with EDII (p < 0.05). Urinary MMP, MEP, MnBP, and DEHP metabolites were positively associated with iNOS or 8-OHdG (p < 0.05). Urinary DEHP metabolites, MiNP, and MiDP were positively associated with EDII.

CONCLUSIONS:Our results suggested that an inflammatory diet pattern was associated with higher phthalate exposures, while might play a potential mediating role in men with prostate enlargement. These findings also suggest that high-fat dietary patterns and bottle tea may be potential sources of exposure to phthalates in the elderly population.

PK-056[Exposures » Food/nutrition]

Urine high-resolution metabolomics identifies environmental metal-associated inflammatory metabolic network community

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BACKGROUND AND AIM: Heavy metal exposures can become toxic because of their non-biodegradable nature and accumulation in cells and organ tissues. Accumulation of heavy metals, including cadmium (Cd) and cesium (Cs), cause disruption of central metabolic pathways in humans. In this study, we used highly informative, existing human urine samples with an untargeted high-resolution mass spectrometry (HRMS) approach to discover possible environmental heavy metal- and essential metal-associated metabolices and metabolic pathways.

METHOD: This study used 104 urine samples collected from adults [Age 52.3 \pm 5.9 y (mean \pm SD),76% female, 2009-2011]. Participants were primarily Emory University or Healthcare employees enrolled in the Emory-Georgia Tech Center for Health Discovery and Well-Being Cohort. Samples were analyzed for high-resolution metabolomics (HRM) by HRMS (C18, negative ESI) followed by advanced data extraction, annotation and pathway enrichment analysis, and for metals (Mg, Co, Zn, Se, Mo, Cd, Cs and Ti) by inductively coupled plasma mass spectrometry.

RESULTS: The 16,045 mass spectral features were extracted and used for integrative analysis. Mean urine concentration of metals, Mg, Co, Zn, Se, Mo, Cd, Cs and Ti, were 59.5, 0.24, 5.8, 24.4, 17.8, 0.23, 4.6 and 0.2 ppb, respectively. Quantified metal values were tested for association with metabolic features using xMWAS for data-driven integration and network analysis (|r| > 0.40 and p < 0.05). Network analysis showed three metabolic communities (C1, C2, C3). C1 included the metal Cs and 244 metabolites enriched in pentose phosphate pathway. C2 included Cd, Co, Ti and Mg and 310 metabolites enriched in prostaglandin, linoleate and ascorbate pathways. C3 included Zn, Se and Mo and 235 metabolites enriched in nitrogen and glutathione pathways.

CONCLUSIONS: Urinary heavy metals are strongly associated with metabolites and pathways, which are closely related to inflammation and oxidative stress.

Keywords: Environmental metal exposure, metabolic disruption, high-resolution metabolomics, Inflammation pathway

Dietary intake of organic foods in agrarian households in India

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BACKGROUND AND AIM: Consumption of organic foods reduces pesticide exposure, which may be beneficial for health. In India, a form of organic farming known as natural farming, is increasingly common. We quantified the proportion and source of naturally farmed food in the daily diet of adults in agrarian households in south India.

METHOD: We collected data from 2964 participants enrolled at baseline in the BLOOM Study (Co-Benefits of Largescale Organic Farming on Human Health), an ongoing evaluation of an agroecology program in Andhra Pradesh, India. Dietary intake was assessed using an interviewer-administered 24hour recall. For each reported food item, interviewers asked participants about the source (home production/market/ other) and whether the item was naturally farmed.

RESULTS: Mean (SD) participant age was 29 (7) years. Half of the participants were women and 56% attended secondary school or higher. Majority (65%) of participants reported no consumption of naturally farmed foods. Naturally farmed food consumption did not differ by sex. More than half (71%) of the daily energy intake [Mean (SD): 2406 (847) kcal] came from naturally farmed foods in those who did consume such foods. Grains and dairy were most likely to be reported as naturally farmed (26% and 22% of grams consumed, respectively). While majority (62%) of homestead food production was naturally farmed, less than 1% of food items sourced from the market were identified as such. More than half of the home-produced fruits (79%), meat (74%), legumes (68%), vitamin A-rich fruits & vegetables (60%), other vegetables (61%), dairy (56%), nuts (54%), and eggs (52%) were reported as naturally farmed.

CONCLUSIONS: Consumption of naturally farmed foods, which were mostly sourced from homestead production, was limited. Reported naturally farmed foods may not be organic certified. Strategies to scale the adoption of natural farming in homestead food production and increase consumption are warranted.

Keywords: Food & nutrition, pesticides, organic food, dietary intake

The relationship between sleep quality, work and residential location and bedroom environment in Hong Kong

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BACKGROUND AND AIM: A good sleep environment plays a vital role in maintaining good sleep guality. Increasing numbers of studies have linked sleep quality to environmental factors, including light and noise. However, other built environment factors like bedroom ventilation, building surroundings, and work and residential location were rarely assessed for sleep quality. The aim of the study was to examine the relationship between sleep quality and the built environment factors in Hong Kong. METHOD:A cross-sectional study was conducted in Hong Kong from 2022.03 to 2023.01. Social demographic information, work and residential location, bedroom environment, and building surroundings were collected from full-time workers older than 18 years old. Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI), while insomnia was assessed by Insomnia Severity Index. Pearson correlation was used to analyze the relationship between sleep quality and built environment factors. Analyses were conducted by SAS 9.4. Ethics approval: CREC 2021.228. RESULTS: We received 1,432 responses, including 1,173 (81.9%) females and 259 (18.1%) males. The average age of the workers was 34.3 ± 8.3 years old. There were 687 (74.0%) workers who reported poor sleep (PSQI>5), with an average score of 7.7 ± 3.2 points. The Pearson correlation showed that sleep quality was highly correlated with insomnia (γ =0.67, p < .0001). The built environment factors like noise at home (γ =0.14, p <.0001) and room ventilation (γ =-0.09, p = 0.0125) had a very low correlation with sleep quality, while light at night (y = -0.11, p = 0.433), and work and residential location (y = -0.01, p = 0.849) was not related to sleep quality. CONCLUSIONS: Our results provided associations between sleep quality and noise at home and room ventilation. We suggest that direct measurements for the built environment, especially the ventilation marker like indoor CO2, are necessary to validate the present observations and provide further explanations for sleep.

Keywords: Built environment, Noise, Light pollution

PK-059[Methods » Modeling]

Regression calibration of 15 particle components in the United States from 2000 to 2019

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BACKGROUND AND AIM: Estimates for air pollutants including PM_{2.5} and its components derived from models utilizing remote sensing and land use variables provide fine spatiotemporal data that are critical for epidemiological research; however, these estimates may contain bias and measurement error. We aim to calibrate annual predictions of 15 particle components from 2000 – 2019 in the United States in four census regions in urban and nonurban areas to reduce measurement error and improve the estimates for epidemiological studies.

METHOD: Annual predictions of 15 particle components including organic carbon, elemental carbon, nitrate, and sulfate derived from an ensemble of machine learning models were first divided into urban and nonurban areas and further stratified into four census regions and calibrated with meteorological variables including temperature, relative humidity and planetary boundary layer height, land use categorizations, slope and aspect ratio of monitor location, population density, inverse weight of the probability of having a monitor, and distance to steel plants.

RESULTS:Our regression calibration models achieved an R2 between 0.32 and 0.94 with models for potassium and nickel performing the worst and models for sulfate and ammonium performance the best. Of the total 60 models, 55 achieved an R2 greater or equal to 0.5 and 30 achieved an R2 greater or equal to 0.75.

CONCLUSIONS:Our results indicate that certain components are more susceptible to measurement error and predictions from our models are improved and more generalizable for epidemiologic studies.

Keywords: Calibration, PM Components, Modeling

Associations of Urinary Phthalate Metabolites with Household Environments among Mothers and Their Preschool-Age Children

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BACKGROUND AND AIM:Phthalates have raised a matter of public health concern due to their extensive use worldwide and negative health effects. Evaluating potential sources of phthalate exposure is crucial to design prevention strategies, especially for vulnerable populations. This study attempted to assess the associations of phthalate exposure with household environments among mothers and their preschool-age children.

METHOD: This study included 528 mother-child pairs who were followed up at ages 3-6 years in the Taiwan Mother Infant Cohort Study between 2016 and 2020. Each mother was interviewed by using a structured questionnaire containing questions on demographic characteristics and factors in lifestyle and household environment, such as the use of plastic food packaging, residential visible mold, insecticide sprays, and electric mosquito repellent. Eleven phthalate metabolites were analyzed in urine samples simultaneously collected from the mother-child pairs.

RESULTS: The phthalate metabolite urinary concentrations were higher among children than among their mothers, except those of mono-ethyl phthalate (MEP) and mono-2-ethylhexyl phthalate (MEHP). Multiple linear regression analyses showed that urine samples collected during the summer showed higher concentrations of phthalate metabolites than those collected in the winter. Family income had negative associations with the concentrations of MnBP and metabolites of DEHP in children. The use of plastic food packaging was positively associated with mono-n-butyl phthalate (MnBP) concentrations in mothers. Residential visible mold or mold stains were significantly associated with higher MnBP and di-2-ethylhexyl phthalate (DEHP) metabolite concentrations in children. The use of insecticide sprays was positively associated with MnBP in children. The use of electric mosquito repellent was significantly associated with higher MEP concentrations in children.

CONCLUSIONS: Significant associations between household environmental factors and phthalate exposure were mostly found in children, potentially indicating different exposure pathways between mothers and their children. Findings from this study provide additional information in designing prevention strategies to protect child health.

Keywords: Phthalates, Endocrine disrupting chemicals, Household environment, Environmental epidemiology

Residential greenness attenuated the adverse impact of early pregnancy PM2.5 constituent exposure on congenital heart disease

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BACKGROUND AND AIM: The few studies that examined the association between PM2.5 constituents and congenital heart diseases, and the role of residential greenness played between them. We examined the mediation and interaction effects of green space on the association between fine particulate matter (PM2.5) and its constituents during early pregnancy (gestational week 3rd to week 8th) and postnatal CHDs.

METHOD: We executed a register system-based case-control study on 7904 singleton live births between 2019 and 2022 in China. In present study, individual PM2.5 exposure is estimated by ordinary kriging interpolation method, and residential green space index is evaluated using normalized difference vegetation index (NDVI). We applied multiple regression model to estimate the impact of PM2.5 associated with CHDs, and further conducted causal mediation analysis to estimate the mediating effects of green space on PM2.5 related CHDs. Additionally, we speculated the potential multiplicative interaction between PM2.5 and greenness exposure and its influence on CHD. RESULTS:Maternal PM2.5 exposure during early pregnancy was related with increased risks for CHDs while the impact for residential NDVI was the opposite which had OR of 1.046 (95% CI:1.040-1.051), and OR of 0.966 (95% CI:0.963-0.967), respectively, per inter quantile range increment in multivariate models. The causal mediation analysis indicated that greenness mediated generally 5.44% of the correlationship between prenatal PM2.5 exposure and CHD. We identified multiplicative interaction = 1.043 (95%CI: 1.037-1.048).

CONCLUSIONS: This study revealed harmful associations between maternal PM2.5 exposure and CHDs in gestational week 3 to 8. And such associations were partially reduced when exposed to residential greenness.

Keywords: Particulate matter, Particle components, Green space, Exposure assessment-air pollution, Birth outcomes

Influence of air pollution and COVID-19 outbreak on sleep and circadian rhythm among Hong Kong working population

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BACKGROUND AND AIM: Air pollution and the waves of COVID-19 outbreak are evident to impair sleep status and circadian rhythm in the general population. This study assessed such potential associations among the employed working population in Hong Kong.

METHOD:We recruited 218 workers (i.e., 109 e-waste workers and 109 office workers) at the end of two COVID-19 community outbreaks (i.e., waves 4th and 5th) in Hong Kong. Participants completed the standard questionnaires and wore the accelerometer for seven days. The residential addresses were divided into areas with high or low air pollution levels according to pollutants concentration (i.e., PM2.5, PM10, NO2) from monitoring stations. The Pittsburgh Sleep Quality Index and accelerometer data derived sleep and circadian rhythm parameters. Multivariate linear regressions measured the association of the interested independent and outcome variables.

RESULTS:A relatively larger proportion of the participants were middle-aged (mean age: 48 years), male (56.0%), living in high-pollution areas (61.7%), and recruited at the end of wave 5th outbreak (51.8%). Workers living in districts with different levels of air pollution had similar sleep status and circadian rhythm, except for one of the circadian rhythm parameters, mesor, which is significantly higher in high-pollution areas. While no significant association was observed between sleep quality and the waves of the outbreak, workers recruited after wave 5th outbreak (i.e., a severer outbreak compared to wave 4th) tended to have a less robust circadian rhythm in interdaily stability (β = -0.07), intradaily variability (β = 0.22), relative amplitude (β = -0.07), mesor (β = -38.20), amplitude (β = -73.75).

CONCLUSIONS: The workers' circadian rhythm was closely associated with the amplitude of COVID-19 waves in the Hong Kong community. Various stakeholders should invest more resources to facilitate the working population's better preparedness for the next potential pandemic (Acknowledgements: GRF/RGC- 14604020 & VCDFIII-136366853).

Keywords: air pollution, COVID-19, environmental epidemiology, outcomes, occupational epidemiology

Impact of ambient temperature on disadvantaged population: focusing on persons with disabilities

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BACKGROUND AND AIM: Despite broad findings on the hazardous impacts of ambient temperatures, little is known about the temperature's impact on persons with disabilities, who account for 16% of the global population as of 2021. Moreover, few studies have assessed the impacts of ambient temperature on emergency department (ED) visits on a national scale even though ED visits show more sensitive and acute outcomes of extreme temperature effect. Thus, we examined the association between ambient temperature and any cause ED visits in the persons with disabilities. METHOD: We collected hospital clinical data based on the Korean National Health Insurance Service -National Sample Cohort database for 18 years of data from 2002 to 2019. We used case-crossover design modeling conditional logistic regression with distributed lag non-linear models. For heat effect, we defined study period from May to September and from November to February for cold effect. RESULTS: There was 18,173 persons with disabilities (mild grade: 8,964 and severe grade: 9,209) among a 1 million cohort population. The total number of ED visits was 99,328 for persons with disabilities. For heat effect, the odds ratio (OR) was 1.06 (95% confidence interval (CI): (0.99, 1.14)) at the 95percentile temperature versus the minimal risk temperature for ED visits. For cold effect, OR was 1.3 (95% CI: (1.17, 1.44)) at the 5percentile temperature. In mild grade disability group, the OR for heat was 1.21 and the 1.32 for cold. The OR for heat and cold was 1.09 and 1.28 respectively in the severe grade disability group.

CONCLUSIONS: Extreme temperatures increased the risk of ED visits for persons with disability and this risk was higher in mild grade disability group. These results could help understand the potential impacts of ambient temperature on persons with disabilities and inform policy-makers to better protect this vulnerable population from adverse health outcomes related to extreme temperatures.

Keywords: Public health, Health inequalities, Temperature extremes

Workplace factors and mental health outcomes

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BACKGROUND AND AIM: Workplace conditions of scientists contribute to depression and anxiety. METHOD: For this cross-sectional study we analysed de-identified data from environmental scientists who had responded to an online survey about self-identified threats and humiliation at the workplace and mental health from January 15th – April 1st. Eligible were environmental scientists who were members or former members of the International Society of Environmental Epidemiology (ISEE). We used generalized linear models to study the cross-sectional association between threats and humiliation at the workplace and self-reported health, depression, anxiety and stress symptoms. RESULTS::Of those who were contacted, 1,907 opened the invitation (50·6%), and 627 participated (32·9%). Threats and humiliation were common exposures of environmental health scientists (77.4% female and 56% male scientists reported at least one threat at the workplace, 77.4% female and 68.9% males reported at least one humiliation event at their workplace). Threats were most common among females, those who were18 – 30 years old, and no professors, humiliation was most common among females. Exposure to threats (eg. being put on leave) and humiliation (eg. being excluded) were associated with worse self-perceived health, and more symptoms of depression, anxiety, and stress in a statistically significant dose -response relationship.

CONCLUSIONS: Workpalce exposures to threats and humiliation are significaantly related to depression and anxiety.

Keywords: Workplace, depression, a nxiety, stress symptoms

The environmental and social drivers of dengue, chikungunya and Zika emergence: a systematic evidence map

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BACKGROUND AND AIM: The environment has impacted the transmission of many climate-sensitive diseases including dengue, chikungunya and Zika with current estimates suggesting 40% of the world's population are vulnerable to infection. This study aimed to review the range of environmental and social risk factors of these arboviral diseases in order to build a conceptual framework of key known drivers, to help inform surveillance and control strategies and to determine gaps in current knowledge and research.

METHOD:A systematic evidence map approach was used based on the eDPSEEA framework, endorsed by WHO. The Embase, Pubmed and Web of science databases were searched to identify drivers in the scientific literature using key search terms related to each disease, environmental drivers (rainfall, temperature, humidity, floods, hurricanes etc) and social drivers (water management, socioeconomic status, travel, behaviours risk perceptions etc). Article abstracts/titles of each article were screened and included based on an agreed selection criterion. Information on study year, country, journal and risk factors were summarised.

RESULTS: Initial screening resulted in 9,546 titles with the most articles published in 2017 (n= 2800) in a variety of infectious disease and epidemiology journals. Preliminary screening indicated most authors (n= 6,870) from Brazil, India, and UK. Key risk factors included high temperatures, high precipitation, extreme dry conditions, lower socioeconomic status, older housing, lack of public water supplies, ineffective solid waste dumping, and doing outdoor activities in the evening. Full results will be presented.

CONCLUSIONS: The method used and results from this study will provide a comprehensive overview of the interacting environmental and social drivers of emerging mosquito-borne arboviruses that pose a risk to the UK, which will help to direct more targeted interventions and strengthen UK's capacity for detection and surveillance of these diseases.

Keywords: infectious diseases, climate, environmental disparities, environmental epidemiology, socioeconomic factors

The comparison of indoor environmental quality of hospitals in the UK and Taiwan: implications for the delivery of low-carbon hospitals

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BACKGROUND AND AIM:Implementing low-carbon/net-zero mitigation strategies in the built environment has become important to combat climate change. However, these strategies may lead to environmental changes (e.g., increased airtightness and unintended low ventilation), which can cause accumulation of pollutants and damp heat, ultimately affecting the health of people indoors. Hospitals rely on highly-controlled central ventilation and on-site human adaptations, making them an ideal setting for examining the impact of mitigation measures. Considering a significant number of staff and patients would be affected by poor indoor environmental quality (IEQ), establishing monitoring systems to continuously collect IEQ data along with data on the experience people have becomes important.

METHOD: This research focuses on monitoring temperature, humidity, PM_{2.5}, CO₂ and TVOC, and comparing the implemented mitigation strategies (e.g., energy efficiency improvement and energy saving plans) in two university-affiliated teaching hospitals in the UK and Taiwan. Fourteen IEQ monitoring devices are installed across different hospital departments. Furthermore, medical staff working in different hospital environments will rate their performance and complete the Warwick-Edinburgh Mental Wellbeing Scales.

RESULTS:IEQ data are collected every 5-10 minutes and paired with local outdoor measurements. The nature of work, department location and human adaptation are found to affect indoor temperatures, pollutant concentrations and working experience. There are no significant variations in indoor temperatures among departments within the same hospital. However, PM_{2.5} exhibits the most distinct distribution patterns among the departments. Particularly in the pharmacy department, PM_{2.5} concentrations are often higher than the ones in other departments, and 2-3 times higher in Taiwan than in the UK.

CONCLUSIONS: The first-time collaboration between the UK and Taiwan aimed at comparing IEQ, working performance and wellbeing in hospitals. This research highlights the importance of recognising the potential impacts of mitigation strategies and addressing the risk factors of indoor pollution to minimise long-term exposure and promote wellbeing in the workplace.

Keywords: Indoor environmental quality, Multi-pollutant, Built environment, Hospital, International collaboration

Long-term exposure to PM2.5 associated with decline in kidney function in a large urban cohort in two Indian cities

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BACKGROUND AND AIM:Recent studies indicate that exposure to fine particulate matter (PM_{2.5}) is associated with decline in kidney function and chronic kidney diseases. However, evidence linking time-varying PM_{2.5} with kidney function in the South Asian population exposed to high levels of PM_{2.5} is limited due to few longitudinal studies and lack of robust exposure data.

