

# Abstracts for the ISEE Asia and Western Pacific (AWPC) Chapter

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## SYMPOSIUM

### SYMPOSIUM 1: Health Impacts in Climate-Affected Communities in Taiwan: Drivers and Adaptation Strategies

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This symposium aims to delve into the intricate relationship between climate change and health outcomes, with a special focus on the epidemiology of non-communicable diseases in regions of Taiwan impacted by climate change. Our goal is to evaluate various factors influencing health, particularly among vulnerable populations such as children and the elderly. We will identify key drivers impacting health outcomes, analyze areas prone to disasters, examine stakeholders involved, and propose adaptive strategies. Our studies specifically investigate the correlation between extreme temperatures and cerebrovascular and cardiovascular diseases across Taiwan. Through our research, we have successfully identified stroke emergency thresholds and region-specific temperature ranges essential for preserving health. Furthermore, our symposium delves into the broader impact of climate change on public health. We will discuss associations between extreme weather events, changes in air quality, and the consequent increase in physiological and psychological stress among populations. By analyzing birth cohort data and local health indicators, our study also explores climate change's effects on children's health, including mental disorders and suicide rates. Additionally, we have projected the Taiwan future incidence of temperature-related ischemic and haemorrhagic strokes as a consequence of global warming. Our aim is to provide a nuanced understanding of variation and uncertainty in future temperature-related incidence by incorporating a range of scenarios that consider demographic and climate changes specific to Taiwan.

### SYMPOSIUM 2: Aeroallergen Exposure: Determinants, Climate Change Influences and Health Implications

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Ambient aeroallergens, such as pollen and fungal spores, are an under-recognised threat to public health. Climate change has led to increases in aeroallergen allergenicity, quantity and seasonal duration. Rising temperatures, changing precipitation patterns and elevated atmospheric carbon dioxide concentrations are influencing the geographical distribution of plants and fungi, affecting the types and amounts of aeroallergens released. This is increasing the burden of allergic diseases and poses significant challenges for healthcare systems that require adjustments in prevention and treatment strategies and resource allocation. This presentation will showcase compelling evidence of the diverse determinants influencing aeroallergen distribution, ranging from vegetation changes to atmospheric conditions. Special attention will be given to the role of climate change as a major driver, elucidating how alterations in weather and air pollution can contribute to altered aeroallergen release, potency, and exposure. Furthermore, we will outline the current evidence on the health impacts of aeroallergens including key susceptibility factors. Understanding who is most vulnerable to aeroallergen exposure is crucial for public health initiatives and targeted interventions. From vulnerable populations to potential exacerbations of pre-existing conditions, we will shed light on the multifaceted consequences of aeroallergen exposures. By synthesizing these key components, this presentation contributes valuable insights into the evolving landscape of aeroallergens, fostering a deeper understanding of their determinants, climate change influences, and the health implications for susceptible individuals.

### SYMPOSIUM 3: Unmasking the Climate Change Challenge: Insight From Malaysia

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The complex intersection of climate change and health in Malaysia presents a multifaceted challenge, encompassing vector-borne diseases, food and waterborne illnesses, leptospirosis, heat-related ailments, children's nutrition, mental health, and the vulnerability of public health systems. Climate change intensifies the threat of vector-borne diseases, particularly dengue fever and malaria, as shifting climate patterns create ideal environments for disease vectors. This necessitates a critical reassessment of public health strategies to effectively counteract and mitigate these emerging risks. Alterations in precipitation patterns and extreme weather events contribute to a surge in food and waterborne diseases, emphasizing the immediate need for enhanced water management, sanitation practices, and food safety measures to safeguard public health. Leptospirosis, an emerging waterborne bacterial disease, requires targeted interventions and vigilant surveillance to counter its increasing prominence in the context of climate change. A neglected tropical ailment, it demands concerted efforts to prevent its spread and mitigate its impact on public health. The escalating risks of heat-related illnesses, particularly among vulnerable populations, underscore the urgent need for adaptive measures, public awareness campaigns, and policy interventions. These actions are crucial to address the health impacts associated with extreme heat events and protect community well-being. Children's nutrition faces challenges due to climate-induced shifts in agriculture and food security, necessitating resilient nutrition programs to safeguard the health of the younger population. The often-overlooked aspect of mental health is highlighted, emphasizing the psychological impacts of climate change-induced events such as floods and extreme weather. It stresses the importance of developing mental health support systems and interventions to alleviate the growing burden on affected populations. Lastly, the vulnerability of public health systems in Malaysia is underscored, emphasizing the necessity for comprehensive adaptation and mitigation strategies. Strengthening healthcare infrastructure and fostering collaboration among policymakers, healthcare professionals, and communities are deemed essential components for building resilience and ensuring the sustained well-being of the population amidst a changing climate.