METHOD:In a representative population-based Indian cohort of 12271 adults in Chennai and Delhi, we investigated the longitudinal associations between annual PM_{2.5} and estimated glomerular filtration rate (eGFR) (using CKD-EPI 2009 equations) at baseline and two follow-ups (average follow-up: 4.4 years, IQR: 3.9,5.2 years). Exposures were assessed at residential geocodes using a high resolution spatiotemporal model for daily PM_{2.5} at 1kmx1km across India. Within each city, linear mixed effect models with inverse probability based weighting for loss-to-followup were implemented, while adjusting for socioeconomic status, time, diabetes and hypertension status. Effect modification by age, sex and obesity were assessed using stratified models.

RESULTS:Annual average PM_{2.5} exposures at baseline and two follow-ups were 32.9, 37.1 and 29.6 μ g/m3 (sd: 3.8, 6.6, 3.9 μ g/m3) in Chennai and 118, 123 and 129 μ g/m3 (sd 15.2, 15.1, 14.3 μ g/m3) in Delhi. Median eGFR at baseline were 112 mL/min/1.73 m² (IQR: 101.9,121.0) in Chennai and 106.4 mL/min/1.73 m² (IQR: 94.4,116.6) in Delhi. A 10 μ g/m3 higher annual average PM_{2.5} exposure was associated with 0.82 mL/min/1.73 m² (95% CI: -1.17,-0.47) and 0.78 mL/min/1.73 m² (95% CI: -1.07,-0.49) decrease in eGFR in Chennai and Delhi, respectively. Further, the decline in eGFR was greater in lean individuals in Chennai and obese individuals in Delhi.

CONCLUSIONS:Long-term exposure to PM2.5 was associated with decline in eGFR levels in both cities. Given the high burden of air pollution and chronic diseases in India, there may be high potential long-term benefits of reducing air pollution on renal health in urban India.

Keywords: Particulate matter, Long-term exposure, Kidney disease, Renal function, India

PK-068[Omics technologies » Proteomics]

Proteomics-based discovery of novel biomarkers for lipid metabolism-related diseases in abandoned mine areas

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BACKGROUND AND AIM: This study was to discover new biomarkers associated with diseases related to abandoned mine areas by performing protein networking mapping of the blood(serum) of residents in the abandoned mine area.

METHOD: The study was conducted in the Goseong province, an abandoned mine area, and the Gimhae province, a control area, in the South Korea. The abandoned mine area was divided into two groups with different levels of exposure. Serum was collected from the Goseong and Gimhae areas, and mass spectrometry was performed for protein profiling. The identified proteins were analyzed for the process of selecting candidate biomarkers through comparative analysis between the exposed and non-exposed groups through relative quantification. Protein network mapping was performed through string software.

RESULTS:As a result of protein profiling, a protein network associated with lipoprotein metabolism was identified in the abandoned mine area. Besides, lipoprotein metabolism changed step by step depending on the degree of mine exposure. Final biomarkers related to lipoprotein metabolism are Alpha-2-macroglobulin, Apolipoprotein A-IV, Apolipoprotein B-100, Apolipoprotein A-I, and Apolipoprotein F.

CONCLUSIONS: The study found that the biomarker panel associated with lipoprotein metabolism can serve as a biomarker to track the risk of diseases associated with abandoned mine areas. Lipoprotein metabolism has a direct connection with cardiovascular disease, which is reported as a major cause of renal function disease. By confirming that lipoprotein metabolism proteins form networking in the abandoned mine area, the possibility of using them as leading biomarkers of renal function decline involved in cholesterol transfer and plasma lipoprotein particle remodeling was validated. These findings suggest that the use of the identified biomarkers can be helpful in predicting the risk of disease occurrence in the abandoned mine area.

Keywords: Abandoned mine area, Proteomics, Lipid metabolism, Renal function, Cardiovascular disease

PK-069[Exposures » Occupational exposures]

Application of artificial intelligence algorithms and low-cost sensors to estimate respirable dust in the workplace

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BACKGROUND AND AIM: Internet of Things and low-cost sensor technology are becoming common tools for environmental exposure monitoring, but few is applied to measure dust in the workplace. This study aimed to develop a predictive model of respirable dust by artificial intelligence (AI) algorithms and low-cost sensors.³

METHOD: A variety of low-cost sensors were combined into a respirable dust sensor module and placed with a portable aerosol monitor (GRIMM 11-D) for a two-week monitoring. The data was collected to establish a predictive model of respirable dust by AI algorithms. The built model was validated by using an aluminum cyclone with an air pump and polytetrafluoroethene filters to sample the 8-hour respirable dust during 5 days in an aircraft manufacturing company. The continuous two-week monitoring of sensor module was performed to evaluate the stability in the workplace. RESULTS: The concentration of respirable dust measured by GRIMM 11-D in a general outdoor environment during two weeks was $28.5 \pm 16.1 \ \mu g/m^3$ (range= $2.4 \cdot 85.3 \ \mu g/m^3$). After establishing various predictive models based on monitoring data and AI algorithms, the random forest method was observed to have the best prediction capacity (R²=0.96, RMSE=3.11, MAE=2.12) compared with other 18 methods. In the field validation, the predictive levels of respirable dust $(35.9\pm4.1 \,\mu\text{g/m}^3,$ range=32.7-42.9 μ g/m³) was close to results collected by the traditional method (38.1±8.9 μ g/m³, range=28.1-52.5 μ g/m³), and the correlation between them was high (r=0.86). The overall average bias was -2.2 μ g/m³ with the precision of 5.8 μ g/m³ to generate the accuracy of 6.2 μ g/m³ (94.2%). The data completeness was 99.7% during the two-week monitoring periods. CONCLUSIONS: The developed predictive model of respirable dust based on AI algorithms and low-cost sensors had the excellent performance in the workplace compared with those measured by the

traditional sampling method. The built sensor module also had good data stability during the sampling period.

Keywords: Exposure assessment, Modeling, Occupational exposures, Particulate matter.

Temperature and gastroenteritis association in refugee camps in Bangladesh, 2019-2021

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BACKGROUND AND AIM: This study aims to determine the association between temperature and gastroenteritis of forcibly displaced persons in refugee camps, Bangladesh.

METHOD: Daily time series data, based on case reports, were collected from two clinics organized by UNHCR in Kutupalong and Nayapara camps in Ukhia and Teknaf Upazila, Cox's Bazar, Bangladesh, from 2019 to 2021. In the absence of a background monitoring station around the refugee camps, we utilized the internally validated ERA5-land reanalysis temperature data, obtained from the European Centre for Medium-Range Weather Forecasts, as a proxy for the ambient air temperature exposure. We modeled the nonlinear lagged associations between daily temperature and gastroenteric cases using a quasi-Poisson generalized linear model coupled with a distributed lag non-linear model. Covariates, such as precipitation, long-term time trend, day-of-the-week, holiday, COVID-19 and reporting system indicator terms, sourced out from literature were adjusted in the model. RESULTS: 33,280 cases in Kutupalong and 31,165 cases in Nayapara were registered for gastroenteritis from 2019 to 2021. The two camp clinics have varying cumulative risk curves. Kutupalong clinic showed an M-shaped risk curve with two distinct peaks at around 21°C and 29°C, with a trough, potentially assumed as the minimum risk temperature (MRT), at 26°C. The relative risk (RR) of 10th percentile (21.1°C) was 2.31 (95% confidence interval [CI]: 1.18, 4.65), while the RR of 90th percentile (28.5°C) was 1.78 (95% CI: 1.24, 2.56), both relative to MRT. In Nayapara, there was a trend towards increased risk at lower temperature. The RR of 10th percentile (21°C) was 1.32 (95% CI: 0.78, 2.24), while the RR of 90th percentile (28.3°C) was 0.75 (95% CI: 0.56, 0.99), relative to MRT.

CONCLUSIONS: Temperatures was found to be associated with gastroenteritis in refugee camps with risks noted to be higher at low temperature.

Keywords: public health, environmental epidemiology

European city clusters based on morphological configurations of urban landscapes and relation with surface urban heat islands

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BACKGROUND AND AIM: The world is becoming highly urbanized. A better understanding of urban design typologies and their association with environmental exposures can help policy-makers determine which actions contribute to more sustainable and healthier cities. We aimed to identify distinct urban configuration types in 932 European cities and evaluate their association with surface urban heat islands (SUHI).

METHOD: We retrieved data on Local Climate Zones (LCZs) representing 17 urban and natural classes at 100m resolution for Europe. We divided each city into five rings starting from the urban center, assuming a monocentric urban configuration. For each ring, we determined the most prevalent LCZ. We conducted a Uniform Manifold Approximation and Projection for Dimension Reduction (UMAP) and we classified the cities into clusters using the hierarchical density-based clustering algorithm (HDBSCAN). The SUHI was estimated as the difference between rural and urban land surface temperatures at 250m resolution. Differences in SUHI between clusters were evaluated using one-way ANOVA and post-hoc Tukey test.

RESULTS: We identified 9 city clusters. Cluster 1 is characterized by compact midrise configurations; cluster 2 has open midrise structures; clusters 3, 4, 5 have open lowrise configurations with low plants, predominantly in central areas in clusters 4 and 5; clusters 6 and 7 are characterized by large lowrise structures and clusters 8 and 9 are open lowrise with scattered trees in cluster 8. We found a significantly lower SUHI in clusters 4, 5, 6 and 7 (mean SUHI range 0.5°C-1.8°C) compared to clusters 1, 3, 8 and 9 (mean SUHI range 2.7°C-3.6°C).

CONCLUSIONS:Our results suggest that distinct morphological configurations exist among European cities and that these are associated with differences in environmental exposures. Our findings indicate a lower SUHI in cities that preserve natural landscapes highlighting the importance of nature-based solutions, particularly in central areas, to mitigate heat effects.

Keywords: Local Climate Zones, Surface Urban Heat Islands, European cities, Clusters

Residential Proximity to Oil and Gas Wells and Survival in Children with Acute Leukemia

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BACKGROUND AND AIM: Living near oil and gas developments may increase the risk of developing childhood leukemia, but their impact on survival is largely unknown. We examined whether living near oil and gas wells is associated with mortality in children with leukemia. METHOD: This study included children with a primary diagnosis of leukemia \leq 19 years in the Texas Cancer Registry, 1995-2017. The location of oil and gas wells in Texas was obtained from the Texas Railroad Commission. Wells were categorized as 1) oil or gas well, 2) service, storage, injection, or disposal (SSID) well, 3) permitted well, 4) horizontal drainhole, or 5) sidetrack well. Distance between residential address at diagnosis and wells in Texas was calculated to determine whether children lived within 1000m from each well type (yes/no). We conducted Cox regression, adjusting for sex, census tract-level poverty, race/ethnicity, age at diagnosis, and decade patient was diagnosed. Analyses were conducted for acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML), separately. RESULTS:8.2% of leukemia patients lived within 1000m of an oil or gas well. 5,980 and 1,297 children were diagnosed with ALL and AML, respectively. The 5-year overall survival for ALL was 85% and 59% for AML. Across the five well types, living within 1000m was not associated with survival in children with ALL. Mortality was significantly higher in children with AML living within 1000m of an oil or gas well (aHR: 1.35, 95% CI: 1.02, 1.80). In dose-response analyses, the association was only significant in those with ≥ 6 oil or gas wells within 1000m (aHR: 1.81, 95% CI: 1.15, 2.86). Elevated risk of death was also observed with SSID, permitted, and sidetrack wells (aHR range: 1.29-1.66). CONCLUSIONS: These findings provide preliminary evidence that pollutants from oil and gas wells may contribute to survival of AML but not ALL.

Keywords: Cancer and cancer precursors, spatial statistics, children's environmental health

Environmental Tobacco Smoke Exposure and Perinatal Health Outcomes in the United Arab Emirates: Interim Analysis from The Mutaba'ah Study

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BACKGROUND AND AIM:Tobacco use is high in the Middle East region; however, there is minimal data on prenatal exposure or the impact on perinatal outcomes. This study investigated the association between environmental tobacco smoke (ETS) exposure and perinatal health outcomes in the United Arab Emirates (UAE).

METHOD: This is an interim analysis of the Mutaba'ah prospective cohort study that is recruiting 17,000 pregnant women in the UAE. We report the available baseline data on ETS exposure (N=8,586) and 4,328 pregnant women who delivered between May 2017 and February 2021. Self-report questionnaires collected data on socio-demographic factors, prenatal tobacco use, and ETS exposure. Perinatal outcomes were extracted from hospital medical records. Univariate and multivariate regression models were used to assess the association between (i) various sociodemographic factors and tobacco use and ETS exposure; and (ii) tobacco use and ETS exposure and perinatal health outcomes.

RESULTS:Self-reported tobacco use during pregnancy was low (0.7%), spousal tobacco use was high (37.9%), and a third (34.8%) of expectant mothers were exposed to ETS (28.0% at home). Employment during pregnancy (adjusted odds ratio (aOR): 1.35, 95% confidence interval (CI): 1.19-1.52), childbirth anxiety (aOR 1.21, 95% CI 1.08-1.36), and increased adults living in the same house (aOR 1.02 95% CI 1.01-1.03) were independently associated with higher odds of being exposed to ETS. Pregnant women with higher education levels (aOR 0.84, 95% CI 0.75-0.94) and higher gravidity (aOR 0.95, 95% CI 0.92-0.99) were less likely to be exposed to ETS. Women exposed to ETS were 31% more likely to deliver prematurely (aOR 1.31, 95% CI 1.06-1.62).

CONCLUSIONS: The majority of ETS exposure occurs at home; therefore, public health efforts targeting smoking cessation amongst husbands and promoting smoke-free homes may help reduce prenatal ETS exposure and adverse perinatal outcomes in the UAE.

Keywords: Epidemiology, Female, Long-term exposure, Pregnancy outcomes, Socio-economic factors.

PK-074[Exposures » Occupational exposures]

Association between leptin and sleep quality of shipyard workers exposed to metal fume particulates

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BACKGROUND AND AIM: This study explores the association between leptin and sleep quality among shipyard workers exposed to metal fume particulates.

METHOD: The study design was a cross-sectional setting. The objects were recruited from a shipyard in northern Taiwan, including welders and office workers. The personal sampling PM2.5 sample was collected on Monday during working hours. On Tuesday morning, the body composition was measured with body composition analyzers. Fasting blood and urine samples were also collected. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was used to analyze the metals in air and urine samples. The Sandwich Enzyme-Linked Immunosorbent Assay measured leptin and serotonin. In addition, the Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. The statistical analyses used IBM SPSS Statistics 22.0.

RESULTS:The concentration of particulate matter (μ g/m3) in the exposure group and the control group were 303.46 (3.15) [GM(GSD)] and 99.38 (3.37) (p<0.001); the serotonin concentration (pg/mL) in the exposure group and the control group were 70.36 (2.83) and 40.23 (3.39) (p=0.09); the leptin concentration (ng/mL) in the exposure group and the control group were 4.60 (1.27) and 4.55 (1.27) (p=0.630), respectively. In linear regression analysis, after adjusting for group, age, and smoking habits, a negative linear relationship between urinary aluminum (β =-0.220; 95% CI: - 0.526,0.000; p=0.050), urinary nickel (β =-0.228; 95% CI:-0.791,-0.012; p=0.044) and serotonin. After adjusted confounders, a negative relationship between serotonin concentration (β =-0.375; 95% CI: -0.123,-0.033; p=0.001) and leptin. In addition, there was a positive linear relationship between the subjective sleep quality index of the Pittsburgh Sleep Quality Index (β =0.345; 95% CI:0.017,0.083; p=0.003) and leptin concentration.

CONCLUSIONS: We conclude that shipyard welders are exposed to high levels of metal fume particulates. Furthermore, some metals are associated with a decrease in serotonin. Conversely, leptin is associated with decreased serotonin and a worse subjective sleep quality index.

Keywords: Heavy metals, Particulate matter, Obesity and metabolic disorders

Role of gut microbiota between exposure to welding fume and sleep quality

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BACKGROUND AND AIM: Approximately 70% of workers in shipyard are exposed to complex mixtures of welding fume that may affect the composition of gut microbiota in welding workers. In the gut microbiota fields, sleep can alter the composition of the gut microbiota through the gut-brain axis, hypothalamic-pituitary-adrenal axis stimulation, immune regulation. This study aimed at the correlation between the shipyard workers in metal fume exposure, composition of gut microbiota species, inflammatory factors and sleep quality.

METHOD: This study conducts a cross-sectional research from a shipyard in northern Taiwan. Since the highest composition and distribution in welding rods are iron and manganese, the subjects were divided into high and low iron-manganese group by intrinsic dose. Inductively coupled plasma mass spectrometry was used to detect the concentration of metals in feces, and the enzyme-linked immunosorbent assay was used to analyze the concentration of plasma hs-CRP.Sleep quality was used by Pittsburgh Sleep Quality Index(PSQI). The identification of bacterial species contained in stool samples was performed by the third-generation sequencing technology, analyzing the 16S ribosomal genes. Statistical analysis was performed with statistical software SPSS version 22.0. RESULTS: The fecal metal AI,V,Cr,Mn,Fe,Co,Ni,Cu,Zn,Cd and Pb concentration in the high ironmanganese internal dose group was significantly higher than the low group. The alpha diversity in microbiota like Shannon and Simpson were non-significant between the two groups. Regarding the PSQI score, there was a non-significant between the two groups. The fecal Cr, Zn and Hg concentrations were significantly negatively associated with the abundance of Actinobacteria, Verrucomicrobia, and Firmicutes. The above fecal metals were also significantly positively associated with Proteobacteria and Lachnoclostridium. Besides, hs-CRP was positively associated with Lachnoclostridium. Moreover, Phocaeicola and Lachnoclostridium showed a significant negative association with PSQI.

CONCLUSIONS: Higher fecal metal concentrations increase the relative abundance of Proteobacteria and some human inflammatory bacteria like Lachnoclostridium. There may have a relationship between worse sleep quality and the abundance of Lachnoclostridium. This study was supported by the Ministry of Science and Technology (MOST111-2314-B-016 -012-MY2.

Keywords: welding metal fume, microbiota, inflammatory factors, sleep quality

Genetic determinants of serum selenoproteins and selenometabolites concentrations in the Aragon Workers Health Study - SelenOmics project

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BACKGROUND AND AIM: Genome-Wide Association Studies (GWAS) pointed out that selenium biomarkers concentrations may be influenced by genetic variation. However, no study has comprehensively investigated genetic determinants of selenoprotein and selenometabolites concentrations. Therefore, we evaluated the association of selenoproteins and selenometabolites concentrations with single-nucleotide polymorphisms (SNPs) through a candidate gene approach in the Aragon Workers Health Study (AWHS), a participating cohort in the SelenOmics project. METHOD: Serum selenoproteins (glutathione peroxidase [GPx], selenoprotein P [SeP], selenoalbumin [SeAlb]) and selenometabolites (Se-metabolites) were measured using HPLC/ICP-MS (N=852). Participants were genotyped with the Infinium Global Screening array (v3.0, Illumina) and SNPs were imputed using the TOPMed Imputation Server. For the candidate gene approach, a total of 863 genes related to selenium, selenoprotein, selenocysteine and glutathione, methionine, cysteine and one carbon and folate metabolism were selected from the NCBI-Gene database. After quality control and SNPs identification in the candidate genes regions (±1Kbp from the gene start/end position) 137652 SNPs remained eligible for the GWAS, which was conducted separately for each of the selenoproteins and total Se-metabolites concentrations (log-transformed). Models were adjusted for age, gender and smoking status.

RESULTS:Serum GPx, SeP, SeAlb and total Se-metabolites concentrations were, 15.82, 66.07, 14.04 and 0.07 µg/L, respectively. The number of SNPs with a suggestive statistical significance p-value \leq 0.001 was 208 for GPx, 161 for SeP, 150 for SeAlb and 132 for total Se-metabolites (no significant SNPs at the Bonferroni threshold). The genes with the lowest p-value were CSMD1 for GPx and SeAlb, -consistently with previous GWAS; ABCG2 for SeP; and NAT2 for total Se-metabolites.

CONCLUSIONS: Identifying genetic variants of serum selenoproteins and Se-metabolites concentration can help understanding selenium-related metabolism and health consequences. Additional studies in other populations are needed to validate these findings.

Keywords: selenium, selenoproteins, selenometabolites, single-nucleotide polymorphisms (SNPs), genome-wide association studies (GWAS)

The impacts of fine particulate matter components and trace elements on rates of dementia hospitalization

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BACKGROUND AND AIM:Research suggests air pollution exposure may accelerate neurodegenerative disease progression. Higher PM2.5 exposure has been associated with increased risks of hospitalization among adults with Alzheimer's Disease and related dementias (ADRD). PM2.5 is a mixture of particles from a variety of industry- and transportation-related sources, some more impactful than others. We explored the impact of long-term exposure to specific PM2.5 components and trace elements on hospitalization with ADRD diagnosis codes among Medicare fee-for-service beneficiaries.

METHOD: We followed 43,456,616 adults aged 65+ in the United States from 2000-2016. We obtained high-spatial-resolution annual average PM2.5 components data-including elemental carbon, ammonium, organic carbon, nitrate, sulfate, bromine, calcium, copper, iron, potassium, nickel, lead, silicon, vanadium, and zinc. We applied nonparametric causal inference methods adjusting for 22 area- and individual-level confounders and estimated hazard ratios (HR) and potential nonlinear exposure-response relationships in single pollutant models, as well as models additionally adjusting for total PM2.5.

RESULTS:Nearly all PM components showed harmful effects, with noticeable increases in ADRDinvolved hospitalization risk at lower exposure levels. HRs ranged from 0.924 (95% CI 0.913-0.935) for silicon to 1.234 (95% CI 1.214-1.254) for sulfate per IQR increase in exposure; only calcium and silicon had HR<1. Based on nonlinear exposure-response curves, increased sulfate caused the largest number of additional ADRD-involved hospitalizations; over 2.5 times the number of hospitalizations occurred at the highest versus lowest sulfate exposure levels. Bromine, potassium, copper, lead, iron, and zinc also showed large increases in ADRD-involved hospitalization rates. Additionally adjusting for total PM2.5 attenuated impacts, but results of the most harmful components were robust. CONCLUSIONS:The effects of most PM components are most toxic informs public health efforts to target damaging sources of air pollution.

Keywords: air pollution, particle components, neurodegenerative outcomes, causal inference

Ingested nitrate and nitrite and end-stage renal disease risk among licensed pesticide applicators and spouses in the Agricultural Health Study

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BACKGROUND AND AIM: Nitrate and nitrite ingestion has been linked to renal cell carcinoma, possibly via the endogenous formation of carcinogenic N-nitroso compounds. These exposures might also play a role in end-stage renal disease (ESRD), but there have been no epidemiologic studies on the associations. We investigated the associations of drinking water nitrate and dietary nitrate and nitrite intakes with incident ESRD among participants of the Agricultural Health Study and explored effects of vitamin C and heme iron intake, which may differentially mediate endogenous nitrosation. METHOD: The primary drinking water source for participants was determined at enrollment. We computed duration-specific average nitrate concentrations for public water supply users (N=14,769) from historical measurements data. For private well users (N=44,863), we developed random forest model estimates of nitrate concentrations based on well location, depth, nitrogen inputs, and other predictors. Dietary nitrate and nitrite were assessed among 30,177 participants who completed the NCI Dietary History Questionnaire at the first follow-up. Incident ESRD between study enrollment (1993-1997) or first follow-up (1999-2003) and December 2018 was ascertained through linkage with the U.S. Renal Data System. We estimated adjusted hazard ratios (HRs) and 95%CI for associations of tertiles (T) of exposure with incident ESRD overall and in strata of vitamin C and heme iron. RESULTS: We identified 469 ESRD cases (206 for dietary analysis). Water nitrate and dietary nitrate/nitrite were not associated with overall ESRD risk. Higher dietary nitrite was associated with ESRD only among participants with vitamin C < median (T3 vs. T1 HR: 2.26, 95%CI: 1.05, 4.86) and those with heme iron \geq median (T3 vs. T1 HR: 1.73, 95%CI: 0.89, 3.39). CONCLUSIONS:ESRD incidence was associated with dietary nitrite intake among participants with lower vitamin C or higher heme iron intake. Research using biomarkers of earlier renal dysfunction and other nutrient profiles may clarify the potential risks associated with nitrite exposures.

Keywords: Occupational exposures, Water quality, Food/nutrition
VO-003[Other » Other (to be specified with keywords in the keywords section)]

The Planetary Child Health and Enterics Observatory (Plan-EO): an Interdisciplinary Research Initiative and Web-Based Dashboard for Mapping Enteric In

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BACKGROUND AND AIM: Diarrhea remains a leading global cause of childhood illness and is caused by various species of climate-sensitive pathogens. The emerging Planetary Health movement emphasizes the interdependence of human health with natural systems, with much of its focus on infectious diseases and their interactions with environmental and human processes. Meanwhile, the era of big data has transformed the curation, aggregation and dissemination of health information engendering a public appetite for open access, web-based repositories of infectious disease data. However, enteric infectious diseases (EID) have largely been overlooked by these developments. METHOD: The Planetary Child Health and Enterics Observatory (Plan-EO) is a new initiative that builds on existing partnerships between epidemiologists, climatologists, bioinformaticians, and hydrologists as well as investigators in numerous low- and middle-income countries (LMICs). Its objective is to provide the research and stakeholder community with an evidence base for the geographical targeting of EID-specific child health interventions. The initiative will produce, curate, and disseminate spatial data products relating to the distribution of enteric pathogens and their environmental and sociodemographic determinants, making them available to decisionmakers via an online dashboard. RESULTS: To date Plan-EO has compiled microdata from 23 studies with ~80,000 diagnostic results from 35,000 children aged 0 - 59 months at sites in 24 LMICs and georeferenced to over 9,000 unique locations and outreach to additional studies is ongoing. An initial published analysis of Shigella has yielded detailed prediction maps and insights into the mechanisms underlying transmission. These approaches will be extended to other pathogens and their findings used to assess their relative sensitivity to changes in climate compared to other determinants such as sanitation improvements. CONCLUSIONS:Plan-EO will eventually develop a scenario-based framework to support decisionmaking, resource allocation and identification of priority populations for targeting EID-specific interventions such as novel vaccines.

Keywords: Planetary health, enteric pathogens, bioinformatics, climate, infectious diseases

Associations of a mixture of whole blood metals with incident uterine leiomyomata

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BACKGROUND AND AIM:Uterine leiomyomata (UL), smooth muscle tumors of the uterus, are a major cause of gynecologic morbidity. Metals may influence UL risk through endocrine disruption and mutagenesis. Metals often co-occur and may interact, necessitating a mixture approach for statistical analyses. Our objective was to estimate the associations of whole blood metals mixture with risk of incident UL.

METHOD: We analyzed data from the Study of Environment, Lifestyle and Fibroids, a prospective cohort study of 1,693 Black individuals with an intact uterus, age 23-35 years, residing in the Detroit, Michigan area at baseline (2010-2012). Participants provided non-fasting whole blood samples at baseline, in which we measured concentrations of 17 metals using inductively coupled plasma mass spectrometry. Participants underwent transvaginal ultrasonography at baseline and 20 months later for ascertainment of UL (88% cohort retention). We used component-wise Bayesian Kernel Machine Regression to estimate associations of the metal mixture with probit of incident UL during 20 months, adjusting for age, body mass index, parity, past-2 year use of depot medroxyprogesterone acetate, and current smoking at baseline.

RESULTS: Among 1,132 participants without UL at baseline, 117 (10%) developed UL within 20 months. The metal mixture was positively associated with probit of UL (e.g., when all metals were at their 75th percentiles, compared with their 50th percentiles, $\beta = 0.07$, 95% CI: -0.02, 0.16). The strongest contributor to the association of the mixture with UL was cadmium, followed by barium, zinc, cobalt, mercury, and nickel. There was no evidence of meaningful interaction between metals. CONCLUSIONS:In a prospective cohort study, a mixture of metals measured in whole blood was weakly positively associated with incident ultrasound-detected UL after 20 months. The association was driven by cadmium, which has been reported to increase fibroid tissue proliferation in laboratory studies.

Keywords: female, mixtures, reproductive outcomes

Association of Long-term Exposure to Air Pollution with Late-Life Depression in Older Adults in the US

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BACKGROUND AND AIM: Emerging evidence has suggested harmful associations of air pollutants with neurodegenerative diseases among older adults. However, little is known about late-life mental outcomes, such as geriatric depression. We aimed to investigate if long-term exposure to air pollution is associated with increased risk of late-life depression diagnosis among US older adults. METHOD: We designed a population-based longitudinal cohort study of US Medicare enrollees >64 yrs. Data were obtained from Centers for Medicare and Medicaid Services Chronic Conditions Warehouse. We included participants continuously enrolled in the Fee-for-Service program and both Medicare Part A & B. After 5-year washout period at entry, a total of 8,907,422 unique individuals were covered over 2005-2016, who contributed to 1,526,690 late-onset depression diagnoses. The exposures consisted of residential long-term exposure to fine particulate matter (PM2.5, ug/m3), nitrogen dioxide (NO2, ppb), and ozone (O3, ppb). Late-life depression diagnoses were identified via information from all available Medicare claims (i.e., hospital inpatient, skilled nursing facility, hospital outpatient, and physician visits). Date of the first occurrence was obtained. Hazard ratios and percentage change in risk were estimated via stratified Cox proportional hazards models accounting for climate coexposures, neighborhood greenness, socioeconomic conditions, healthcare access, and urbanicity level.

RESULTS:A total of 8,907,422 enrollees were included with 56.8% being female and 90.2% being White. Each 5-unit increase in long-term mean exposure to PM2.5, NO2, and O3 was associated with an adjusted percentage increase in depression risk of 0.91% (95%CI, 0.02%-1.81%), 0.61% (95%CI, 0.31%- 0.92%), and 2.13% (95%CI, 1.63%-2.64%), respectively, from tri-pollutant model. Effect heterogeneity was found among subpopulations by comorbidity condition and neighborhood contextual backgrounds.

CONCLUSIONS: Among US older adults, harmful associations were observed between long-term exposure to air pollution and increased risk of late-life depression diagnosis. This study suggests air pollution is a potential risk factor for late-onset depression.

Keywords: Air pollution, Big data, Incidence, Long-term exposure, Mental health outcomes

Consistency of findings between experimental and observational analyses of placental monon-butyl phthalate (MnBP) and anti-androgenic effects

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BACKGROUND AND AIM:Prenatal phthalates, measured in maternal urine, are associated with antiandrogenic effects in the male fetus. Here, phthalates were measured in placental chorion without (CS, chorion smooth) and with villi (CF, chorion frondosum) sampled at birth (N=33). First trimester placental villi were cultured and dosed with 120 nM mono-n-butyl phthalate (MnBP) and placental conditioned media (PCM) was placed on male fetal gonads (N=10). Fetal testosterone (experimental) and AGD (observational) were measured as proxies of one another, and the aim was to assess MnBP effects, mediated by the placenta.

METHOD:At birth, measures of male AGD-penis (AGD-P) and AGD-scrotum (AGD-S) were obtained. MnBP was measured by LC-MS in term placental tissues. Placental hormone human chorionic gonadotropin (hCG) was measured in maternal serum (observational) and in PCM (experimental), and hCG mRNA was measured in placental villi. Multivariate regression and causal mediation analyses were applied to assess and compare direct and indirect effects of MnBP.

RESULTS:Placental (CS) MnBP was negatively associated with AGD-S when first trimester hCG was held constant (controlled direct effect [CDE]: -0.60 95% CI -1.06, -0.14). The natural indirect effect (NIE, mediated effect of MnBP) was positive (0.19 95% CI -0.03, 0.40). In the experimental model, MnBP had no effect when PCM hCG protein was analyzed as a mediator (N=10). When placental CGB (mRNA that encodes hCG β subunit) was treated as the mediator, the effect of MnBP on fetal testosterone was positive (N=4, CDE 2.63 95% CI 0.32, 4.94), and the mediated effect was negative (NIE -3.57 95% CI -6.31, -0.84).

CONCLUSIONS: Associations of placental MnBP with fetal testosterone and newborn AGD were present

in complementary model systems. MnBP effects were mediated by placental hCG in both models, with distinctions in mRNA vs. protein mediation in the organoid model. These findings corroborate existing knowledge and add additional insight into placental-fetal endocrine disruption.

Keywords: phthalate, placenta, anti-androgen, epidemiology, organoid

Integrating data across multiple sites in the northeastern United States to examine associations between prenatal metal mixtures and child cognition

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BACKGROUND AND AIM:Data integration from sociodemographically and geographically diverse epidemiologic studies can provide enhanced exposure contrast and statistical power to examine associations between environmental exposures and health outcomes. We implemented a novel Hierarchical Bayesian Weighted Quantile Sum (HBWQS) regression to combine data across three sites in the northeastern United States to examine associations between prenatal exposure to metals and childhood cognition.

METHOD: Analyses included data from 419 mother-child dyads from the dual-site PRogramming of Intergenerational Stress Mechanisms (PRISM) cohort, based in New York City (NYC) and Boston, and First Thousand Days of Life (FTDL) cohort, based in Northern Virginia. Arsenic (As), Cadmium (Cd), Manganese (Mn), Lead (Pb) and Antimony (Sb) were measured in maternal prenatal urine. Children aged 3 to 11 years completed the NIH Toolbox Cognition Battery. We examined associations between metal mixtures and cognition scores using the HBWQS, combining data from multiple cohorts while accounting for individual cohort differences. We compared HBWQS regression results to within cohort analyses and traditionally pooled BWQS results.

RESULTS:The HBWQS regression showed a negative association between the prenatal metal mixture and the childhood cognition composite score in all cohorts: PRISM-Boston (β : -2.93; 95% CrI: -5.66, 0.44; 90% CrI: -5.17, -0.28), PRISM-NYC (β : -3.40; 95% CrI: -7.07, 0.37; 90% CrI: -6.25, -0.23) and FTDL (β : -3.63; 95% CrI: -6.96, 0.02; 90% CrI: -6.30, -0.86). The largest contributors to the mixture effect were As (48%) and Pb (17%). We did not detect these associations in analyses within individual cohorts or traditionally pooled models.

CONCLUSIONS: As we move into an era of open data sharing, more epidemiologic studies are combining data among multiple cohorts. We demonstrated the advantages of a novel statistical

approach that accounts for study heterogeneity and provides enhanced power to detect associations between a prenatal metal mixture and cognitive outcomes in childhood.

Keywords: Mixtures, heavy metals, Children's environmental health, epidemiology

Associations between Exposure to Persistent Organic Pollutants and Subsequent Body Composition Response to Bariatric Surgery

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BACKGROUND AND AIM: Persistent organic pollutants (POPs) may act as obesogens, but whether POP exposures affect metabolic responses to bariatric surgery is understudied. We assessed the associations between POP exposures and subsequent changes in body composition measures after bariatric surgery.

METHOD: We conducted a prospective cohort study of 26 patients who underwent bariatric surgery and were followed-up at median (IQR) 248 (189, 347) days post-surgery. We measured six lipophilic POPs concentrations (DDT, DDE, HCB, and PCBs 118, 138 and 153) at baseline in plasma, visceral adipose tissue (VAT), and subcutaneous adipose tissue (SAT) collected at surgery. Body composition by DEXA was measured at baseline within 2 months prior to bariatric surgery, and at the follow-up post-surgery visit. Changes in body mass index (BMI), VAT mass (primary endpoint), total fat mass, total fat mass index, or total fat as a percent of body mass from before to after bariatric surgery were determined based on the dates of surgery and the follow-up visit. We estimated the POPs associations with monthly change in body composition outcomes using mixed effect regression models adjusted for age, race, smoking status, and surgery type.

RESULTS:Higher baseline plasma concentrations of PCB-118 (concentrations above vs. below detection limit) were associated with lower changes [β (95%CI)] in BMI [-0.8 kg/m2/month (-1.4, -0.2)], VAT mass [-0.2 kg/month (-0.3, -0.1)], total fat mass [-2.1 kg/month (-3.7, -0.5)], total fat mass index [-0.6 kg/m2/month (-1.2, -0.2)] and total fat percentage [-0.6%/month (-1.3, 0.0)]. For other POPs measured in plasma, as well as POPs measured in VAT and SAT, we observed similar negative associations as for plasma PCB-118 but the associations were weaker.

CONCLUSIONS: Exposure to POPs at baseline may blunt individuals' body composition responses to bariatric surgery. These pilot data support the concept that certain POPs act as obesogens.

Keywords: Endocrine disrupting chemicals, obesity and metabolic disorders.

VO-009[Chemical exposures » PFAS]

Associations between prenatal exposure Perand polyfluoroalkyl substances and liver fat content in Singaporean children

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BACKGROUND AND AIM: The prevalence of non-alcoholic fatty liver disease (NAFLD) in children has risen significantly in the last two decades, particularly among obese children (30%). Studies suggest that exposure to per- and polyfluoroalkyl substances (PFAS) may contribute to metabolic changes that lead to fatty liver. In this study, we aimed to investigate whether prenatal exposure to PFAS is associated with percent liver fat in healthy children at age 6 and 7, using non-invasive magnetic resonance spectroscopy (MRS) techniques.

METHOD: We examined 525 mother-newborn pairs from the Growing up in Singapore Towards Healthy Outcomes birth cohort study. We measured concentrations of eight PFAS compounds in cord blood, and estimated percent liver fat in children at age 6 and 7 using MRS. We estimated covariate-adjusted associations between PFAS compounds and percent liver fat using multivariable regressions. We also investigated effect modification by sex.

RESULTS:Mean liver fat content was 0.75 ng/mL. Overall, we did not observe any associations between PFAS compounds and percent liver fat. For instance, a twofold increase in Perfluorooctanoic acid was associated with a slight non-significant increase of 0.03% (95% CI: -0.08, 0.14) in child liver fat content. Similar results were observed for other PFAS. No consistent pattern of effect modification by sex was observed.

CONCLUSIONS: In this study, we did not observe any associations between prenatal exposure to PFAS and percent fat in the liver. This is the first study to rely on a direct measure of fat in the liver using MRS techniques.

Keywords: Children's environmental health, Risk assessment

VIRTUAL ORAL ABSTRACTS

Longitudinal Dietary Fluoride Exposures in Association with Cardiometabolic Outcomes in School-Aged Children living in Mexico

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BACKGROUND AND AIM:Fluoride intake is ubiquitous and constitutes a long-term exposure during childhood. Experimental research suggests lipid disturbances induced by fluoride with implications for cardiometabolic health. However, epidemiological studies are scarce and mostly cross-sectional. We evaluated associations between repeated dietary fluoride exposure and cardiometabolic outcomes in Mexican children.

METHOD:Dietary-derived fluoride measurements from food-frequency questionnaires were obtained at ages 4, 6 and 8 years for ~500 children from the Programming Research in Obesity, Growth, Environment and Social Stressors (PROGRESS) cohort. Using covariate-adjusted linear mixed-effects and linear regression models, we assessed associations of fluoride exposure on cardiometabolic risk components measured at ages 4-8 years, including lipids (total cholesterol, HDL and LDL in mg/dL, and log-transformed triglycerides), glucose, log-transformed leptin (in ng/mL), and age- and sex-adjusted z-scores of body mass index (z-BMI), waist circumference (WC), and blood pressure (BP). We also calculated a cardiometabolic risk score using the z-score sum of WC, BP, glucose, and triglycerides-to-HDL ratio.

RESULTS:A doubling of fluoride intake at age 4 was associated with an annual increase in triglycerides [β =2.02 (95% CI: 0.37, 3.69)], total cholesterol [β =1.46 (95% CI: 0.52, 2.39)], HDL [β =0.39 (95% CI: 0.02, 0.76)], and LDL [β =0.87 (95% CI: 0.02, 1.71)] and a decrease in leptin [β =-3.58 (95% CI: -6.34, -0.75)] between ages 4-8 years. At age 6, fluoride intake was associated with higher HDL [β per-fluoride-doubling=4.40 (95% CI: 1.70, 7.11)]. Cross-sectional analyses at age 8 indicated that higher tertiles of fluoride exposure were associated (p-tertile trend<0.05) with increases in z-BMI, triglycerides, glucose, leptin, and cardiometabolic risk score, with stronger associations observed in boys compared to girls (p-sex interaction<0.05).