#### **SYMPOSIUM 4: Influence of Climate Change on Exposure to EDCs and Health Impact in East-Asian Countries**

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Persistent organic pollutants (POPs) have accumulated in the environments, and climate change has been recognized as a factor capable of influencing POP levels and trends in the environments as well as in human. Changes in environmental conditions such as the extreme weather (high or too low temperature), wildfires, radiation, and food supply, are likely to impact human society's behavior and exposure to specific POPs, mostly are endocrine disrupting chemicals (EDCs). Thus, evidence of how EDCs exposure affects human health with time is crucial. Susceptible populations, like children and pregnant women are most vulnerable for the impact of climate change. The adoption of a sustainable lifestyle is a key solution to combat climate change. However, as we develop new chemicals to promote the adaption of a sustainable lifestyle of human society, the emergence of new pollutants or health threats poses additional challenges to be addressed. New and emergent environmental pollution, including novel EDCs or POPs, anti-bacterial agents, fire-retardants, personal care products, or new substitutes will be influenced by climate change. In this symposium, five scientists from east-Asian countries will report their latest scientific evidence related to the above issues.

#### **SYMPOSIUM 5: Unravelling Climate Change and Natural Disasters for a Resilient Future**

by *Rahmawati Pare (Chair) | Che Ismail Che Noh (Co-chair) | Carolyn Melissa Payus | Ejria Saleh | Janice Lynn Ayog | Noor Sheena Herayani Harith | Biomedical Department, Faculty Of Medicine & Health Science, Universiti Malaysia Sabah, Malaysia | Faculty Of Medicine & Health Science, Universiti Malaysia Sabah, Malaysia | Natural Disaster Research Centre (NDRC), Faculty Of Science And Natural Resources, Universiti Malaysia Sabah, Malaysia | Borneo Marine Research Institute (BMRI), Universiti Malaysia Sabah, Malaysia | Civil Engineering Programme, Faculty Of Engineering, Universiti Malaysia Sabah, Malaysia | Civil Engineering Programme, Faculty Of Engineering, Universiti Malaysia Sabah, Malaysia*

Climate change will increase natural disaster risk amplifying the impacts of extreme weather events, floods, droughts, sea level rise, cyclones and wildfires. The World Meteorological Organization predicts that there will be increased warming in the next five years, including the occurrence of a strong El Niño. The Intergovernmental Panel on Climate Change also warns that future warming will intensify the water cycle, causing multiple weather extremes and changes, indicating future intensifying climate change impacts. Every natural disaster occurrence has unavoidable negative consequences, mainly health, such as mortality and illness. For instance, individuals in flood-prone areas have a higher risk of drowning since drowning accounts for 75% of flood deaths. Therefore, it is crucial to incorporate these specific risks, such as drowning incidents, into comprehensive disaster risk management strategies. A holistic climate and natural disaster management strategy plan is needed, tackling both mitigation and adaptation. One of the mitigation efforts can be made by incorporating scientific and engineering methods into early warning systems for disasters, which can help communities and authorities take effective action to protect themselves. Addressing community-based preparedness and resilience—for example, by providing community capacity building to guarantee the communities' safety in the event of a disaster—is one of the most important adaptation initiatives. This bottom-up strategy includes local communities and individuals in planning and decision-making as it recognizes that communities are the first responders. A systematic approach needs to be done, for instance, in the context of a flood, assessing the flooding risk and its impact. Strategic plans can be developed to formulate effective strategies and solutions for both mitigation and adaptation tailored to the specific needs of vulnerable communities. Ultimately, the two approaches require collective action through collaborative efforts between multiple stakeholders, which are essential for developing effective and equitable solutions for a resilient future.