CONCLUSIONS: Dietary fluoride exposure in early- and mid-childhood was associated with adverse cardiometabolic outcomes in school-aged children. Further longitudinal studies are needed to corroborate these findings and associations at later ages.

Keywords: Fluoride, endocrine disruptor, cardiometabolic outcomes, children

Ambient fine particulate matter exposure and risk of incident liver cancer in the NIH-AARP Diet and Health Study

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BACKGROUND AND AIM: Fine particulate matter (PM2.5) exposure has been associated with liver cancer incidence and mortality in limited studies. We sought to evaluate this relationship in a large study with historical exposure assessment and available histology information.

METHOD: We used a spatiotemporal prediction model to estimate annual average historical PM_{2.5} concentrations at residential addresses of 499,729 participants in the NIH-AARP Diet and Health Study, a cohort in 6 states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) and 2 metropolitan areas (Atlanta, Georgia, and Detroit, Michigan) enrolled in 1995-1996. Historical exposures were estimated for a 5-year period pre-enrollment (1990-1994). We used Cox regression to estimate hazard ratios (HR) and 95% CIs for risk of incident liver cancer per interquartile-range increase in PM_{2.5}, adjusted for confounders. We also conducted analyses stratified by sex, age, race/ethnicity, smoking, body mass index (BMI), and state.

RESULTS:A total of 1,625 liver cancers were diagnosed in follow-up through 2017. We observed a non-significantly increased risk of liver cancer associated with PM_{2.5} exposure (HR=1.05 [0.96-1.14] per 4.43 μ g/m³); associations were slightly stronger for hepatocellular carcinoma, the predominant subtype (84% of cases; HR=1.06 [0.97-1.16]). Participants who were over 70 years old at enrollment had a significantly increased risk of liver cancer (HR=1.46 [1.01-2.12]) versus other age groups (p-interaction<0.0001) and risk was elevated among Hispanic participants (HR=1.20 [0.89-1.67]; p-interaction<0.0001). State-specific associations ranged from HR=0.61 [0.41-0.89] in North Carolina to HR=1.28 [0.44-3.73] in Georgia (p-interaction=0.12). We found no interactions with sex, BMI, or smoking (p-interaction>0.05).

CONCLUSIONS:Our findings from this large U.S. cohort suggest that ambient PM_{2.5} levels at the home are associated with liver cancer risk. Regional differences in PM_{2.5} chemical constituency and the association in the Hispanic population, who have some of the highest liver cancer incidence rates, are important areas for future research.

Keywords: long-term exposure, cancer and cancer precursors

VO-012[Chemical exposures » Endocrine disrupting chemicals]

Early-life exposure to persistent organic pollutants and cardiometabolic health in young adults from the CHAMACOS cohort

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BACKGROUND AND AIM: Early-life exposure to persistent organic pollutants (POPs) may contribute to later obesity and metabolic disorders. We examined associations of prenatal and childhood exposure to POPs with obesity and associated metabolic conditions among 530 Mexican-American young adults from the CHAMACOS cohort.

METHOD: We measured serum concentrations of five organochlorine pesticides [OCPs; dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), hexachlorobenzene (HCB), β -hexachlorocyclohexane, trans-nonachlor] and four polybrominated diphenyl ether (PBDE) flame retardants [congeners 47, 99, 100, and 153] in maternal and child samples collected during pregnancy and at age 9 years. We collected anthropometric measurements and serum markers associated with metabolic syndrome at age 18 years. We fitted single-pollutant regression models to examine the exposure-outcome associations of interest.

RESULTS:Overall, we found that higher child OCP concentrations were associated with lower BMI (e.g., β DDE = -3.8; 95% CI: -5.3, -2.3), lower waist circumference (e.g., β DDE = -7.8; 95% CI: -11.5, -4.2), lower HOMA-IR (e.g., β DDE = -2.2; 95% CI: -3.6, -0.7), and decreased odds of metabolic syndrome (e.g., OR per 10-fold increase in HCB = 0.1; 95% CI: 0.0,0.9) at age 18. We also observed that higher prenatal concentrations of DDT, but not other OCPs, were associated with lower HOMA-IR levels at age 18 (β DDT = -1.0; 95% CI: -1.9, 0.0). Higher child concentrations of BDE-153, but not other PBDE congeners, were associated with lower waist circumference (β 153 = -11.7; 95% CI: -16.8, -6.5), lower HOMA-IR levels (β 153 = -2.1; 95% CI: -4.3, 0.1), and decreased odds of metabolic syndrome [OR153 = 0.2; 95% CI: 0.0, 0.7]. We found null associations of prenatal PBDE concentrations with cardiometabolic health outcomes at age 18.

CONCLUSIONS: We showed an inverse relationship between childhood exposure to several POPs and obesity and metabolic disorders in young adulthood. Our future analyses will examine effect modification by sex and consider reverse causality.

Keywords: Chemical exposures, Endocrine disrupting chemicals, Obesity and metabolic disorders,

VO-013[Respiratory and allergic outcomes » Respiratory outcomes]

Association between prenatal exposure to pesticides, individually and as a mixture, and childhood lung function in Mexican children

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BACKGROUND AND AIM: Prenatal pesticide exposure may affect lung development and lead to a decrease in lung function in childhood. There is limited epidemiologic data on these associations in Latin America. We aim to examine associations between prenatal exposures to pesticides, individually and as a mixture, and lung function in childhood, and explore sex differences. METHOD: We assessed 197 mother-child dyads enrolled in the Programming Research in Obesity, Growth, Environment, and Social Stressors birth cohort in Mexico City. We quantified organophosphate insecticides in 2nd trimester urine. Pre and post bronchodilator (BD) lung function was tested at ages 8-11 years, and age, height and sex adjusted z-scores were calculated. Associations were modeled using generalized linear models, Quantile G-Computation (g-comp) and Weighted Quantile Sum (WQS) regression repeated holdout with interaction terms, adjusting for maternal education, age and socioeconomic status at enrollment, and urinary creatinine. RESULTS: We observed prenatal concentrations of 4-nitrophenol (PNP) were associated with post BD FEV1 (β: -0.03, 95% CI [-0.05, -0.01]) and post BD FVC z-scores (β: -0.03, 95% CI [-0.05, -0.01]). In stratified models, 4-nitrophenol was associated with reduced post BD FEV1 and post BD FVC zscores in males (β : -0.03, 95% CI [-0.05, -0.01]; β : -0.03, 95% CI [-0.05, -0.01]) but not in females (β: -0.001, 95% CI [-0.07, 0.07]; β: 0.01, 95% CI [-0.06, 0.09]), respectively. There was a

suggestive association between prenatal exposure to pesticide mixtures and reduced post BD FEF zscore (g-comp, OR: -0.22, 95% CI: -0.51, 0.07) and (WQS, OR: -0.09, 95% CI: -0.32, 0.14). Malathion dicarboxylic acid (MDA) was the main contributor of the mixture. CONCLUSIONS:Higher prenatal levels of PNP are associated with reduced mid-childhood lung function;

the association was stronger in males compared to females. Future work investigating pesticide exposure and lung function trajectories will be important for understanding long-term impacts.

Keywords: pesticides, mixtures, respiratory outcomes

VO-014[Exposures » Other (to be specified with keywords in the keywords section)]

Persistent organic pollutants in hospitalized individuals in the municipality of Petropolis, Brazil

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BACKGROUND AND AIM:Persistent organic pollutants (POPs) are highly lipophilic and can accumulate and biomagnify in food chains. Characterized as a public health problem, exposure to these compounds enables the development of diseases like cancer, cardiovascular disease, diabetes, and obesity. The objective of this study was to estimate the plasma levels of organochlorine pesticides and PCBs in 151 samples (97 women; 54 men) in hospitalized individuals in Petropolis, Brazil. METHOD:Individuals over 18 years of age and residing for at least 2 years in the mountainous region of the State of Rio de Janeiro, Brazil, participated in a cross-sectional study. Interviews using a structured questionnaire and blood samples to estimate plasma levels of persistente organic pollutants provided data. Gas chromatography coupled with triple quadrupole mass spectrometry provided the levels of organochlorine pesticides and PCBs.

RESULTS: Compared to data present in the literature, the concentration of POPs was lower, and individuals from 55 to 64 years of age (3.28 ng mL-1) and women (2.52 ng mL-1) presented a higher average concentration of organochlorine pesticides; men (0.05 ng mL-1) also presented a high concentration of PCBs.

CONCLUSIONS: This is the first Brazilian study to estimate the concentration of several POPs in a hospital-based sample that includes men and women, thus contributing to the characterization of our population regarding environmental exposures relevant to health.

Keywords: Chemical exposures, Pesticides, Environmental epidemiology.

Quality of urban green spaces and nutritional status: an epidemiological study in an urban context using Street View technology

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BACKGROUND AND AIM: Urban green spaces (UGS) can be a valuable resource for improving human health. The quality of UGS as determinant of population health have been a topic scarcely explored. We aim to assess the association between obesity status and the proximity and quality of UGS by using Google Street View (GSV) images.

METHOD:A population-based study called Córdoba Obesity and Diet Study II (multistage-random sampling; n=1328 adults from Córdoba, Argentina) was carried out (2019-2022 period), collecting anthropometric measurements, lifestyles and socio-demographic data. Indicators of proximity (500m buffer) of dwellings to large UGS (>1ha) were constructed using QGIS 3.28. GSV was used to remotely visualise eight quality dimensions (surroundings, access, facilities, amenities, aesthetics, safety, potential usage, land cover), adapted from the RECITAL green space quality assessment tool. Items were scored with a five-point Likert scale for each UGS; mean scores within each buffer were calculated. The association of obesity status with the presence of UGS within the buffer (total sample: n=1328), and with overall/partial quality scores of UGS (sub-sample: n=636 subjects living near a UGS) was assessed by using adjusted logistic regression models.

RESULTS:Obesity status (25.9% of sample) was not associated with the proximity (500m buffer) of large UGS. However, a trend towards an inverse association was observed with the mean quality score of UGS (OR=0.6; p=0.11) in the sub-sample who had at least one UGS near their home (47.9%). Two quality dimensions of UGS showed significant inverse associations: aesthetics (OR=0.6; p=0.03), and amenities (OR=0.6; p=0.02), both related to the beauty and attractiveness of spaces, and to features that make them more comfortable and enjoyable.

CONCLUSIONS: In our urban context, proximity to UGS is not associated with obesity, but certain dimensions of quality may be a protective factor. Digital tools such as GSV are useful resources for further exploration of this topic.

Grants FONCYT-PICT-2020-A-03283.

Keywords: obesity and metabolic disorders, green space, environmental epidemiology

Associations of Street-View Greenspace with Incident Cardiovascular Disease in the US-based Nationwide Nurses' Health Study from 2000 to 2016

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BACKGROUND AND AIM: Epidemiologic studies have used satellite-derived measures of greenspace to show that greenspace is negatively associated with cardiovascular disease (CVD) incidence/mortality. However, satellite-derived measures do not capture ground-level visible exposures that reflect a participant's lived experience. Google Street View (GSV) images offer the opportunity to measure greenspace from an on the ground perspective and to examine specific greenspace features that may be most relevant for health. We aimed to evaluate street-based greenspace-CVD, stroke, and myocardial infarction incidence associations in a nationwide cohort.

METHOD:We followed 96,531 participants from the US-based Nurses' Health Study from 2000 to 2016. Based on deep learning algorithms applied to 350 million GSV images, we linked GSV-based percentage of trees to participants' biennially assessed residential addresses from 2004 to 2016 in a 100m buffer. We used time-varying Cox proportional hazards models to calculate hazard ratios (HRs) and 95% confidence intervals (95%CI). We specified a model adjusted for individual-level age, race, marital status, husband's education, and neighborhood confounders (e.g. median household income). RESULTS:During follow-up, we observed 5,636 cases of CVD, 2,931 cases of stroke, and 2,705 cases of non-fatal myocardial infarction and fatal coronary heart disease (CHD). For CVD incidence, we observed a HR of 0.98 (CI 0.92, 1.05) per inter-quartile range (IQR) of percentage of trees. Results for total CHD and stroke were similar.

CONCLUSIONS: Preliminary results suggest that percentage of trees was not associated with incidence

of CVD, stroke, or CHD. Ongoing studies from our team are examining other specific features of greenspace (e.g., percentage of grass, shrubs, and total greenspace) in association with cardiovascular health.

Keywords: Built environment, Green space, Cardiovascular diseases, Public Health, Environmental Epidemiology

Associations of Early Pregnancy Per- and Poly-Fluoroalkyl Substances Exposure with Birth Outcomes: Effect Modification by Prenatal Folate Status

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BACKGROUND AND AIM:Folate status was negatively associated with blood PFAS concentrations. This study aimed to determine if prenatal folate status modifies associations between pregnancy plasma per- and polyfluoroalkyl substances (PFAS) concentrations and birth outcomes in a large pre-birth cohort in the United States (U.S.).

METHOD:Our study included 1400 mother-singleton pairs from a prospective pre-birth cohort in eastern Massachusetts, U.S. recruited between 1999-2002. Plasma concentrations of folate and six PFAS compounds, and dietary folate intake (by food frequency questionnaire) were assessed in early pregnancy (median 9.6 gestational weeks). Birth outcomes included birthweight, birthweight z-score standardized by gestational age and sex, and gestational age. We applied generalized additive models (GAM) to explore the changes in PFAS-birth outcome relationships across continuous folate measures (dietary folate intake or plasma folate concentrations). We stratified linear regression models of PFAS and birth outcomes by quartiles of the two folate measures.

RESULTS:GAM showed that plasma concentrations of select PFAS were associated with lower birthweight and birthweight z-score, and shorter gestational age only at lower folate levels while associations trended to null as folate increased. Stratified analyses showed perfluorooctanoic acid (PFOA) concentrations were associated with lower birthweight and birthweight z-score only among mothers whose dietary folate (birthweight: -89.13 grams, 95% CI: -166.84, -11.42; birthweight zscore: -0.13, 95% CI: -0.26, -0.003) or plasma folate (birthweight: -87.03 grams, 95% CI: -180.11, 6.05; birthweight z-score: -0.14, 95% CI: -0.3, 0.02) were below the 25th percentiles (660 mcg/day, 14 ng/mL), while no associations were found among mothers in the other folate groups. CONCLUSIONS:In this large U.S. cohort, early pregnancy PFAS exposure was associated with adverse

birth outcomes only among mothers with lower early pregnancy dietary or plasma folate levels. If confirmed in other settings, these findings may have important implications for identifying vulnerable populations and evaluating folate intervention studies.

Keywords: PFAS, birth outcomes, folate, mitigation

Long-term exposure to fine particulate matter on cardiovascular mortality in 11 US States: A difference-in-difference analysis

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BACKGROUND AND AIM: While some recent air pollution studies have utilized causal modeling methods to examine cardiovascular outcomes, cause-specific cardiovascular (CVD) mortality studies are limited. The published studies tend to use propensity score matching or inverse probability weighting to make the exposure independent of all measured confounders. However, this only controls for measured confounders or unmeasured confounders that are highly correlated to the measured confounders.

METHOD: We utilized a variation of a difference-in-difference (DID) approach to assess the effect of long-term fine particulate matter (PM2.5) exposure on the overall cardiovascular (CVD) mortality rate between 2000 to 2016 among 11 US States (Florida, Georgia, Indiana, Kansas, Massachusetts, Missouri, Montana, New Hampshire, New Jersey, Ohio, and Texas). Predicted annual PM2.5 exposures from a validated ensemble exposure model and ambient meteorology from gridMET predictions were aggregated to all census tracts within the 11 US States. We computed the mortality rate by census tract and year and included demographic and socioeconomic variables from the decennial Census and the American Community Survey. Interaction terms were used to assess effect measure modification by various socioeconomic variables.

RESULTS:For each one µg/m3 increase in annual PM2.5, the absolute rate of annual CVD mortality increased significantly by 3.29 deaths (95% CI: 2.20-4.37) per one million person-years. The percent of foreign-born and Hispanic individuals in a census tract modified the association between PM2.5 and CVD mortality by 100.60 deaths (95% CI: 94.40, 106.80) and 26.65 deaths (95% CI: 23.04, 30.26) per one million person-years, respectively. Median household income decreased the association between PM2.5 and CVD mortality by 0.83 deaths (95% CI: -0.79, -0.86) per 1 billion person-years. CONCLUSIONS:Utilizing a casual approach, annual PM2.5 exposure increased the absolute rate of CVD mortality reported by 11 US States. Specific demographic and socioeconomic variables modified this association.

Keywords: Air pollution, cardiovascular mortality, epidemiology, causal inference

Estimating attributable deaths from short-term pollution effects using a Total Risk Index approach

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BACKGROUND AND AIM: Air pollution health effects are traditionally estimated for single pollutants, but uncertainty exists about impacts from pollutant mixtures. This analysis uses a multi-pollutant risk estimate – a Total Risk Index (TRI) – to study short-term mortality risk and quantify attributable deaths in New York City (NYC).

METHOD: Daily citywide average air pollution concentrations were collected from the US Environmental Protection Agency's Air Quality System and mortality records from NYC Vital Statistics. Trends in fullyear and seasonal TRI for non-external mortality were examined using time-series models in five-year rolling segments (2000-2019). Pollutants considered were nitrogen dioxide (NO2), fine particulate matter (PM2.5) and warm season ozone. Due to changes in pollution trends around 2005, attributable counts (ACs) were extracted from single, co-pollutant, and TRI models covering 2005-2019 for four mortality outcomes: all-natural-cause, cardiovascular disease (CVD), cancer, and respiratory disease. RESULTS: Warm-season three-pollutant TRI was generally positive over time, reaching ~3% excess risk for models in the 2000's and ~2.5% in the 2010's, and was most strongly influenced by inclusion of NO2. Annual average TRI-AC was 677 (95%CI: 291,1076) from full-year models, similar to singlepollutant NO2 AC (665; 273, 1052). For all outcomes, warm-season three-pollutant TRI-ACs were higher than cold-season two-pollutant TRI-ACs, except for CVD mortality which was similar across seasons. TRI-ACs for the mortality sub-causes in the warm season were larger than any singlepollutant model ACs. Full-year TRI-ACs declined for non-external and CVD mortality and warm-season TRI-ACs declined less over the study period. Warm-season respiratory mortality TRI-AC was stable. CONCLUSIONS: Despite large declines in NYC's PM2.5 and NO2 concentrations, total pollution risk remains positive, with NO2 gaining importance for attributable burden. Ozone impacts from regional source emissions persist. Novel application of a TRI provides an additional policy tool to quantify emissions source impacts.

Keywords: air pollution, mortality, time series, mulit-pollutant, attributable deaths

Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution: What's Next?

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BACKGROUND AND AIM:Although concentrations of ambient air pollution continue to decline in highincome regions, epidemiological studies document health effects at levels below current standards. The Health Effects Institute (HEI) recently completed a comprehensive research program to investigate the health effects of long-term exposure to low levels of air pollution in the United States (US), Canada, and Europe. We present a summary of the results of the three studies, their strengths and weaknesses, future research opportunities, and implications of findings for risk assessment and regulation.

METHOD: The three studies considered associations between fine particulate matter (PM2.5), nitrogen dioxide, ozone, and other pollutants with many health outcomes, including cause-specific mortality and cardiovascular and respiratory morbidity, among others. To ensure high quality research and comparability across studies, HEI worked actively with the study teams, and engaged independent expert panels for project oversight and review.

RESULTS:All three studies documented positive associations between mortality and PM2.5 concentrations below the US National Ambient Air Quality Standards and current and proposed European Union (EU) limit values. Furthermore, the studies documented non-threshold linear (US), or supra-linear (Canada and Europe) exposure-response functions between PM2.5 and mortality. Substantial heterogeneity was found within and across studies both in the magnitude and shape of the association.

Strengths of the studies included the large populations (7-68 million), state-of-the-art exposure assessment methods, and thorough statistical analyses with novel methods. However, the HEI Review Panel had concerns about the validity of the exposure estimates in rural areas, zipcode-level aggregation in the US analysis, and the influence of co-pollutants. Future work is needed to better understand potential sources of heterogeneity in the findings across studies and regions. CONCLUSIONS:The research program provided important evidence of associations between long-term exposures to low levels of air pollution and health effects, suggesting that lowering current standards could yield further health benefits.

Keywords: air pollution, long-term exposure, mortality, epidemiology, policy

Exposure to triclosan and adolescent hormone concentrations in the Health Outcomes and Measures of the Environment Study

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BACKGROUND AND AIM:Triclosan, an antimicrobial, has been associated with altered pubertal and andrenarcheal hormone concentrations in cross-sectional studies, but the findings are inconsistent. We examined associations of gestational and childhood triclosan exposure with hormone concentrations in adolescence.

METHOD:In 157 participants in the Health Outcomes and Measures of the Environment Study, a prospective pregnancy and birth cohort based in Cincinnati, Ohio, we quantified total urinary triclosan concentrations up to twice during pregnancy and up to 8 times between birth and 12 years. We averaged measurement-error-corrected and creatinine-adjusted concentrations across the gestational and childhood periods. At 12 years, we quantified adrenal, pituitary, and gonadal hormones in morning blood [males (n=73) and females (n=84)—dihydroepiandrostendione sulfate (DHEA-S), luteinizing hormone (LH), follicle stimulating hormone (FSH); males—testosterone; females—estradiol]. We calculated percent change in hormone concentration per doubling of urinary triclosan concentrations in gestation or childhood using generalized linear models adjusting for triclosan concentrations in the other period and sociodemographic and perinatal factors. For DHEA-S, FSH, and LH we examined if child's sex modified associations between urinary triclosan and hormone concentrations.

RESULTS: For females, each doubling of average childhood triclosan was associated with a 15.9% decrease in estradiol concentrations (95% CI: -29.1, -0.1). We found suggestive evidence of sex-specific associations between gestational triclosan exposure and FSH concentrations, where a doubling

of triclosan was associated with lower observed FSH concentrations among males [-7.3% (-16.6, 3.1)] and higher observed concentrations among females [5.3% (-4.4, 15.8), p-interaction=0.09]. No strong evidence of associations between triclosan and other hormones was identified. CONCLUSIONS:Gestational and childhood triclosan concentrations were related to some pubertal hormone concentrations in a sex-specific manner. Our findings indicate the need to better elucidate potential actions of triclosan on the pituitary versus the ovary and more precise windows of exposure sensitivity.

Keywords: endocrine disrupting chemicals, long-term exposure, children's environmental health;

Prenatal exposure to mixtures of traffic-related air pollutants and birthweight in a birth cohort

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BACKGROUND AND AIM: While previous analyses using linear regression have linked prenatal PM2.5 exposure to decreases in birthweight, studying the effects of air pollutant mixtures on birth outcomes is difficult due to strong correlations between pollutants. This study explored how exposure to a mixture of traffic-related air pollutants during the 3rd trimester of pregnancy impacts birthweight. METHOD: We included 4,634 mother-infant pairs from a birth cohort in New York State. Air pollution data came from the EPA's Community Multiscale Air Quality model and were matched to the census tract centroid associated with each maternal home address. Birthweight came from vital records. We used linear regression to study the association between PM2.5 exposure and birthweight, and Bayesian kernel machine regression to study the potential non-linear effects and interactions between PM2.5 and other traffic-related pollutants (O3, NOx, SO2, and CO), adjusting for maternal socio-demographics, infant characteristics, and seasonality.

RESULTS:Fully-adjusted linear regression models showed that an IQR increase in PM2.5 exposure during the 3rd trimester led to a 31.9g reduction in birthweight (95% CI: -68.8, 5.1). Individual exposure-response curves generated by BKMR showed that PM2.5, NOx, and CO exposure negatively impacted birthweight when other traffic-related pollutants were fixed at their median, with higher exposures leading to more severe reductions. There was also a significant interaction between PM2.5 and NOx exposure. Specifically, the association between PM2.5 exposure and birthweight was strongest when NOx was held constant at its 25th percentile compared to the 50th and 75th percentiles, respectively. Importantly, the threshold of PM2.5 exposure leading to reductions in birthweight changed based on NOx concentrations.

CONCLUSIONS:Our results suggest that prenatal exposure to a subset of traffic-related air pollutants during the 3rd trimester can negatively impact birthweight. The non-linear relationships between air pollution and birthweight highlight the importance of considering mixtures of pollutants and their interactions.

Keywords: Air pollution, birth outcomes, environmental epidemiology, mixtures, particulate matter

Comparing wildfire smoke effects on adverse pregnancy and birth outcomes in the Western US under changing climate regimes

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BACKGROUND AND AIM: Climate change increases wildfire frequency and levels of air pollution, causing growing concerns on human health. Little is known about how wildfire smoke exacerbates reproductive health over long decades. We aim to compare effects of wildfire smoke on adverse pregnancy and birth outcomes (APBO) between 2001 and 2018 in the western US. METHOD: Birth record for 647,815 delivers in 2018 and 2,696,128 in 2001-2004 were obtained across five states of the US and were linked with wildfire smoke exposure in the mother's residential county during the entire gestational period. Monthly exposure to total fine particulate matters (PM2.5) and their components (black/organic carbon) were estimated by high-resolution geo-statistical models and were further decomposed as fire and non-fire sourced PM2.5 using a chemical transport model. Double-robust logistic regression model was used to assess the associations between wildfire PM2.5 exposures and APBO, including preterm birth (PTB), low birth weight (LBW), fetal death (FD), gestational hypertension (GTH) and eclampsia, separately between the almost two-decade interval. RESULTS: Total PM2.5 concentration decreased from 9.2 to 7.3 µg/m3 from 2001 to 2018, while wildfire PM2.5 exposure increased from 0.5 to 6.3 µg/m3. Compared to the marginal associations found between 2001-2004, wildfire PM2.5 and its components are consistently and significantly associated with elevated risk of PTB and LBW, especially over the entire prenatal period [e.g. Odds Ratio: 1.07 (95%CI: 1.05, 1.09) for PTB and 1.06 (1.04, 1.08) for LWB per 2 µg/m3 in PM2.5]. In contrast, associations between wildfire exposure and other outcomes were identified in earlier years [1.17 (1.15, 1.19) for GTH and 1.41 (1.30, 1.52) for eclampsia] than a recent year. No associations were found for FD with exposures in any years.

CONCLUSIONS: This study suggests that increasingly common wildfire exposures exacerbated by climate change are significantly associated with serious PTB and LBW outcomes across the western US.

Keywords: Wildfires, Air pollution, Pregnancy outcomes, Reproductive outcomes, Big data

A comparative time-series analysis and deep learning projection of innate radon risk in Canadian and Swedish residential buildings

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BACKGROUND AND AIM:Accumulation of radioactive radon gas in indoor air poses a serious risk to human health by increasing the lifetime risk of lung cancer and is classified by IARC as a category one carcinogen. Radon exposure risks are a function of geologic, geographic, design, and human behavioural variables, and can change over time. The objectives of this study were to assess, compare and predict the risk of exposure to indoor air radon in Canadian and Swedish houses constructed between 1945 to 2020 to come up with evidence to could support building codes policy that can reduce the risk.

METHOD:Closed passive etched track detectors made from CR-39 plastic film were used to test radon. Statistical analysis was conducted in MS Excel 2016, SPSS, Prism 9.0, and R (4.0.2). Predictive timeseries analyses were conducted using traditional Autoregressive Integrated Moving Average (ARIMA), and the new generation deep learning time series forecasting toolsets in MATLAB2020b using Python codes.

RESULTS: While Canadian and Swedish properties built between 1970 and 1980 are comparable (96– 103 Bq/m3), innate radon risks subsequently diverge, rising in Canada and falling in Sweden such that 21st Century Canadian houses show 467% greater average radon (131 Bq/m3) relative to Swedish equivalents (28 Bq/m3). These trends are consistent across housing types and regions within each country. The introduction of energy efficiency measures within Canadian and Swedish building codes coincided with opposing radon level trajectories in each nation. Deep machine learning modelling predicts that, without intervention, average Canadian residential radon levels will increase to 176 Bq/m3 by 2050.

CONCLUSIONS: The risk from exposure to indoor radon is higher in Canada compared to that in Sweden and the risk will continue to increase adding burden to lung cancer morbidities and mortalities. This emphases the importance and urgency of future building code intervention to achieve systemic radon reduction in Canada.

Keywords: Radon Health Risk, Time-Series, Deep Machine Learning, Lung Cancer, Canada Sweden.

VO-025[Air pollution » Particulate matter]

Incorporating Exposure Uncertainty in Estimating Causal Exposure-Response Relationships Between Long-term Exposure to PM2.5 and Cardiovascular Disease

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BACKGROUND AND AIM: The estimate of causal exposure-response relationship between air pollution and cardiovascular disease remains lacking, and possibility has been raised that exposure uncertainty may render effect estimate unreliable. We aim to provide robust estimate of causal exposure-response relationships between long-term PM2.5 exposure and risk of hospitalization with major cardiovascular diseases (CVD): ischemic heart disease, cerebrovascular disease, heart failure, cardiomyopathy, arrhythmia, valvular heart disease, thoracic and abdominal aortic aneurysm, and all these combined. METHOD: Using national Medicare fee-for-service beneficiaries during 2000–2016, we constructed a separate cohort for each CVD and linked annual PM2.5 predictions to each person-year. The outcome was defined as the first hospitalization during follow-up. PM2.5 uncertainty was estimated based on the difference between monitored and predicted levels. For each person-year, we predicted the probability of PM2.5 exposure, assuming it was normally distributed, fell within each disjoint unitlength interval from 0 to 20 μ g/m3 ([0, 1), [1, 2), ... [19, 20]). For each interval, we fitted a beta regression to estimate inverse probability weights for all person-years with exposures fell within that interval, adjusting for measured confounders. We treated exposure effect for lowest interval ([0, 1))as reference, and estimated relative risks for other intervals comparing to the reference. Stratified analysis was performed by individual and community-level characteristics.

RESULTS: Except for valvular heart disease, causal exposure-response estimates showed "S"-shaped curves for all outcomes. Annual PM2.5 posed the highest risk for heart failure, with the risk for the highest exposure interval 1.74 (95% CI: 1.71, 1.76) times larger than reference. Younger age group, Medicaid enrollees, and communities with lower population density experienced higher risk for all outcomes.

CONCLUSIONS:Long-term PM2.5 exposure increased risk of hospitalization for major CVD, except valvular heart disease. The robust causal exposure-response estimates provide significant implications for presently being reviewed national standard.

Keywords: Particulate matter, Long-term exposure, Environmental disparities, Cardiovascular diseases, Causal inference

VO-026[Climate » Temperature]

Extreme heat exposure and spontaneous abortion: A case-crossover study

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BACKGROUND AND AIM:We conducted a case-crossover study nested within a prospective cohort to examine the association between extreme heat exposure during periconceptional and prenatal periods and odds of spontaneous abortion (SAB; pregnancy loss before 20 weeks' gestation). METHOD:We used data from Pregnancy Study Online, a web-based preconception cohort study in which individuals trying to conceive were enrolled during the preconception period and followed throughout pregnancy. We restricted our analysis to the 616 participants who resided across the contiguous United States and reported SAB during the study period (2013-2021; May-September). We examined two potential critical windows of exposure: self-reported SAB date and date of conception. We used a time-stratified control selection strategy in which we selected all dates in the same month on the same day of the week as the case date. For all case and control dates, we obtained county-level population-weighted temperature and wet bulb globe temperature (WBGT) from the ERA5-Land reanalysis dataset. We defined extreme heat exposure as county-specific temperature or WBGT ≥95th percentile during any of the three days preceding conception or SAB date. We estimated the association between extreme heat and SAB using conditional logistic regression.

RESULTS: Exposure defined as temperature \geq 95th percentile during the three days before conception was associated with increased odds of SAB (odds ratio [OR]=1.23, 95% CI: 0.97, 1.55). Results were in the same direction, but weaker for WBGT \geq 95th percentile (OR=1.10, 95% CI: 0.88, 1.39). Extreme heat in the three days preceding the SAB date was not appreciably associated with odds of SAB (OR=1.01, 95% CI: 0.77, 1.32).

CONCLUSIONS: Days with extreme heat preceding conception may be associated with greater odds of SAB. Heat near the SAB event date was not associated with SAB. These results shed light on what periods are potentially etiologically relevant for heat-related risk of SAB.

Keywords: climate, epidemiology, pregnancy outcomes, reproductive outcomes, temperature

VO-027[Methods » Other (to be specified with keywords in the keywords section)]

""Imputation of missing data in long term air pollution exposure"

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BACKGROUND AND AIM: Missing data in air pollutant monitoring is a common problem observed in urban air quality networks that compromises the internal validity of epidemiological studies and air quality decision making. AIM: To evaluate imputation methods to replace missing data in long-term exposure.

METHOD: Ecological study, with data the Air Monitoring Network of Bogotá D.C., Colombia for nitrogen dioxide during 2018. Several imputation techniques were evaluated: mean, median, random forest, decision forest, classification trees using regressions, predictive mean matching, linear regression and neural network). Measures of central tendency, dispersion and line graphs were used to compare methods

RESULTS: Missing data were assumed to follow a completely random pattern (Missing Completely at Random), since the loss was due to a power outage. The percentage of missing data at the Carvajal Sevillana (15%), Centro de Alto Rendimiento (19%), Guaymaral (21%) and Puente Aranda (8%) stations was less than 25%. For the mean and median imputation techniques, similar results were obtained in the summary measures, differing with the predictive values of the linear regression. On the other hand, the techniques of classification trees by regression, random forests and decision forests, underestimate the values of the summary measures with respect to the values without imputation. While imputation with predictive mean adjustment and neural network, similar values were observed with the data observed without imputation

CONCLUSIONS: In conclusion, it was observed that the imputation with random forest, predictive mean adjustment and neural network provides similar data to those observed for 24-hour mean nitrogen dioxide concentrations.

Keywords: Long-term exposure, Epidemiology, Methodological study design

Socio-spatial profiles of health transition in Argentina: exploring social inequalities in preventive practices for breast and cervical cancer

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BACKGROUND AND AIM: Argentina has experienced changes (transitions) in its health system and health care, with heterogeneous impacts on women's health. This work aimed to identify socio-spatial profiles of health transition (HT) related to preventive practices for breast and cervical cancers within Argentina.

METHOD:A nationwide ecological study was performed in Argentina. Indicators of socio-sanitary vulnerability (related to health resources, health services accessibility, and socioeconomic context) and demographic characteristics (urbanization, population structure) were selected from official data sources about 24 geographical units (2005-2018 period). Multiple Correspondence Analysis (MCA) coupled with Hierarchical Cluster Analysis was used to identify socio-spatial clusters representing HT profiles across Argentina. Mammography screening practice and Pap smear (%) in target women (aged 50-70 and 25-65, respectively) for 2018 were included as supplementary variables and exploratively projected in the graph constructed from MCA. All variables were categorized by tertiles (low/intermediate/high levels).

RESULTS:High socioeconomic stratum and health insurance coverage, low infant mortality, and high rate of physicians appeared close to a high level of mamograms and Pap practices in the dimensional space produced by the MCA, indicating co-occurrence in the data set. Based on the dimensions obtained by the MCA (76% of the total explained variance), three socio-spatial profiles of HT were identified. The first profile (located in the central and southern region of Argentina) was characterized by low socio-sanitary vulnerability, high prevalence of preventive practices for breast and cervical cancer, and aging population. The second one, showed intermediate levels of socio-sanitary vulnerability and preventive practices, with high density of mammographs (per 10,000 women). The third HT profile (Northern Region), presented high socio-sanitary vulnerability and low preventive practices, with low health resources (rate of physicians, mammograph density, and health insurance

coverage).

CONCLUSIONS: Different HT profiles related to preventive practices of breast and cervical cancer coexist within Argentina, shaping underlying social-spatial inequalities in women's health.

Keywords: cancer and cancer precursors, epidemiology, female, socio-economic factors
Heat-Wave and Cold-Spell Acclimation Analysis by Physical and Cognitive Functions among an Advanced Age Cohort in China

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BACKGROUND AND AIM: Acclimation is a form of adaptation to climate change involving adjusting to future climate based on past occurrences. We aim to study acclimation by past exposure to heat waves and cold spells on premature mortality in China.

METHOD: We used data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS, 2008-2018). We counted the number of heat-wave or cold-spell event days in a ten-year period, where heat-wave events were defined as three or more consecutive days with daily minimum temperature exceeding the 95th percentile, while cold-spell events were defined as three or more consecutive days with a daily maximum temperature below the 5th percentile. We collected demographic and socio-economic characteristics, measured physical (IADL) and cognitive disability (MMSE). We used logistic regression models adjusted for age, sex, administrative region, urban or rural residence, co-residence, air pollutants (PM2.5, ozone and NO2), green and blue space around the residential locations. RESULTS: We included 13,744 participants (median baseline age: 86.87, 57.10% female). During the follow-up period, the average number of heat-wave and cold-spell events were 1.90 and 1.89 per person-year, respectively. Each day increase in past exposure is associated with lower mortality for both heat-wave (OR: 0.89, 95%CI: 0.87, 0.91) and cold-spell (OR: 0.83, 95%CI: 0.81, 0.86). The protective effect of heat-wave frequency (OR:0.93, 95%CI:0.90, 9.60) and cold-spell frequency (OR:0.85, 95%CI:7.99, 9.07) is most significant among people with full IADL function. The protective effect of cold-spell frequency was higher among those with normal MMSE status (OR: 0.86, 95% CI: 0.83, 0.88) than those with poor MMSE status (OR: 0.991, 95%CI: 0.989, 0.994). CONCLUSIONS: The study reported protective effects of the frequency of the extreme temperature events modified by physical and cognitive functions, providing valuable information on targeted caring strategies. The elderly with physical or cognitive function decline will have worse adaptation to climate change.

Keywords: acclimation, heat-wave mortality, cold-spell mortality, physical function, cognitive function

Survival effects of delays on treatment initiation and conclusion in a cervical cancer hospitalbased cohort of a developing country

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BACKGROUND AND AIM: to evaluate the effect of delays in cervical cancer treatment initiation and conclusion in hospital-based survival among Brazilian women

METHOD:A retrospective follow-up study was proceeded in a cohort of women diagnosed with cervical cancer, treated in 2012-2014, and followed until December 31, 2017, in Rio de Janeiro. Delays in treatment initiation definition were based on the Brazilian law of 60 days for treatment initiation from diagnosis. Delays for treatment conclusion definition were based on the literature and sample distributions: <120/121-200/>200 days. The outcome was the death of all causes from the diagnosis. Death causes and dates were obtained from a record linkage procedure between the hospital-cancer registry and the Mortality Information System(SIM). Overall 36 months survival was estimated by Kaplan-Meier method and Log-Rank test. Crude and adjusted HR, with respective 95%CI, were estimated by Proportional Cox regression.

RESULTS:From 869 included women, 260(29.9%) died in a median follow-up time of 27 months. Delays on treatment initiation(> 60 days) was 94.3%, while delay on treatment conclusion(>120 days) was 81.4%. Overall survival was 61.3%, varying from 62.6% among women treated within 60 days to 63.5% for 61-90 days. Among late stage women(IIB-IIIB), those treated within 60 days presented poorer survival rate(40.1%) than those treated in 61-90 days(52.5%) and >90 days(53.3%). Delays on treatment conclusion reduced survival, ranging from 60.7%(>200 days) to 72.2%(<120 days), (L-R p-value=0.054). Overall multivariate analysis showed that delays on treatment initiation did not affect death risks in 36 months. Compared to women taking less than 120 days to finish treatment, those taking 121-200 days had a death-risk 89% higher(95%CI:1.10-3.24), while those taking over 200-days had a death-risk 111% higher(95%CI:1.31-3.39), regardless of age, stage, treatment protocol, and time to treatment initiation.

CONCLUSIONS: Delays in cervical cancer treatment conclusion affected 36-month survival, and death risks, rather than delays in treatment initiation, among Brazilians.