#### **SYMPOSIUM 6: Tackling Health Risk under Climate Change and Environment in West Pacific Region: Activities Taken by WHO and WHO Collaborating Centres**

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“Climate change, the Environment and Health” is one of the four regional priorities in Western Pacific Region (WPR). Air, water, and soil contamination also threaten the health of people in WPR. To tackle these environmental threat and health risk of the people, the

World Health Organization (WHO) and WHO Collaborating Center (WHOCC) work together. In this symposium, we introduce WHO Asia-Pacific Centre for Environment and Health in the Western Pacific Region and WHOCCs activities. The work of WHO ACE cuts across the following three key areas: 1. Air quality, energy and health, 2. Climate change and health, and 3. Water and the living environment. The office focuses on the health impacts of climate and environmental change as a priority. WHOCC for children's health and environment (University of Queensland) aims to address the impact of environmental exposures on child health through a holistic approach to environmental health research and policy reform. WHOCC for Minamata disease, with the most knowledge on Minamata disease and mercury, works to disseminate this knowledge to help solve the world's mercury pollution problems. WHOCC for environmental health and prevention of chemical hazard (Hokkaido University) works on health effects related to chemical exposure and works to protect people from harmful chemicals. Through this symposium WHO ACE and each WHOCC introduce their specific aim and activities to make conference participants aware of our activities and work together towards "For the Future".

### **SYMPOSIUM 7: Extreme Weather and Climate-related Events and Human Health in Asia: From Evidence Generation to Health Response**

by *Xerxes Seposo (Chair) | Athicha Uttajug (Co-chair) | Muhammad Abdul Basit | Maggie Ooi Chel Gee | Vera Phung Ling Hui | Geminn Loius Apostol | Hokkaido University, Japan | Hokkaido University, Japan | Hokkaido University, Japan | National University of Malaysia, Malaysia | The University of Tokyo, Japan | Ateneo centre for Research and Innovation, Philippines*

Extreme weather and climate-related events, such as heat waves, droughts, floods, biomass burning, and storms, are expected to worsen due to climate change, posing serious threats to human health. The health impacts of these extreme events include direct and indirect effects, such as injuries, deaths, mental stress, infectious diseases, malnutrition, and displacement. This symposium aims to share the latest research, practice, and policy on the topic of extreme events, climate change, and health, with a focus on the Asia setting. In brief the symposium will cover the following: assessment of exposures and how they are measured as well as the accompanying variability and uncertainty of the exposure, determination of the epidemiological evidence linking weather and climate-related events and various health outcomes alongside the confounders of the association, and identification of the challenges and opportunities for implementing the adaptation and mitigation policies and actions to protect and promote health from weather and climate-related events, and the evaluation and monitoring of the policies and actions. Several key topics of significance will be highlighted for the public, enabling them to apply the knowledge and skills gained from the symposium in their workplace or country. The symposium will also facilitate dialogue and collaboration among researchers, practitioners, and policymakers from different disciplines, sectors, and regions, with the end goal of contributing to the advancement of knowledge and practice on the topic of weather and climate-related events, climate change, and health in Asia, as well as to the support of the global efforts to achieve the Sustainable Development Goals and the Paris Agreement.

### **SYMPOSIUM 8: Epidemiological Evidence in Per- and polyfluoroalkyl Substances and Child Health Based on Birth Cohort Studies in Asia**

by *Yu Gao (Chair) | Mei Huei Chen (Co-chair) | Yu Ait Bamai | Surabhi Shah | Department of Environmental Health, School of Public Health, Shanghai Jiao Tong University School of Medicine, Shanghai, China | Institute of Population Health Sciences, National Health Research Institutes, Miaoli, Taiwan | Center for Environmental and*

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Per- and polyfluoroalkyl substances (PFAS) is a synthetic compound widely utilized for its stable properties such as waterproofing and oil resistance. Its persistent nature in the environment and potential health hazards have raised concerns. Therefore, the international community has begun to collaborate in the establishment of global regulation and control measures. However, existing PFAS in the environment continue to pose a threat to susceptible pregnant women and children. Emerging alternative substances require thorough scientific research and assessment of their potential health hazards to the human body. Birth Cohort Consortium of Asia (BiCCA) was established since 2012 to facilitate exchange of knowledge and collaboration between cohorts and researchers, and exploration of future need for children's environmental health research. Currently, BiCCA consists of 34 cohorts with a total of over 80,000 children in 17 Asian countries. Despite different challenges, our international collaboration provides evidence on prenatal and postnatal environmental exposure and maternal and child health. In this symposium, we would like to present research results from four Asian countries covering a variety of study period and region. Each study's enrolment period spans from 2003 (the Hokkaido Study on Environment and Children's Health, Japan), 2004-2005 (The Taiwan Birth Panel Study, Taiwan), 2006-2010 (Ewha Birth & Growth Retrospective Cohort, Korea), and 2010- 2013 (Laizhou Wan Birth Cohort, China). Health outcomes include birth outcomes, thyroid function, allergies, infectious diseases, growth, and neurodevelopment. This symposium brings together research from the past two decades, focusing on the multifaceted impacts of PFAS on children's health through the birth cohort studies in Asia. It not only presents the evolving risks of PFAS exposure but also offers empirical research from various regions in Asia. Empirical evidence from various regions in Asia, when compared internationally, can also serve as valuable references for future monitoring or regulation.

### **SYMPOSIUM 9: TROPIC Network: A Tropical Cyclone Network for International Health and Resilience**

by *Yoonhee Kim (Chair) | Lisa Yamasaki | Robbie M. Parks | Paul Lester Carlos Chua | Department of Global Environmental Health, Graduate School of Medicine, The University of Tokyo | Department of Global Health Policy, Graduate School of Medicine The University of Tokyo, Japan; Centre Hospital of the National Centre for Global Health and Medicine, Tokyo, Japan | Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, New York, NY, USA | Graduate School of Medicine, The University of Tokyo*

In much of the tropics worldwide, tropical cyclones, such as hurricanes, typhoons, and tropical storms, have a devastating impact on the economy, environment, and human health. Trends in more active recent hurricane seasons, and stronger longer lasting hurricanes indicate that tropical cyclone exposure is and will remain an important public health concern. However, beyond some recent studies, there remains a critical research gap in understanding the full extent of the impact of tropical cyclones on health, especially in countries where the impacts of tropical cyclones are the greatest. The presentations in this symposium will highlight important new case studies on the wide-varying and long-lasting impacts of tropical cyclones on health outcomes in several locations throughout the world. Each presentation will provide insights from a range of countries and focus on the wide-ranging impacts of each on mental and physical health, and developmental outcomes. It will also form a focal point of TROPIC, a new global tropical cyclone health resilience network. Tropical cyclones impact many millions of people globally each year. This symposium will



### O113: Cardiovascular-kidney-metabolic multimorbidity and mortality: the impacts of air pollution and Life's Essential 8

by Meijie Jiang | Shuzhen Liu | Xu Gao | Peking University | Peking University | Peking University

Cardiovascular-kidney-metabolic (CKM) syndrome hints at an underlying multimorbidity pattern (CKMM) with at least two of three types of diseases including metabolic disease (MBD), chronic kidney disease (CKD), and cardiovascular disease (CVD). Evidence on environmental risks for CKM health and potential CKMM, especially air pollution, is scarce. Therefore, we conducted a multi-state modeling study to explore CKMM and estimate air pollution's impact on CKMM temporal progression among ~0.38 million participants. The modifying effect of Life's Essential 8 (LE8) on CKMM under air pollution was additionally evaluated. During a median 12.5-year follow-up, 75,288 participants had a first CKM (FCKM), and 14,346 developed comorbidities indicating the CKMM exists.  $PM_{2.5}$ ,  $PM_{10}$ ,  $NO_x$ , and  $NO_2$  were associated with CKMM and the two gaseous pollutants were related with subsequent death. Particularly, hazard ratios (HRs) for FCKM to CKMM and for CKMM to death were 1.011 (95% CI: 1.005-1.016) and 1.020 (95% CI: 1.006-1.033) per  $5\text{-}\mu\text{g}/\text{m}^3$  increase in  $NO_x$ , respectively. Furthermore, individuals with CKD presented the highest risk of developing CKMM than those with MBD or CVD. For the  $5\text{-}\mu\text{g}/\text{m}^3$  increment of  $NO_x$ , the corresponding risks of CKMM elevated by 1.8% for individuals with CKD but were 1.0% and 0.8% for those with MBD and CVD, respectively. Optimal cardiovascular health measured by LE8 reduced the risks of CKMM development and death across all pollutants. Our study identifies CKMM as a critical multimorbidity pattern, with air pollution having profound adverse impacts on its development through multi-stage dynamics that could be mitigated by maintaining optimal cardiovascular health.