Keywords: cervical cancer, delays in treatment, hospital-based cohort, survival, Brazil

Herbal medication and gout in a population of former sugarcane workers with elevated risk of chronic kidney disease

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BACKGROUND AND AIM:Sugarcane workers have an elevated prevalence of chronic kidney disease of non-traditional causes (CKDnt), a disease in which occupational heat exposure and intense physical exertion are suspected initiators. Sugarcane workers often first exhibit kidney dysfunction. Hyperuricemia among patients with kidney dysfunction increases risk of gout, an inflammatory condition which can result in severe pain and swelling. We previously reported that the majority of former sugarcane workers who had kidney dysfunction were experiencing hyperuricemia. We found that the use of natural remedies, including chamomile, was common in this population, though we have not yet examined whether chamomile, in particular, may influence risk of gout. Our objective was to determine if consumption of chamomile as an herbal medication was associated with lower odds of gout, among former sugarcane workers with kidney dysfunction.

METHOD: The study population consisted of 311 former sugarcane workers who were patients at a renal clinic in northwestern Nicaragua. They were male, non-diabetic, attended the clinic for at least one year. Participants self-reported use of chamomile as a natural remedy in the last year. Gout in the preceding year was determined from abstracted medical records. Unconditional logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (95% CIs), for 293 subjects with complete information on covariables age, hypertension, CKDnt stage, alcohol consumption, and allopurinol prescription.

RESULTS:Gout was experienced by 26% of participants within last year. Overall, 16% percent of participants used chamomile in the last year. The adjusted odds of gout was lower among chamomile users compared with non-users, though CIs were wide (OR= 0.56, 95% CI (0.20, 1.56)). CONCLUSIONS:We cannot conclude whether chamomile use reduced odds of gout among former sugarcane workers with kidney dysfunction. However, greater understanding of what factors affect gout and hyperuricemia in this population would improve quality of life.

Keywords: Food/Nutrition, Cardiovascular disease

Associations of Exposure to Urinary Metals with Kidney Injury Biomarkers among Pre-adolescent Children: A Cross-Sectional Study

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BACKGROUND AND AIM: Exposure to toxic metal(loid)s, including arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) may have nephrotoxic effects in children. We assessed concurrent metal exposure and their associations with urinary kidney injury biomarkers in pre-adolescent children. METHOD: Cross-sectional analyses included 551 children participating in the Programming Research in Obesity, Growth, Environment and Social Stressors birth cohort study in Mexico City. Concentrations of As, Cd, Pb, and Hg and kidney injury biomarkers were quantified in the child's urine at the 8-12 years study visit. Associations of urine metal mixtures (As, Cd, Pb, and Hg combined) with individual kidney injury biomarkers were assessed using weighted quantile sum regression. Covariates included child's age, sex, body mass index z-score, urine creatinine, socioeconomic status, and smoking exposure at time of visit.

RESULTS:Per each quartile increase in the urine metal mixture, osteopontin was 0.36 ng/mL (95% CI: 0.17, 0.55) higher, primarily due to the contributions of Hg (39%) and Cd (31%). Per each quartile increase in the urine metal mixture, albumin (0.53 ng/mL; 95% CI: 0.35, 0.72), uromodulin (0.29 ng/mL; 95% CI: 0.14, 0.44), retinol-binding protein 4 (0.54 ng/mL; 95% CI: 0.34, 0.74), and beta-2-microglobulin (0.45 ng/mL; 95% CI: 0.21, 0.68) were higher, primarily driven by As. Per each quartile increase in the urine metal mixture, glutathione S-transferase alpha (0.68 ng/mL; 95% CI: 0.36, 0.99), alpha-1-microglobulin (0.19 ng/mL; 95% CI: 0.09, 0.29), and kidney injury molecule-1 (0.52 ng/mL; 95% CI: 0.39, 0.65) were higher, primarily driven by Cd.

CONCLUSIONS: These findings expand on prior research in which we reported associations between prenatal exposure to metals and urinary kidney injury biomarkers. Exposure to these metals and their combinations, may lead to subclinical tubular or glomerular injury in preadolescence.

Keywords: Heavy metals, Children's environmental health, Mixtures, Exposures

VO-033[Air pollution » Other (to be specified with keywords in the keywords section)]

Health impact analysis of source-apportioned air pollution changes in New York City, 2005-2015

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BACKGROUND AND AIM: To inform pollution policy, we estimated air quality and health impacts attributable to pollution source changes in New York City (NYC).

METHOD:Air pollution, mortality, and morbidity data were obtained from US EPA's Air Quality System, NYC Department of Health and Mental Hygiene Vital Statistics, and New York Statewide Planning and Research Cooperative System, respectively. "Before" (2005-2007) and "after" (2013-2015) periods were compared based on policy events and changes in seasonal pollution patterns. PM2.5 source apportionment was performed using positive matrix factorization. Health impacts of NO2 and source-apportioned PM2.5 were analyzed using EPA's BenMAP and NYC-specific concentration-response functions developed by study co-authors for short-term impacts of air pollution.

RESULTS: Among PM2.5 constituents, the ammonium sulfate factor (associated with coal-fired power plants) showed the largest reduction in mass (4.2 μ g/m3) and annual attributable counts (AC) and fraction (AF)—mortality: (AC: 127 [95%CI: 23,231], AF: 0.26%); asthma emergency department visits (EDV): (AC: 1516 [1150,1878], AF: 3.3%); asthma hospitalizations: (AC: 312 [213,410], AF: 3.5%); cardiovascular disease (CVD) EDV: (AC: 165 [46,283], AF: 0.37%); CVD hospitalizations: (AC: 251 [105,396], AF: 0.46%). PM2.5 from ammonium nitrate, residual oil, and traffic factors each fell <0.5 μ g/m3. NO2 fell about 11 ppb, yielding greater annual reductions in AC than any PM2.5 source factor—mortality (AC: 208 [83,333]); asthma EDV (AC: 2103 [1659,2541]); asthma hospitalizations (AC: 392 [271,510]); CVD EDV (AC: 172 [27,315]); CVD hospitalizations: (AC: 410 [231,587]).

CONCLUSIONS: Ammonium sulfate reductions comprised the bulk of PM2.5 changes, likely reflecting lower SO2 emissions from power plants. While PM2.5 from residual oil fell about 54%, traffic and ammonium nitrate contributions fell only 20-26%, suggesting greater potential for PM2.5 reductions from traffic and nitrate precursors. NO2 reductions exhibited the greatest health benefits, underscoring the importance of NOx mitigation, such as emissions control technologies and electrification.

Keywords: policy, mortality, respiratory outcomes, cardiovascular diseases

How would emission-reductions in Justice40 locations reduce racial-ethnic disparities in air pollution exposure?

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BACKGROUND AND AIM:During the past decades, air quality in the US has improved dramatically, however, disparities persist. Exposure disparities by race-ethnicity are larger than, and independent of, disparities by income or other socioeconomic measures. The Biden Administration's Climate and Economic Justice Screening Tool (CEJST) is the signature element and the ongoing approach of the White House Justice40 Initiative ("J40"), which is a general policy to address environmental injustice. This study aims to explore whether emission-reductions brought about by CEJST/J40 investments will eliminate disparities in PM2.5 exposure by race-ethnicity and other attributes.

METHOD: We compare a Business As Usual ("BAU") scenario against two scenarios wherein CEJSTidentified locations ("J40 communities") experience aggressive or very aggressive additional emission reductions. BAU simply continues historical rates of emissions and emission-changes into the future; in the two CEJST scenarios, we double or quadruple emission reduction in J40 communities, relative to BAU. We use InMAP to predict how changes in emissions would impact annual-average PM2.5 concentrations and concentration-disparities.

RESULTS: Under the BAU scenario, disparities remain in place. Racial-ethnic disparities remain larger than disparities for J40 communities and for low-income populations. The CEJST scenarios eliminate absolute and relative disparities for J40 communities and for low-income populations in 20 years; however, they do not reduce relative disparities by race-ethnicity.

CONCLUSIONS: Results from our analysis indicate that additional and more targeted actions, beyond

CEJST/J40, will be needed to end racial-ethnic exposure disparities in the next decades. In the bigger picture, our study argues that Regulatory Impact Analysis (RIA) for air pollution must quantify whether and how policies/tools will not only affect air quality overall, but also reduce absolute and relative disparities, and that regulatory approaches are needed that are specifically designed to remove disparities.

Keywords: Air pollution, Particulate matter, Environmental justice, Environmental disparities, Policy

Effects of triclosan and triclocarban exposure on bile acid homeostasis in Chinese school-aged children

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BACKGROUND AND AIM: Human exposure to triclosan and triclocarban has been proposed to have potential effects on bile acid homeostasis by disrupting gut microbiota, but the relevant information remains limited. Therefore, our study aimed to investigate the associations of triclosan and triclocarban in urine with bile acid homeostasis in Chinese school-aged children.

METHOD:In 2019 and 2020, we selected 545 Han children aged 7-11 years old from a dynamic cohort of school-aged children established in Shanghai. Urinary concentrations of triclosan, triclocarban and nine typical bile acids, including cholic acid (CA), chenodeoxycholic acid (CDCA), deoxycholic acid (DCA), lithocholic acid (LCA), ursodeoxycholic acid (UDCA), glycocholic acid (GCA),

glycochenodeoxycholic acid (GCDCA), glycodeoxycholic acid (GDCA), and glycoursodeoxycholic acid (GUDCA) were determined by liquid chromatography tandem mass spectrometry. To indicate the microbial transformation of bile acids by gut microbiota, seven urinary concentration ratios of bile acids, including DCA/CA, LCA/CDCA, UDCA/CDCA, CA/GCA, DCA/GDCA, CDCA/GCDCA, and UDCA/GUDCA were constructed. Linear models of generalized estimating equations (GEE) were used to analyze the associations of urinary triclosan and triclocarban with bile acids and their concentration ratios.

RESULTS:Triclosan and triclocarban were detected in 53.39% and 34.31% of urine samples with the 75th percentiles of creatinine-corrected concentrations being 2.94 µg/g and 0.40 µg/g, respectively. After adjusting for potential confounders, urinary concentration of triclosan was positively associated with urinary UDCA concentration and LCA/CDCA, but negatively associated with urinary CA concentration and CA/GCA. Urinary triclocarban concentration was positively associated with urinary concentrations of DCA, LCA, UDCA, GCA, and GDCA. Children with detectable triclosan in urine had lower urinary CA, CDCA, and GCA concentrations and CA/GCA, but higher DCA/CA. Children with detectable triclocarban in urine had higher urinary GCA concentrations.

CONCLUSIONS: Exposure to triclosan and triclocarban could affect bile acid homeostasis in school-aged children by inhibiting the microbial transformation of bile acids in gut microbiota.

Keywords: children's environmental health, metabolomics, obesity and metabolic disorders, long-term exposure

Oxidative potential and health risk assessment of ambient fine particulate matter around an opencast coal mining area in India

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BACKGROUND AND AIM:Particulate matter (PM2.5) exposures are prominent around opencast coal mining areas due to heavy transportation and mining activities. However, the toxicity of fine PM in mining communities, especially in India, is not well understood. This study aims to examine the oxidative potential (OP) of PM2.5 as an indicator for oxidative stress for better understanding of the health risks associated with exposure.

METHOD:PM2.5 was collected from roadsides and residential sites near an active coal mining area in Eastern Maharashtra, India. Oxidative potential of PM to examine the generation of reactive oxygen species (ROS) was carried out by dithiothreitol (OPDTT) and ascorbic acid (OPAA) assay. Further, inhalation health risk (USEPA IRIS), and PM2.5 bound water-soluble metals (through ICP-MS) were also examined.

RESULTS:PM2.5 levels at coal-haul road were 10 times higher than the urban background site (average ~500 ± 190 µg/m3). The inhalation risk for PM2.5 was observed to be 4 x 10-4, indicating a significant risk to the population. The OPvolAA and OPvolDTT levels were higher at the roadside (2.3 ± 0.6 nmol min-1 m-3 and ~1.9 ± 0.8 nmol min-1 m-3 respectively) compared to residential sites (~0.76 ± 0.01 nmol min-1 m-3 and 0.94 ± 0.2 nmol min-1 m-3 respectively) against the background 0.6 ± 0.2 nmol min-1 m-3 (OPAA) and 0.9 ± 0.12 nmol min-1 m-3 (OPvolDTT). Cr (20 ± 2.3 µg/m3), Ni (5.6 ± 0.3 µg/m3), Cu (67.2 ± 9.5 µg/m3), and Fe (350 ± 36.7 µg/m3) emerged as prominent transition metals.

CONCLUSIONS: The present study examines the intrinsic OP of fine PM around opencast coal mines to highlight the oxidative burden of fine PM and the need for incorporating PM composition and toxicological basis in regulation of environmental levels of PM. Further statistical analysis to examine the association of levels of OP and its chemical drivers is underway

Keywords: Exposures, particulate matter, toxicology, heavy metals, risk assessment

The joint association of air pollution and sleep posture with mild obstructive sleep apnea in patients from Taipei Sleep Center

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BACKGROUND AND AIM:Obstructive sleep apnea (OSA) is negatively affected by a supine sleep position and air pollution and positively affected by a nonsupine sleep position. However, their interaction effects on OSA remain unclear. To evaluate the interaction effects of air pollution (NO2/PM2.5) and sleep position on OSA on additive and multiplicative scales.

METHOD: This study included 3,330 individuals. Personal exposure to air pollution was assessed using a spatiotemporal model. OSA was diagnosed through polysomnography. The associations of supine and nonsupine sleep positions and air pollutants with mild OSA and their interaction effects on mild OSA were explored through generalized logistic regression.

RESULTS: Supine sleep position and high NO2 level independently increased the risk of mild OSA. The interactions between supine sleep position and NO2 at lag(0–7 days), lag(0–1 year), and lag(0–2 years) were significant (P = 0.042, 0.013, and 0.010 respectively). The relative excess risks due to interactions on the additive scale for 1-week, 1-year, and 2-year NO2 exposure and supine sleep position were 0.63 (95% CI: 0.10–1.16), 0.56 (95% CI: 0.13–0.99), and 0.64 (95 % CI: 0.18–1.10); the corresponding odds ratios for interactions on the multiplicative scale were 1.45 (95% CI: 1.01–2.07), 1.55 (9% CI: 1.09–2.22), and 1.60 (95% CI: 1.12–2.28). The positive interactions persisted in men and participants with obesity. No interaction was observed between nonsupine sleep position and NO2 level; nevertheless, significant interactions were noted on both the negative additive and multiplicative scales for men.

CONCLUSIONS: Prolonged supine sleep duration significantly increased the risk of mild OSA, particularly in men and participants with obesity. Although the benefits of a nonsupine sleep position are considerably less than the risks of NO2 exposure, avoiding prolonged sleep in a supine position may reduce the risk of mild OSA from exposure to high levels of NO2 in men.

Keywords: short-term exposure, long-term exposure, spatial statistics, environmental epidemiology

Interaction between greenspace and risk factors for dementia and cognitive decline: a cohort study from UK Biobank

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BACKGROUND AND AIM: The Lancet Commission on dementia prevention, intervention, and care had identified twelve risk factors for dementia and cognitive decline. However, we do not know how greenspace might modify the relationship between these risk factors and dementia incidence or cognitive domains.

METHOD:A cohort study was conducted among 435,649 adults aged 37-73 from the UK Biobank between 2006 to 2010. The outcome measures consisted of ICD-based dementia diagnosis and seven cognitive tests, with each test assessing a specific cognitive domain. Residential greenspace indicated by percentage of outdoor greenspace at 300m buffers. We used logistic regression models and multivariate regression models to estimate the effects of 12 identified risk factors, greenspace, and their interaction on dementia incidence and cognitive domains, adjusted for a range of key covariates. RESULTS:Of 502285 participants, 5971(1.20%) were diagnosed with dementia. There is no interaction between greenspace and any risk factor on dementia incidence. However, for cognitive domains, fully models showed interaction effects of greenspace with PMcoarse and PM10 on numeric memory and reaction time scores, respectively.

CONCLUSIONS: Though there is no interaction between greenspace and any risk factor on dementia incidence, we can find the interaction effects of greenspace with several air pollutants on numeric memory and reaction time. Strategies are needed to improve air quality and greenspace to decrease risk of cognitive decline and dementia.

Keywords: greenspace, cognitive function, dementia, risk factor

Association of Ambient Air Pollutants and Pancreatic Cancer in a Matched Case-Control Study

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BACKGROUND AND AIM:Pancreatic cancer is one of the leading causes of cancer-related death, but our understanding about the etiology of this devastating disease remains very limited. Air pollution is the greatest environmental risk causing diseases and premature deaths throughout the world. The aim of study was to explore the relationship between air pollutants and pancreatic cancer in a Taiwan population-based cohort.

METHOD:A nationwide matched case-control study was conducted using the National Health Insurance Database in Taiwan. 6,497 cases were selected from those diagnosed with pancreatic cancer during 2015-2017. For each case, we selected two controls by matching their age, sex, occupation, insurance cover amount, living in the six municipalities or not, diagnosed/examined date, and hospital. Concentrations of each year from 2005-2014, 5-year and 10-year averages of air pollutants of particulate matter (PM) 2.5, PM10, nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), and ozone (O3) were estimated for residential location. A conditional logistic regression was implemented to estimate the association between air pollutants and pancreatic cancer. RESULTS:In univariate analyses, NO2, CO, and O3 were significantly associated with pancreatic cancer risk; in multivariate analyses, O3 was the only significant pollutant. A dose-response relationship of O3 with pancreatic cancer was observed. Pancreatic diseases, acute pancreatitis, chronic pancreatitis, and diabetes mellitus (DM) were the significant mediators between O3 exposure and pancreatic cancer risk.

CONCLUSIONS:O3 might be the key air pollutant to increase the risk of pancreatic cancer. Exposure to O3 would mediate pancreatic diseases, pancreatitis, or DM, raising the risk of pancreatic cancer.

Keywords: air pollution, air pollutant, cause pancreatic cancer, matched case-control study, ozone

Prenatal exposure to air pollution and infant growth: A trajectory analysis based on a birth cohort

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BACKGROUND AND AIM: Growth during early-life stage is a rapid and dynamic process that is vulnerable to environmental hazards. We examined the associations between prenatal exposure to air pollution and growth trajectories of infants based on a birth cohort.

METHOD: A birth cohort was constructed using medical records of over 3,800 infants born between 2015 and 2019 in Foshan, China. Physical growth (body length and weight) and neurodevelopment were measured repeatedly within the first year after birth. Prenatal exposure to air pollutants including particulate matter with aerodynamic diameter $< 2.5 \,\mu m$ (PM2.5), carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), ozone(O3) was estimated using satellite-based spatialtemporal models at each participant's residence. Latent Class Growth Modelling (LCGM) was used to identify trajectories of physical growth and neurodevelopment. Logistic regression was used to investigate the associations between prenatal exposure to air pollution and the risk of physical and neurodevelopmental disruptions among infants, with adjustment for an array of potential confounders. RESULTS: Based on the LCGM analyses, two growth trajectories were identified for body length [normal (93%) and retardation (7%)], three for body weight [normal (59.6%), retardation (9.4%), and overgrowth (31%)], and two for neurodevelopment [normal (66.1%) and retardation (33.9%)]. Prenatal exposure to PM2.5, NO2 and SO2 was significantly associated with increased risks of neurodevelopmental delay. SO2 exposure was also associated with an increased risk of growth retardation in body length. None of the air pollutants was significantly associated with weight growth. CONCLUSIONS: Our results suggest that prenatal exposure to air pollution was associated with increased risks of retardation in both physical growth, particularly body length, and neurodevelopment in infants.

Keywords: Prenatal exposure, air pollution, infant growth, trajectory analysis

Residential wood burning in two Swedish cohorts: Public health implications of sourcespecific particulate ambient air pollution

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BACKGROUND AND AIM: It is well known that wood-smoke is harmful in high doses, for example when cooking without chimneys in low-income countries. There are experimental studies indicating that wood-smoke even at lower doses, such as those that occur in some residential areas, can be harmful to our health. But there have previously been few studies on the population level on long-term effects; despite the fact that wood-smoke in many areas is the largest source of air pollution exposure. A rise in wood-burners in the wake of the rising costs for energy are furthermore likely to be creating 'pollution hotspots' in affluent areas. Environmental inspectors and policy makers' call for more knowledge, as a basis for recommendation, as wood-burning currently is regulated in some areas but not in others.