### O121: Prenatal exposure to air pollutants and acceleration of epigenetic aging: a study from the EDC birth cohort

by Dong-Wook Lee | Inha University

Air pollution is implicated in increasing epigenetic age, a measure of biological aging that assesses the methylation status of specific CpG sites in relation to chronological age. Studies have linked epigenetic age acceleration (EAA) with cancer and mortality risks. Furthermore, prenatal exposure to air pollutants might play a crucial role in determining health outcomes, potentially acting as a risk factor for adverse birth outcomes. This study analyzed DNA methylation data from the EDC birth cohort, comprising 726 mother-child dyads. We examined whole blood samples from 60 children at age 2 and 80 children at age 8, utilizing the HumanMethylationEPIC array. We calculated epigenetic aging markers including Horvath's all tissue clock, Horvath's skin and blood clock, Wu's clock, and PedBE's clock. EAA was defined as the residuals from linear regression models of epigenetic age against chronological age. We estimated prenatal exposure to air pollutants, including particulate matter  $< 10\mu\text{m}$  ( $PM_{10}$ ) and  $< 2.5\mu\text{m}$  ( $PM_{2.5}$ ), sulfur dioxide ( $SO_2$ ), nitrogen dioxide ( $NO_2$ ), carbon monoxide (CO), and ozone ( $O_3$ ). The study investigated the association between prenatal air pollutant exposure levels and EAA using linear regression models. We found a two-fold increase in prenatal exposure to  $PM_{10}$ , CO, and  $O_3$  was associated with an increase in EAA at age 2. Our findings suggest that prenatal exposure to  $PM_{10}$ , CO, and  $O_3$  may contribute to accelerated epigenetic aging from an early age, highlighting the potential long-term health implications of air pollution exposure during pregnancy.

### O122: Associations between exposure to heavy metals in PM2.5 during preconception and early pregnancy and the risk of neural tube defects

by Tsai-Wei Ho | Chau-Ren Jung | Chung-Chin Lee | Bao-Ru Chuang | Hao-Hsuan Lin | Chuan-Yao Lin | Bing-Fang Hwang | Department

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Neural Tube Defects (NTDs) is a severe congenital defect of the central nervous system that deeply affect fetal development. Our previous study found a positive association between  $PM_{2.5}$  exposure and NTDs during preconception and early pregnancy. However, whether or not exposure to heavy metals in  $PM_{2.5}$  associated with NTDs needs further elaboration. We conducted a nested case-control study of 150,436 newborns born in Taiwan from 2004 to 2017, and the weekly average  $PM_{2.5}$  concentrations of arsenic (As), cadmium (Cd), lead (Pb), and mercury (Hg) were estimated by using the Weather Research and Forecasting/Chem (WRF/Chem) model corresponding to their mother's residence. We investigated the association between exposure to heavy metals in  $PM_{2.5}$  and NTDs during the 3 months before conception and first trimester. We identified 13,676 cases of NTDs among 150,436 participants. Each case was matched for gender and day of delivery to randomly selected controls ( $n=136,760$ ) at a 1:10 ratio. The conditional logistic regression was used to adjust for socioeconomic status (SES), maternal age, weight, anemia, heart disease, diabetes, syphilis, gestational diabetes, gestational hypertension, preeclampsia, thalassemia, smoking and drug, yielding the odds ratios (ORs) and 95% confidence intervals (CIs) for As (OR = 1.03, 95% CI = 1.02-1.05), Cd (OR = 1.04, 95% CI = 1.03-1.05), Pb (OR = 1.06, 95% CI = 1.05-1.07), and Hg (OR=1.17, 95% CI=1.14-1.19) per interquartile change. In conclusion, our study suggests that exposure to heavy metals in  $PM_{2.5}$  during preconception and early pregnancy may increase the risk of NTDs in newborns.

### O131: Probabilistic risk assessment for determining non-essential metals in commercial infant formula products in Taiwan

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During the early months of life, infant formula plays a crucial role as a primary source of both food and essential nutrients for infants, serving as a replacement for or supplement to breast milk. However, non-essential metals in infant formulas are a concern because infants are highly vulnerable to chemical exposure. The aim of this study was to investigate infant exposure to non-essential metals in infant formula products in Taiwan and assess the associated health risks. In this study, concentrations of arsenic (As), barium (Ba), cadmium (Cd), manganese (Mn), lead (Pb), and vanadium (V) in 45 formula products for 0-1-year-old infants were determined by inductively coupled plasma mass spectrometry. The mean of As, Ba, Cd, Mn, Pb, and V concentrations were 6.42, 280, 3.72, 1425, 20.4, and 21.9  $\mu\text{g}/\text{kg}$ , respectively. According to our probabilistic simulation of the estimated daily intake of metals, the proportion of hazard quotients exceeding one was 7.69% for As and 3.29% for Mn, and that of hazard index (HI) values exceeding 1 was  $>17\%$  for metals. Arsenic had the largest HI contribution (46.9%), followed by Mn (22.3%) and Pb (12.7%). The non-essential metals content in infant formula raises potential non-carcinogenic health concerns for infants in Taiwan. Therefore, regulations for non-essential metals

must be imposed on related food products in Taiwan, with a particular focus on As and Mn.

### **0132: The relationship between dietary complexity and cognitive function in Guangxi, China: A cross-sectional study**

by *Ruoyu Gou* | *Ningxia Medical University*

The composition of the human diet is complex and diverse, and the relationship between dietary composition and cognitive decline has not been adequately studied. Therefore, this study explored the possible association between food items and the risk of cognitive impairment. This cross-sectional study was based on an ecological longevity cohort and included 2881 participants (1086 men and 1795 women) aged >30 years between December 2018 and November 2019. The association between food items and the risk of cognitive impairment was explored using the Bayesian kernel machine regression (BKMR) learning model. Finally, 2881 participants (1086 men and 1795 women) were included. In all participants, the multivariable logistic analysis showed that fresh fruit consumption was associated with cognitive function (OR=0.9994, 95%CI: 0.9988-0.9999, P=0.021). Using the BKMR model, none of the 18 food items were significantly correlated with cognitive function among women. In men, when the other food items were fixed at the 25th, 50th, and 75th percentile values (P25, estimate=-0.2388; P50, estimate=-0.2099; P75, estimate=-0.1576), there was a negative correlation between fresh fruit consumption and the predicted risk of cognitive function disorders. Men displayed a negative association between fresh fruit consumption and the risk of cognitive function disorders, but this was not apparent among women.

### **0133: Association of urban food environment and cognitive function among older adults**

by *Deanna Sim* | *Weiju Zhou* | *He Li* | *Xiangwei Dai* | *Zhanjun Zhang* | *John S. Ji* | *Vanke School of Public Health, Tsinghua University, Beijing, China* | *Vanke School of Public Health, Tsinghua University, Beijing, China* | *Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, Beijing, China* | *Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, Beijing, China* | *Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China* | *Vanke School of Public Health, Tsinghua University, Beijing, China*

Access to nutritious food is imperative for facilitating healthy diet and aging. We aim to explore how the urban food environment may affect cognitive function among older adults. We used data from the Beijing Community-based Cognitive Function Screening (CCFS) program, which conducted Mini mental state examination (Mini-MMSE) and Episodic memory test (EMT) to 61,754 participants in 2019. Food environment metrics were derived based on the geographical coordinates of community healthcare centers, encompassing the density calculations of various food entities. Multivariable linear regression models are used to estimate the associations of these food entities with cognitive function. The participants have a mean (SD) age of 70.95 (6.54). For each IQR increase in restaurant density, there is a decline in Mini-MMSE ( $\beta = -0.03$ , 95% CI -0.05 to -0.02) and EMT (-0.09, -0.20 to 0.02) scores. Similarly, for each IQR increase in fast food shop density, there is a decline in Mini-MMSE (-0.05, -0.06 to -0.03) and EMT (-0.46, -0.55 to -0.36). On the other hand, increase per IQR in dessert and drinks shops density is associated with an increase in Mini-MMSE scores (0.04, 0.03 to 0.05) and EMT scores (0.27, 0.19 to 0.34). Lastly, increase per IQR in fruit and vegetables vendor density is associated with increase in Mini-MMSE (0.05, 0.04 to 0.06) and EMT (0.11, 0.03 to 0.19). The results revealed that higher density of restaurants and fast food shops within the neighborhoods are linked to decrease in cognitive function scores, while higher density of desserts and drinks shops and fruits and vegetable vendors are associated with increase in cognitive function scores.

This insight can guide evidence-based strategies for public health interventions aimed at fostering healthier urban food environments amidst population aging.