In the present study, the aim was to estimate the levels of wood-smoke at the home address in two population-based cohorts.

METHOD: We used a quite unique data collection on all chimneys, that was available in two counties in Sweden with high spatial resolution. The cohorts (>100 000 individuals each) have good data on other risk factors, and were linked to health records and mortality registries.

RESULTS:We observed an increased risk for low birth weight, autism spectrum disorders and preeclampsia (with adjusted odds ratios of 1.14 (95% confidence interval, CI: 1.04–1.26), 1.12 (95% CI: 0.94–1.34) and 1.35 (95% CI: 1.01-68) per IQR increase in PM2.5 from woodburning in the entire pregnancy. We observed no dose-response association between PM2.5 from woodburning and incident diabetes, dementia or lung cancer (but clearer associations with vehicle exhaust, except for dementia).

CONCLUSIONS: Together, this evidence may imply that health effects of wood-smoke in ambient air was present for outcomes related to exposure during pregnancy, but not later in life in this setting.

Keywords: Particle components, Long-term exposure, Particulate matter, birth outcomes, planetary health

Long-term exposure to air pollution and mortality due to chronic kidney disease – results from the multicentre ELAPSE-study

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BACKGROUND AND AIM:Air pollution has been shown to be associated with cause-specific mortality. However, mortality due to chronic kidney disease (CKD) is understudied despite the kidney being a central organ of detoxification. We investigated the association of mortality due to CKD with long-term exposure to air pollution in the Effects of Low-Level Air Pollution: A Study in Europe (ELAPSE). METHOD:We included five population-based cohorts from four European countries from the pooled ELAPSE cohort which were linked to data from local mortality registries. CKD-death was defined as ICD10 codes N18-N19 or corresponding ICD9 codes. Mean annual exposure at home address was determined with Europe-wide hybrid land use regression models for particulate matter $\leq 2.5 \mu m$ (PM2.5), nitrogen dioxide(NO2), black carbon (BC) and ozone (O3) with a spatial resolution of 100m x 100m. Cox regression models were adjusted for age (time-axis), cohort and sex (both as strata), calendar year of recruitment, smoking status, marital status, employment status and neighbourhood mean income. Dose-response was investigated with splines, threshold and subset analyses. RESULTS:Over a mean follow-up time of 20.4 years, 313 of 289,564 persons died from CKD. Associations were observed for all pollutants, positive for PM2.5 (hazard ratio (HR) with 95% confidence interval (CI) of 1.31 (1.03-1.66) per 5µg/m3 increase), BC (1.26 (1.03-1.53) per $0.5 \times 10 - 5/m$), NO2 (1.13 (0.93-1.38) per $10\mu g/m3$) and negative for O3 (0.71 (0.54-0.93) per $10\mu g/m3$). Results were robust when additionally adjusting for smoking intensity and duration, BMI, education or residential greenness. Exclusion of the large Austrian cohort, that contributed 226 cases, lead to null associations. Dose-response analysis showed no evidence for a threshold. CONCLUSIONS:Our results suggest a possible association of air pollution with mortality from CKD. Results were robust to other model specifications but susceptible to cohort selection. Therefore, further even larger studies are needed to confirm our results.

Keywords: long-term exposure, particulate matter, oxides of nitrogen,

Analysis of long-term mortality risks of PM2.5 in the UK Biobank cohort

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BACKGROUND AND AIM: The association between long-term exposure to fine particulate matter (PM2.5) and mortality is established. However, several aspects remain unclear regarding the actual exposure risk window and the form of the temporal dependency. We studied the association of exposure to PM2.5 on cause-specific mortality in the UK Biobank cohort, characterising the temporal dependencies through a detailed reconstruction of exposure histories and the definition of informative risk summaries.

METHOD: The analysis included 502,381 participants to the UK Biobank cohort followed-up in the period 2006-2019. Exposure to PM2.5 was assigned by linking detailed residential histories and locations with high-resolution spatio-temporal maps. We performed a Cox proportional hazard model for time-varying exposure, applying a risk-set sampling scheme to reconstruct annual exposure averages in 365-day windows prior to the event over eight years (0-7 lags) for 100 controls for each case. We analysed risks for different causes of death controlling for several individual-level confounders.

RESULTS:Long-term exposure to PM2.5 was consistently associated with non-accidental mortality using different time windows: the hazard ratio (HR) for a 5 μ g/m³ increase was 1.06 (95%CI: 1.00-1.13) at lag0 (previous 365 days), 1.09 (1.01-1.17) at lag0-1, 1.12 (1.03-1.21) at lag0-4, and 1.13 (1.03-1.24) at lag0-7. Preliminary results of an application of distributed lag models suggests a spike in risk at lag 1 (in the window 365-730 days earlier), with an HR of 1.83 (0.96-1.22). We found positive but non-significant associations for respiratory and lung cancer mortality, and a null association for cardiovascular causes.

CONCLUSIONS:Long-term exposures to PM2.5 was associated with an increased risk of natural mortality at different temporal windows. The magnitude of the association increased when exposures at longer lags were included, with the highest risks in the window corresponding to 1-2 years earlier.

Keywords: Air Pollution, Particular matter, Long-term exposure, Survival, Mortality

Associations between prenatal air pollution exposure and placental DNA methylation: a French multi-cohort study

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We investigated the association between prenatal NO2, PM10 and PM25 exposure levels and changes in placental DNA methylation (DNAm) patterns and further explored potential windows of susceptibility and sex-specific alterations.

METHOD: DNAm levels were measured using the Infinium Methylation EPIC BeadChip in 871 placental samples from the three mother-child cohorts EDEN, PELAGIE and SEPAGES, recruited across four different French cities. Daily exposure levels of each pollutant were estimated based on maternal residential address, using validated spatiotemporally resolved exposure models. We conducted an epigenome-wide association study to identify differentially methylated positions (DMPs) and regions (DMRs).

RESULTS:We found 4 CpG sites significantly associated with at least one air pollutant in the whole population after correction for multiple tests and more than 300 sex-specific associations. Top DMPs (p-value<0.001) associated with PM exposure during the third trimester of pregnancy were significantly enriched (FDR<0.05) in genes related to the calcium signaling pathway in girls and to the development of the hypothalamus in boys. The regional analyses identified 31 DMRs associated with air pollutant exposure in the whole population. Moreover, we detected sex-specific (34 in girls, 35 in boys) and pollutant-specific (5 for NO2, 4 for PM) DMRs. Our results were validated using an independent data set of 668 EDEN participants whose placenta DNAm levels were measured using the Illumina 450K BeadChip.

CONCLUSIONS: These findings highlight global and sex-specific modifications of placental DNA methylation patterns associated with prenatal air pollutant levels which could provide clues about the molecular pathways through which air pollution may influence sex-specific response to oxidative stress and brain development.

BACKGROUND AND AIM: Exposure to air pollution during pregnancy may alter placental DNA methylation patterns and induce changes in placental and fetal development and later disease susceptibility.

Keywords: Air pollution, Particulate matter, Pregnancy outcomes, Male, Female

Critical windows of susceptibility of maternal exposure to fine particulate matter and the risks of stillbirth and spontaneous preterm birth

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BACKGROUND AND AIM: Few studies have investigated weekly or monthly exposure-lag-response relationships between ambient fine particulate matter (PM2.5) and spontaneous preterm birth (sPTB) or stillbirth. This study aimed to identify potential critical windows of susceptibility for these associations which are currently unknown.

METHOD:A total of 414,771 singleton birth records which included 0.5% stillbirths and 3.7% sPTB were spatiotemporally linked to monthly PM2.5 concentrations between 1st January 2000 and 31st December 2015 in Western Australia. PM2.5 exposure for three months preconception to birth and adjusted hazards of stillbirth and sPTB were estimated by distributed lag linear and non-linear Cox proportional hazard models.

RESULTS:The mean (standard deviation) PM2.5 exposure was 8.1 (1.0) µg/m3 for the study period. The identified potential critical windows of susceptibility ranged from the 3rd to the 7th gestational month. The strongest adjusted hazards per 5 µg/m3 (international annual limit) and 3 µg/m3 (excess of Australian standard over international limit) PM2.5 exposure increase were 1.12 (95% CI 1.05, 1.19) and 1.07 (95% CI 1.03, 1.11), respectively during 3rd gestational month for stillbirth and 1.04 (95% CI 1.02, 1.05) and 1.02 (95% CI 1.01, 1.03), respectively during 5th gestational month for sPTB. No obvious associations were found for preconception exposures. For stillbirth but not for sPTB, the interactive effects of PM2.5 exposure and biothermal stress were observed. For both birth outcomes, the effect estimates were disproportionately elevated for male infants and births to mothers aged 20–34 years, high socioeconomic status, and pregnancy complications. CONCLUSIONS:Maternal ambient PM2.5 exposure is associated with higher hazards of stillbirth and sPTB, even at levels below the new international yearly average limit of 5 µg/m3. The identified potential critical windows of exposure susceptibility and sensitive subpopulations could guide future aetiological studies, public health initiatives, and policy considerations.

Keywords: Long-term exposure, Birth outcomes, Environmental epidemiology, Modeling

The impact of residential relocation on childhood BMI: an exposome-wide natural experiment

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BACKGROUND AND AIM:Residential relocation can cause sudden and simultaneous changes in multiple environmental exposures and provides a unique opportunity to estimate the potential health impacts of interventions on the external exposome. This study uses residential relocation as a natural experiment to assesses the impact of exposome relocation trajectories on BMI during childhood in the EXPANSE project.

METHOD: We collected 27,019 repeated age-and-sex standardized BMI z-scores (z-BMI) observations from 2,915 children and adolescents in the PIAMA (Netherlands) and BAMSE (Sweden) studies who changed address once between 2 and 24 years. Considering various domains of the urban exposome (traffic-related pollution, built surface, green variability, blue space, socioeconomic deprivation), we used a k-means clustering approach to characterize their living environment before and after moving as low, medium and high hazard environments for each exposome domain. The impact of changes in the urban exposome following residential relocation on z-BMI was estimated using fixed-effects models for panel data. We fitted single and multiple exposome domains models and included non-linear time-trends in z-BMI.

RESULTS:We found consistent associations between relocating to areas with a worse living environment and increasing z-BMI in the single domain models. The multiple domains models revealed that the association for air pollution and built surface was partially confounded by the other exposome domains. In PIAMA, moving to areas with increased socioeconomic deprivation was significantly associated with increased z-BMI after relocation in all models.

CONCLUSIONS: This is one of the first studies to use residential relocation as a natural experiment to assess the impact of changes in various aspects of the urban exposome on health. Results suggest that relocating to new environments with different levels of pollution, built surface and socioeconomic deprivation can have direct impacts on childhood bodyweight. Results inform planning of urban environments to promote healthy weight in children.

Keywords: urban exposome, built environment, residential relocation, BMI

A systematic review of exposure-response relationships between the exposome and children health

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BACKGROUND AND AIM: Health impact assessment studies quantifying the impact of the chemical and urban exposomes on children's health are lacking. A synthesis of available exposure-response relationships is an essential first step to fill the gap. We reviewed exposure-response relationships available in the literature relating risk factors with health outcomes in children.

METHOD:Out of 621 studied factor-outcome pairs for which level of evidence was assessed, 112 factor-outcome pairs had an overall probability of causation above 60% and were therefore prioritized. This list included risk factors such as perfluoroalkyl compounds (PFOS, PFAS), metals, phthalates, phenols, pesticides, polycyclic aromatic hydrocarbon (PAH), tobacco, persistent organic pollutants (POP), air pollution, green spaces, food environment, noise and UV radiation. Our search strategy for exposure-response relationships consisted in looking for meta-analyses first and if not available for epidemiological studies.

RESULTS: We could identify exposure-response relationships in the literature for 58 factor-outcome pairs: half from published meta-analyses, half from single epidemiological studies. Exposure-response relationships were available for tobacco (death, birth outcomes, orofacial clefts, respiratory health), lead (asthma, neurodevelopment, delayed puberty and iron deficiency anaemia), PCBs (neurodevelopment, bronchitis and birth outcomes), bisphenol A (cognition and obesity), HCB (respiratory health), BDE-47 (neurodevelopment), BDE-153 (behavior), DDE (hypospadias and cryptorchidism), organophosphate pesticides (cognition), methylmercury (cognition), PFAS (immune system, birth weight, behavior, miscarriage), arsenic (cognition, birth weight), cadmium (cognition, birth weight), manganese (behavior), air pollution (respiratory health), noise (reading comprehension), green spaces (birth weight), food environment (malnutrition) and heat (birth outcomes and stillbirth). For 54 of the 112 substance-outcome pairs, there was a lack of dose-response relationships from epidemiological studies on children.

CONCLUSIONS: This review can be used to identify research gaps and help perform quantitative health impact assessment of the exposome on child health.

Keywords: Exposome, Chemical exposures, Children's environmental health, Environmental

epidemiology

Effects of ambient temperature on preterm birth, stillbirth, and low Apgar score in Soweto, South Africa: A case-crossover analysis

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BACKGROUND AND AIM: To evaluate acute effects of ambient temperature on risk of preterm birth (PTB), stillbirth, and low Apgar score in a low-income urban setting.

METHOD:Time-stratified case-crossover analysis of 18,226 singleton live PTBs (<37 weeks' gestation), 4,201 stillbirths, and 748 cases of low Apgar score (\leq 3 at 5 minutes of age) between April 2016 and March 2022 in Soweto, South Africa. Gridded daily mean temperatures (ERA5-Land reanalysis) were linked with outcomes by date of delivery and location of birthing facility (n=10). Low and high temperatures were defined as the 5th and 95th percentiles of daily mean temperature, respectively, and compared with the temperature of minimum effect (TME). We explored effect modification by season of birth, facility type, infant sex, maternal age, parity, and HIV status.

RESULTS:High temperature (22.5°C vs TME) 0-6 days before delivery was associated with a 6.7% (95% CI 1.8% to 11.9%) increased odds of PTB and 19.1% (2.1% to 38.9%) increased odds of stillbirth. Point estimates of association between high temperature and stillbirth were greater among women living with HIV, women who gave birth in primary (vs tertiary) facilities, younger women (<35 years), and female foetuses. Maternal factors (age, parity) did not modify the effect of high temperature on PTB. Low temperature (9°C vs TME) 0-6 days before delivery was associated with an increased odds of stillbirth among nulliparous, but not multiparous, women (73.7%, 1.6% to 196.9%; -6.1%, -34.5% to 34.6%, respectively) and with an increased odds of PTB among HIV-negative women (23.8%, 0.73% to 52.0%), but not among women living with HIV (-5.3%, -30.9% to 29.9%). Exposure to high or low temperatures did not increase risk of low Apgar score.

CONCLUSIONS: High ambient temperatures increase risk of PTB and stillbirth in a low-income setting. For the first time, we show evidence of temperature effect modification by maternal HIV status.

Keywords: Climate, Temperature extremes, Pregnancy outcomes, Birth outcomes, Environmental epidemiology

In utero exposure to synthetic phenols and phthalates and child respiratory health: a mixture analysis based on clustering

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BACKGROUND AND AIM: Exposure to phthalates and synthetic phenols is ubiquitous and some of them are suspected to impact child respiratory health. We investigated associations between prenatal exposure to a mixture of phenols and phthalates and child respiratory health in a cohort with improved exposure assessment and objective markers of lung function at early age. METHOD: Prenatal exposure to 7 phenols, 4 parabens, 13 phthalate and 2 non-phthalate plasticizer metabolites was assessed from two pools of 21 maternal urine samples collected in the 2nd and 3rd trimesters among 457 mother-child pairs. Lung function was assessed using tidal breathing flowvolume loops and nitrogen multiple breath washout at 2 months and by oscillometry at 3 years. History of respiratory health diseases was evaluated from repeated questionnaires up to 3 years of age. A cluster-based analysis was applied to identify prenatal exposure patterns. Adjusted linear regressions were used to study associations between these clusters and respiratory health. RESULTS: Four prenatal exposure patterns were identified: 1) low concentrations of all biomarkers (n = 106, reference group), 2) low phenols, parabens, moderate phthalates (n = 162), 3) high phthalates, parabens and phenols except bisphenol S (n = 109), 4) high parabens, moderate phenols, low phthalates (n = 102). At 2 months, compared to cluster 1 infants, cluster 2 infants had lower functional residual capacity and tidal volume and higher ratio of time to peak tidal expiratory flow to expiratory time (tPTEF/tE) while cluster 3 had lower lung clearance index and higher tPTEF/tE. No significant association with history of respiratory health disease in the first 3 years of life was detected as well as with lung function measurements at 3 years.

CONCLUSIONS: Relying on improved exposure assessments and objective markers of lung function our study suggested that prenatal exposure to mixtures of phthalates might reduce lung volume in early life.

Keywords: Phenols, Phthalates, Respiratory outcomes, Children's environmental health, Mixtures analysis

Environmental and social inequities in continental France: an analysis of exposure to heat, air pollution and lack of vegetation

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BACKGROUND AND AIM: Cumulative exposure to heat, air pollution, lack of vegetation and social deprivation increases health vulnerability and limits population's capacity to adapt to climate change. Our study sought to characterize fine-scale exposure to heat, air pollution and lack of vegetation in continental France between 2000 and 2018, describe spatio-temporal trends and environmental hotspots (i.e. areas that cumulate the strongest overexposures), and study association with social deprivation.

METHOD: European and French social deprivation indexes (EDI and FDep), vegetation (NDVI, Normalized Difference Vegetation Index) and daily temperatures, PM2.5, PM10, NO2 and O3 concentrations were estimated for 48,185 census districts. Reference values were selected to characterize (over-)exposures. Hotspots were defined as areas cumulating over-exposure to temperature, air pollution and lack of vegetation. The associations between i) hotspots and ii) exposure to heat and social deprivation were studied using logistic regressions.

RESULTS:Over-exposure to heat was higher in 2015-2018 compared to 2000-2014. Exposure to all air pollutants but O3, decreased during the study period. In 2018, 79 to 100 % of the urban census districts exceeded the 2021 WHO air quality guidelines depending on the air pollutant. Vegetation stayed stable between 2000 and 2018. In urban areas, the most deprived census districts were at higher risk of being hotspots (odd ratio (OR): 10.86, 95% CI: 9.87-11.98 using EDI and OR:1.07, 95% CI:1.04-1.11 using FDep).

CONCLUSIONS: Nation-wide fine-scale environmental data reveals inequalities in cumulated exposure

to heat, air pollutants and lack of vegetation in France. Such approach can support the integration of inequities in adaptation strategies to climate change.

Keywords: temperature, particulate matter, green space, socio-economic factors, environmental disparities

Rising food/fuel prices from the Russia-Ukraine war: Pay-as-you-go LPG consumption & food security impacts in a Kenyan informal urban settlement

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BACKGROUND AND AIM: Higher global energy and food prices from the Russian-Ukrainian war have led to financial hardships worldwide. We assessed impact of higher prices on clean cooking fuel consumption and food security in Nairobi, Kenya.

METHOD: From August-October 2022, telephonic surveys were administered to 701 customers of PayGo Energy, a company offering pay-as-you-go liquefied petroleum gas (PAYG LPG) for clean cooking in an informal settlement in Nairobi. Food security was assessed using the reduced Coping Strategies Index (rCSI), a validated tool used by the World Food Programme. Survey data was linked to customers' PAYG LPG consumption data to compare cooking patterns before/after the start of the Russian-Ukrainian war.

RESULTS:At the time of the survey, 56% (n=393) of PayGo Energy customers were food insecure. Nearly all (99%; n=692) customers reported an unusual rise in food prices in their community, and 75% (n=524) reported a noticeable increase in the price of PAYG LPG in 2022. Approximately 30% (n=201) of customers reported reducing their PAYG LPG usage due to rising food prices. Because of higher LPG costs, 11% (n=77) of households reported decreasing their PAYG LPG consumption and 5% (n=33) switched their primary cooking fuel. From June-September 2022, when Kenyan food prices were 13-16% above pre-war levels, households significantly reduced their PAYG LPG consumption by 12% (95%CI:-23%,0%) (from 0.93 to 0.82 kg/capita/month), on average, due to rising food costs. Households that reported reducing their PAYG LPG consumption due to higher food costs were more likely (68%) to skip more meals in 2022 than households that did not lower their usage (45%). CONCLUSIONS:Several households reduced their PAYG LPG consumption in 2022 to cope with higher food and fuel prices. Keeping these costs stable is important for maintaining food security and access to clean cooking fuels in informal urban settlements in Kenya.