### **0141: Ambient temperature and mortality in the states of Penang and Kedah in Malaysia**

by *Nik Muhammad Nizam Bin Nik Hassan* | *Wan Rozita Wan Mahiyuddin* | *Noraishah Mohamad Sham* | *Nadia Mohamad* | *Robaida Ismail* | *Rafiza Shabarudin* | *Mohd Talib Latif* | *Norlen Mohamed* | *Mohd Faiz Ibrahim* | *Fadly Syah Arsad* | *Institute for Medical Research, National Institutes of Health* | *Institute for Medical Research, National Institutes of Health* | *Institute for Medical Research, National Institutes of Health* | *Institute for Medical Research, National Institutes of Health* | *Institute for Medical Research, National Institutes of Health* | *School of Environmental and Natural Resource Sciences, Faculty of Science Technology, Universiti Kebangsaan Malaysia, Bangi, Selangor* | *Disease Control Division, Ministry of Health Malaysia, Putrajaya* | *Institute for Medical Research, National Institutes of Health* | *Institute for Medical Research, National Institutes of Health*

Studies have found that ambient temperature that deviates from the optimum increased the risk of morbidity and mortality. However, less evidence is available in developing countries, especially in Malaysia. Malaysia's northern regions have recorded extreme temperature events in the past. In this study, we examined the effects of ambient average temperature on natural-cause mortality in Penang and Kedah in North Peninsular Malaysia. Daily mortality counts, meteorology and air pollutants data were obtained for Penang and Kedah from 2007 to 2018. A time series model was used to examine the effects of average temperature on natural-cause mortality (ICD10: A00-R99), while controlling for relative humidity, daily average PM10 and Ozone, day of the week and long-term trend. A distributed lag non-linear (DLNM) model was used to examine the delayed effects of temperature on mortality up to 21 days. Non-linear effects of temperature on natural-cause mortality were found for both Penang and Kedah. The relative risk (RR) of natural-cause mortality associated with high temperature (99th percentile) relative to 90th percentile of temperature for lags 0 to 21 was 1.19 (95%CI: 1.07, 1.32) for Penang and 1.15 (95%CI: 1.04, 1.28) for Kedah. The RR of natural-cause mortality associated with extreme cold temperature (1st percentile of temperature) relative to 10th percentile temperature over lags 0 to 21 days was 1.28 (95%CI: 1.12, 1.47) for Penang and 1.23 (95%CI: 1.03, 1.47) for Kedah. Both states showed immediate high temperatures effects while lower temperatures showed delayed effects. There is impact on mortality from extreme high and low temperatures for both Penang and Kedah. This study provides useful data for better policy making in local preparedness responses to manage the impact of high and low temperatures on human health.

### **0142: Health impacts of dry and moist heat in South Korea**

by *Jieum Oh* | *Department of Public Health Science, Graduate School of Public Health, Seoul National University*

Heatwaves can cause significant health problems worldwide and the humidity has a large impact on how a given heatwave affects human health. In general, hot and humid conditions can be more dangerous than equivalently hot but dry conditions, while, appropriate humidification can reduce inflammatory responses. This study used the National Health Insurance Service-National Sample Cohort (NHIS-NSC) from 2011 to 2019 during the warm season (May to October), covering South Korea nationwide with 250 districts. We used temperature and relative humidity to define dry and moist heatwaves. Health outcomes were defined as hospitalization through emergency room (ER) visits. To estimate the association between dry/moist heatwaves and ER hospitalization, we performed a time-stratified case-crossover design with the

distributed lag model. For all-cause, dry and moist heatwaves were not significantly associated with ER hospitalization; however, the association was differed by causes. The risk of moist heatwaves is higher for endocrine and mental diseases, while the risk of dry heatwaves is higher for circulatory, respiratory, and genitourinary diseases. Also, the risk of moist heatwave is prominently higher in 20-44 years age group. We found that the health impacts by the combination of heat and humidity on health. The risk of hospitalization attributable to dry and moist heatwaves was different by each cause. Our results imply the need to develop heat action plans considering humidity conditions. Our results suggest that the humidity conditions that increase vulnerability to temperature may differ for each disease.

#### **O143: Remotely sensed metrics and covid-19 spread during the delta surge in NCR plus, Philippines: a novel environmental modelling for the post-pandemic era**

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To demonstrate a cost-effective method for modelling the spread of communicable diseases, using publicly available and remotely sensed environmental data, focusing on COVID-19 during the Delta variant surge in the National Capital Region Plus, Philippines. Ordinary least squares (OLS), geographically- (GWR) and temporally weighted (TWR), and geographically and temporally weighted regression (GTWR) models fitted monthly COVID-19 incidence and remotely sensed bioclimatic and atmospheric variables to identify the best predictors of COVID-19 spread and select the best-performing model. Nitric oxide, sulphur dioxide, precipitation, temperature, and relative humidity significantly explained COVID-19 spread, significantly explaining 38.33% of the variability. In the presence of nonstationary, the GTWR model outperformed the alternatives, increasing the explanatory power of the relationship to 72.83%. This research signifies the integration of environmental factors in disease surveillance using GTWR model and remote sensing. While acknowledging limitations, such as the absence of ground truth data and sociodemographic metrics, this study contributes to the understanding of the environmental determinants of COVID-19 spread, particularly in vulnerable regions like the Philippines.