Keywords: Russia-Ukraine war, food security, energy security, LPG, clean cooking

Monitoring human-related Encephalitozoon spp. in farms from Makeni, Sierra Leone

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BACKGROUND AND AIM: Encephalitozoon spp. were previously detected in farm animal faeces sampled in 2019 from different recreational areas/farms across Bombali and Tonkolili Districts (Sierra Leone). To perform further monitoring of these species in animals, food and the environment from different farms (Lion Poultry and family farms) to identify potential risks for the food chain.

METHOD:Ninety-eight samples were collected in Summer 2022: 50 farm animal faeces (chicken, duck, sheep, goat, cow, pig) and 25 water, 20 food and 3 leaf that these farm animals were eating/drinking. Spores of human-related Encephalitozoon were investigated in concentrated/pre-treated samples by immunofluorescent-antibody test using a specific monoclonal antibody (Mab) of murine origin IgG2a, patented as a diagnostic tool.

RESULTS:Sixteen samples were positive for spores of the genus Encephalitozoon, specifically 14 animals (8 chicken, 3 goats, 2 ducks, 1 pig) and 2 water. None of the food samples were positive. Moreover, structures compatible with Encephalitozoon spp. were observed in 5 animal (2 duck, and one chicken, sheep, goat and pig) and 3 water samples. This is the first study reporting the presence of human-related microsporidia in ducks. Results would be similar to those observed in 2019, suggesting a moderate circulation of Encephalitozoon spp. in the farms. Thus, spores were molecularly detected using SYBR Green real-time PCR in three goat fresh faecal samples [two E. intestinalis and one E. cuniculi] after processing 75 goat samples in 2019.

CONCLUSIONS: Encephalitozoon spp. could infect humans living in close proximity to these farms and/or through consumption of contaminated water and/or these farm animals. Although zoonotic transfer of microsporidia from farm animals to humans are rare, appropriate cleaning and implementation of hygiene practices and food processing/management would be required to minimise the risks of infection, especially in immunocompromised individuals due to the opportunistic nature of these parasites.

Keywords: Microsporidia, Encephalitozoon, animal and food samples, farms, Sierra Leone.

Association between long-term exposure to air pollution, risk of infection by SARS-CoV-2 virus and COVID-19 in the French CONSTANCES cohort

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BACKGROUND AND AIM:Several studies suggested long-term air pollution exposure was associated to increased risk of SARS-CoV-2 infection. However, the evidence remains limited for individual-level studies and particularly using serology data.

Our objective was to investigate the association between long-term exposure to air pollution and 1) SARS-CoV-2 infection and 2) COVID-19 disease, among adults from the SAPRIS study based on the French CONSTANCES population-based cohort.

METHOD:SARS-CoV-2 serology was assessed between May to October 2020 using ELISA test, and COVID-19 disease was defined by self-reporting medical diagnosis of SARS-COV-2 infection and associated symptoms. Pre-pandemic (2019) annual exposure to PM with an aerodynamic diameter of ≤2.5 (PM2.5), black carbon (BC) and nitrogen dioxide (NO2), was estimated at residential address using hybrid land-use regression model. Log-binomial risk ratios (RRs) with inclusion center as a random effect, adjusting for individual and area-level covariates were used.

RESULTS: Among the 33975 participants, 1695 (4.99%) had a positive serology, and 802 (2.8%) reported COVID-19 disease. Exposure to PM2.5 and NO2 were associated to a higher probability of SARS-COV-2 infection (Adjusted RRs per interquartile increase (aRR[95%CI]): 1.28 [1.09: 1.49] for PM2.5, 1.21 [1.07: 1.36] for NO2) and COVID-19 disease (1.40 [1.10: 1.78] for PM2.5, 1.42 [1.19: 1.70] for NO2). Stratified analysis showed higher associations of PM2.5 and NO2 to SARS-COV-2 infection among men, participants over 60 years old, or with pre-existent chronic disease, and to COVID-19 disease among participants with pre-existent chronic disease. Exposure to BC was associated to a higher probability of COVID-19 disease (aRR=1.20 [1.03: 1.39]) but not SARS-COV-2 infection (1.08 [0.94-1.19]), except in stratified analysis in the tertile of the most deprived area. CONCLUSIONS:Long-term exposure to air pollution was substantially associated to increased risks of SARS-COV-2 infection and COVID-19 disease. These results could help to better understand or prevent respiratory infections.

Keywords: air pollution, long-term, infectious disease, COVID-19

Health impact assessment of road traffic noise exposure – A case study of a pre- and postdensification scenario

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BACKGROUND AND AIM: In many places worldwide there is an ongoing urbanization, often achieved through densification. An increased number of inhabitants in an area often leads to both increased traffic and placement of new buildings closer to roads, and thus increased population exposure to road traffic noise. The aim of the study was to estimate and compare the health impacts of road traffic noise exposure for an urban area pre- and post-densification.

METHOD:Noise at the façade of residential buildings within the area of Drottninghög located in the city of Helsingborg, Southern Sweden, was simulated using the Nordic prediction method for road traffic and exposure assessed for all people living in the area Geographical Information Systems software SoundPLAN. Health impact assessments based on exposure-response functions from The Worlds Health Organisation was calculated including road traffic noise annoyance and adverse sleep disturbance.

RESULTS:A large proportion (70%) of the population was found to be exposed above the health-based guideline value of Lden 53 dB(A) in pre-densification scenario. In the post-densification scenario this proportion increased even further to 85% of the population. The proportion of annoyed in the pre-densification scenario were 5.8% compared to 11.2% in the post-densification and the proportion adversely sleep disturbed 2.8% respectively 4.3%.

CONCLUSIONS: Densifying the area in accordance with the municipal planned strategy will considerably increase the proportion of annoyed and sleep disturbed part of the population living in the area. Health is an important aspect in creating a sustainable city and urban planning initiatives needs to be more ambitious.

Keywords: Exposure assessment, Modeling, Risk assessment, Traffic-related

Municipality assessment of temperature-related respiratory morbidity risks in Norway

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BACKGROUND AND AIM:Local differences in health risks associated with heat and cold temperatures may result from heterogeneity in the distributions of the drivers of vulnerability. Identifying these risks factors is crucial to characterize local vulnerability and cope with the trends in changes in temperature improving adaptation to climate change by designing tailored public health interventions. We aimed to analyse the association between ambient air temperature and respiratory morbidity (hospitalizations) in mainland Norway, and to characterize municipal-level patterns in the risks and impacts of temperature-related respiratory morbidity.

METHOD: We estimated the association of heat- and cold-related respiratory morbidity by designing case time series and distributed nonlinear lag models on mean daily temperature and series of respiratory hospitalizations between 2008 and 2018 for 356 municipalities in Norway. We then derived pooled associations of heat and cold morbidity for the 11 counties through multivariate meta-regression and assessed potential vulnerability factors among predictors of socioeconomic, climate, and other environmental factors at the municipality level.

RESULTS:The analysis included 4 980 626 hospitalizations with a respiratory ICD-10 code, of which 70% corresponded to under 65 years old and under 5% to over 85 years. On average, the relative risks (RR) due to temperatures increased with younger age and were highly dissimilar geographically. Under 65 years group reported consistently higher pooled RR at 1st percentile and 99th percentile vs. the minimum mortality temperature (MMT) than the older groups (RR at 1st percentile 3.83 (95%CI 1.83-7.99), vs. 65-74 2.12 (1.01-4.45), 75-84 1.62 (1.47-1.79), 85+ 1.51 (1.38-1.64) and at 99th percentile 0-64 1.46 (0.73-2.89), vs. 65-74 1.16 (0.57-2.37), 75-84 1.04 (0.95-1.13) and 85+, 1.00 (0.99-1.01)).

CONCLUSIONS:Our analysis suggests that public health and climate policies should consider both local and national levels standpoints for designing tailored interventions and effective implementations.

Keywords: Environmental epidemiology, temperature, morbidity, hospitalizations
Outdoor artificial light-at-night and cancer risk: an exposure assessment comparative study between DMSP, VIIRS and ISS satellite data

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BACKGROUND AND AIM:Artificial light-at-night (ALAN) exposure alter circadian rhythms and health. Most studies use images from the Defense Meteorological Program (DMSP) or the Visible Infrared Imaging Radiometer Suite (VIIRS) that do not provide information on blue light spectrum. The DMSP has low spatial resolution (>1km to 5km) and poor sensitivity at low-level exposures. We previously studied ALAN in relation to colorectal cancer (CRC) using images from the International Space Station (ISS) with high resolution (30m) and color information. We compared individual exposure data from the three satellites and their associations with CRC risk.

METHOD: We used data from 410 CRC cases and 970 controls from the MCC-Spain study (2008-2013), in Barcelona and Madrid. Visual ALAN (radiance) was assessed from DMSP-OLS (2011) and VIIRS (2013) and was compared to visual ALAN (luminance) and an index of blue light spectrum from ISS images (2012 Madrid; 2013 Barcelona). Estimates were assigned to participants' residence using GIS. We compared agreement between estimates (standardized) using Bland Altman plots, and estimated OR for cancer risk adjusting for relevant confounders.

RESULTS:Both VIIRS and DMSP-OLS-assessed visual light, underestimated ALAN compared to ISS, and there was poor correlation between the three sources of ALAN data. Using ISS data we found an association between blue light exposure and CRC risk (OR=1.70, 95%CI 1.46–1.99) but no association for visual light. We observed an association between DMSP-OLS and CRC risk (OR=1.34, 1.16–1.55). Finally, we observed a non-linear inverse association between VIIRS and CRC risk.

CONCLUSIONS:Our results suggest that blue light, which is the most relevant to circadian disruption, is most strongly associated with cancer risk. There is a need for validation and standardization of methods assessing ALAN in epidemiological studies. Older, imprecise methods should be substituted by images with precise spatial resolution and accurate light estimation, including spectrum data.

Keywords: Artificial light-at-night, satellites, circadian misalignment, cancer

VO-057[Air pollution » Particulate matter]

The impact of the new World Health Organization Air Quality Guidelines for Particulate Matter on the life expectancy in Germany

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BACKGROUND AND AIM:In 2021 the World Health Organization (WHO) has published their new air quality guidelines, with much lower guidelines for particulate matter (PM2.5). We aim to estimate the gain in life expectancy if the guideline value for PM2.5 would have been met in Germany in 2017. METHOD:Using the life table approach we estimated the life expectancy gain if the PM2.5 concentrations in Germany would be reduced to the annual WHO air quality guideline of 5 μ g/m3. A relative risk of 1.08 (95% confidence interval (CI) 1.06-1.09) is applied to the mortality risk of the male and female German population in 2017.

RESULTS: If the average population based PM2.5 exposure in 2017 of 10.7 μ g/m3 would be reduced to 5 μ g/m3 the life expectancy of males would be prolonged by 154 (95% CI 116-172) days and of females by 137 (95% CI 103-153) days. For males the life expectancy is prolong from 79.9 years to 80.1 years and for females from 83.9 to 84.3 years if the WHO PM2.5 guideline would be met. CONCLUSIONS: The compliance of the air quality with the WHO air quality guidelines would have a positive impact on the German life expectancy.

Keywords: Mortality, Public health, Exposure assessment-air pollution, Environmental epidemiology

Long-term exposure to air pollution and noise, and cardiovascular biomarkers

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BACKGROUND AND AIM:To explore the associations between long-term exposure to $PM_{2.5}$ (i.e., particulate matter with an aerodynamic diameter below 2.5 µm) from road-traffic and residential wood combustion, road-traffic noise, and serum C-reactive protein (CRP), a biomarker for e.g. infection, inflammation, and cardiovascular risk. To evaluate the association between long-term exposure to road-traffic nitrogen dioxide (NO₂) and the serum cardiovascular biomarkers troponin I and NT-proB-type natriuretic peptide (NT-proBNP).

METHOD: We obtained the outcome data from the Finnish population based FINRISK study for the period 1997-2012. Participants were living in Helsinki, Vantaa, or Turku regions and aged 25–74. Exposure levels were obtained from detailed emission and atmospheric dispersion computations as well as the cities involved in the study, and linked to the home addresses of study participants. PM_{2.5} exposure was estimated by using the predicted yearly source-specific PM_{2.5} concentrations in outdoor air. We performed cross-sectional analyses using linear and additive models and adjusted for potential confounders.

RESULTS:The mean concentrations for road-traffic PM_{2.5}, wood combustion PM_{2.5} and road-traffic NO₂ in the study samples were 0.64, 0.44 and 7.79 μ g/m3, respectively. We found no association between road-traffic PM_{2.5} (% CRP change for 1 μ g/m3 increase in PM_{2.5} levels: 0.6; 95 % CI: -9.6, 12.0; n = 4147), wood combustion PM_{2.5} (-11.8; 95 % CI: -26.2, 5.3; n = 4147) or road-traffic noise and CRP. We also found no association between road-traffic NO₂ and troponin I (% troponin I change for 1 μ g/m3 increase in NO₂ levels: 0.4; 95 % CI: -0.7, 1.5; n = 1434) or NT-proBNP (-0.4; 95 % CI: -1.5, 0.7; n = 1407).

CONCLUSIONS:Long-term exposure to relatively low levels of air pollution from traffic and residential wood combustion and to road-traffic noise were not associated with the cardiovascular biomarkers investigated in this study.

Keywords: Particulate matter, oxides of nitrogen, noise, long-term exposure, cardiovascular diseases

Domestic use of pesticides during adulthood and risk of testicular germ cell tumors: a French nationwide case-control study

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BACKGROUND AND AIM: The most frequent cancers among men between 15 and 39 years old, testicular germ cell tumors (TGCT), have seen their incidence growing significantly in the past few decades. Hypotheses have been made that this could be due to environmental causes, one of them being the exposure to pesticides. Here, we estimated the association between domestic use of pesticides during adulthood and risk of TGCT.

METHOD:A nationwide case-control study was conducted in 20 university French hospitals, 454 cases of TGCT and 670 controls were recruited. A questionnaire was administered collecting sociodemographic data, medical history and domestic pesticide use between 18 and 25 years old, divided in any use of pesticides, insecticides, herbicides and fungicides. Multivariate conditional logistic regression adjusted for confounders (identified using a directed acyclic graph: participant's education and occupation, lived for more than 6 months in rural area during adulthood and use of pesticides during puberty) was used to estimate odds ratios (OR) for TGCT and by histological subtypes (nonseminomas and seminomas) and their 95% confidence interval (CI).

RESULTS:The prevalence of reported use of any pesticides between 18 and 25 was 85.8% (84.8% for insecticides, 13.3% for herbicides and 16.7% for fungicides). For domestic exposure to any pesticides during adulthood statistically significant positive associations with overall TGCT (OR=1.59, CI=1.13-2.22) and seminomas (OR=2.05, CI=1.20-3.54) were found but not for non-seminomas (OR=1.27, CI=0.80-2.03). For sub-categories of pesticides, only the use of any insecticides showed a statistically significant positive association with overall TGCT (OR=1.51, CI=1.09-2.08), persistent for seminomas (OR=1.75, CI=1.07-2.86) but not for non-seminomas (OR=1.29, CI=0.81-2.04).

CONCLUSIONS: This study provides some evidence of a positive association between exposure to domestic pesticides during adulthood, particularly insecticides, and TGCT, specifically seminomas cases.

Keywords: Cancer and cancer-precursors, Testicular germ cell tumors, Risk assessment, Environmental epidemiology

VO-060[Birth and pregnancy outcomes » Pregnancy outcomes]

Longitudinal associations between prenatal exposure to phthalates and steroid hormones in maternal hair samples from the SEPAGES cohort

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BACKGROUND AND AIM: Phthalate metabolites have been linked to hormonal disruption in laboratory animals and a few mother-child cohorts. Data on phthalate replacements is scarce. Our objective was to study the longitudinal associations between prenatal exposure to phthalates and maternal steroid hormones at delivery in a new-generation cohort.

METHOD: Among 382 mother-child dyads from the French SEPAGES cohort (Grenoble, France), metabolites from 7 phthalate compounds and the replacement di(isononyl)cyclohexane-1,2dicarboxylate (DINCH) were measured in within-subject pools of repeated urine samples collected at the second and third pregnancy trimesters (≈ 21 samples/trimester). Metabolites from 5 steroid hormones were measured in maternal hair samples collected 1-3 days after delivery reflecting on their cumulative levels over the third trimester. Associations between phthalate metabolites (individually or as a mixture) and hormones were examined using adjusted linear and Bayesian Weighted Quantile Sum (BWQS) regression models at both the second and third trimesters of pregnancy. RESULTS: Each doubling in third trimester urinary mono-benzyl phthalate (MBzP) concentrations, a metabolite of butyl-benzyl-phthalate (BBzP), was associated with average increases of 12.9% (95%CI: 2.52, 24.2) for Σcortisol, 10.5% (95%CI: 0.44, 21.5) for Σcortisone, 16.5% (95%CI: 5.67, 28.4) for 11-dehydrocorticosterone and 11% (95%CI: 2.27, 20.4) for testosterone, together with a suggestive 10.5% (95%CI: -1.57, 24.1) increase in progesterone hair levels. Each doubling in second trimester sums of di-isononyl phthalate (Σ DiNP) metabolites and Σ DINCH metabolites were inversely associated with testosterone hair levels (-4.70%; 95%CI: -8.72, -0.50 and -6.73%; 95%CI: -12.9, -0.12, respectively). Other associations appeared isolated, not following a pattern. A non-significant trend towards a positive phthalate mixture effect was observed with most hormones at the third - but not second – trimester, with MBzP and mono-isobutyl phthalate (MiBP) showing the highest weights.

CONCLUSIONS: This cohort with improved exposure and hormone assessment showed that some phthalates, especially BBzP, may affect steroid hormone levels during pregnancy.

Keywords: endocrine disruption, phthalate, cortisol, testosterone, pregnancy

VO-061[Methods » Environmental epidemiology]

Associations between perinatal urban environment and children cardiometabolic health phenotypes at age 5 years

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BACKGROUND AND AIM: Evidence suggests that urban environment comprising air pollution, built environment and noise, encompassing pregnancy period, could affect fetus future cardiometabolic health. Cardiometabolic health parameters were previously mostly explored one at a time, ignoring their intercorrelation. This study aims to investigate children sex-specific cardiometabolic health phenotypes at age 5 years in associations with prenatal urban environment.

METHOD:A subsample of the EDEN mother-child cohort study, with available data on biological blood sampling once the offspring turned 5, was analyzed (n=686). Pregnant women residential exposures included estimates of air pollution, built environment, natural spaces, traffic, meteorology, unhealthy food environment and area deprivation index (p=33). Four sex-specific cardiometabolic health patterns were previously derived by principal component analysis ("higher adiposity", "higher insulin resistance", "unhealthier lipid profile", "higher blood pressure" in boys; "higher adiposity", "higher insulin resistance and healthier lipid profile", "higher insulin resistance and unhealthier lipid profile", "higher insulin resistance and unhealthier lipid profile", "higher regression adjusted for parental socioeconomic background (study center, parental educational attainment, household income) and imputed for missing covariates were carried out. Multiple testing correction was performed.

RESULTS: Greater population density (individuals/km²) during pregnancy was associated with boys'

higher score for the "unhealthier lipid profile" pattern (β [CI95%]: 0.25 [0.09-0.40]). Living in the highest deprivation area ("highest quintile") was also associated with girls' higher score for a "high insulin resistance and unhealthier lipid profile" pattern (β [CI95%]: 0.70 [0.24-1.16]). No further associations were observed.

CONCLUSIONS: Children whose mothers lived in a deprived area during pregnancy were more likely to have an unhealthier lipid profile at 5 years. Our findings call for replications at later ages and in other population and eventually for further investigation of the proportion of these associations mediated by lifestyle.

Keywords: Environmental epidemiology, Obesity and metabolic disorders, Socio-economic factors, Children's environmental health