#### **O151: The role of humidity in the association between heat and mortality: a comparison of relative and absolute humidity**

by *Jieun Min* | *Whanhee Lee* | *Jieun Oh* | *Cinoo Kang* | *Eunhee Ha* |  
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Although recent studies have reported the interaction effect of high temperature and humidity on mortality, the findings are not consistent.

Therefore, this study aimed to investigate the potential contribution of humidity in the association between heat and mortality using the two most used humidity measures: relative and absolute humidity (RH and AH). We collected daily time-series data on mean RH (%), temperature (°C), and mortality (all-cause and cause-specific) counts for all 229 districts in South Korea, with a total of 979,063 deaths occurring in summer months (June to September) between 2011 and 2021. AH (g/m<sup>3</sup>) was calculated as RHx(saturation water vapor amounts)/100. A case time-series design was applied to each humidity measure, using a distributed lag non-linear model for temperature and linear interaction term for humidity. The association between heat and all-cause mortality was evident on humid days when using AH, while RH did not modify the association. Relative risk (RR) of respiratory disease-related mortality at 99<sup>th</sup> versus 90<sup>th</sup> percentile temperature was 1.26 (95% CI: 1.08–1.46) for low AH and 1.07 (95% CI: 1.00–1.14) for high AH. RR of endocrine disease-related mortality at 99<sup>th</sup> percentile was 1.17 (95% CI: 0.93–1.48) for low AH and 1.22 (95% CI: 1.10–1.35) for high AH. The heat-related cause-specific mortality risk was not different by RH. This study observed that AH modified the association between heat and mortality, while RH did not. The findings of this study can provide the evidence on the role of humidity in the heat-related mortality and suggest that researchers need to think about which humidity measure to use when evaluating the health effect of humidity.

#### **O152: Assessing household vulnerability to climate change among community in Carey Island**

by *Raheel Nazakat* | *Robaida Ismail* | *Nik Muhammad Nizam Nik Hassan* | *Noraishah Mohammad Sham* | *Nadia Mohamad* | *Mohd Faiz Ibrahim* | *Siti Aishah Rashid* | *Fadly Syah Arsad* | *Wan Rozita Wan Mahiyuddin* | *Rafiza Shabarudin* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *SEAMEO TROPED Network Malaysia, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.* | *Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia.*

The rising in intensity and frequency of climate-related hazards are placing communities along coastal regions at risk, potentially heightening the household's vulnerability in regards of health and livelihoods. This study aimed to determine the household vulnerability to climate change among residents of Carey Island using an integrative framework from three dimensions: exposure, sensitivity, and adaptive capacity. Primary and secondary data for assessing vulnerability were gathered from the households residing at Kampung Melayu, Carey Island. Face-to-face interviews were conducted among 37 randomly selected household heads, utilizing a pre-tested questionnaire. The collected data were used to derive a composite vulnerability index (VI) and categorized into four groups (low, moderate, high, and very high) using quarterly percentile distribution. The findings revealed that 59.5% of respondents experienced moderate exposure, and 40.5% faced high exposure to climate

change. Additionally, 81.1% of the respondents exhibited moderate sensitivity, while 18.9% showed low sensitivity. Moderate adaptive capacity was observed in 46.0% of respondents, with 43.2% showing high adaptive capacity, 8.1% displaying very high adaptive capacity, and 2.7% having low adaptive capacity. The composite VI indicated that 86.5% of respondents were moderately vulnerable, and 13.5% were highly vulnerable to climate change impacts. The high vulnerability stemmed from increasing exposure to temperature, precipitation, shoreline erosion and rising sea levels. Limited access to healthcare facilities on the island coupled with a lack of financial capital, physical capital and adaptive behaviour contribute to the high vulnerability. Most households in this study site faced significant exposure to climate change, leading to moderate vulnerability. This signifies the urgent need for community-based adaptations, focusing on improving healthcare access, providing financial incentives, and promoting adaptive behaviour to enhance the community's resilience towards climate change impacts. This study provides baseline information on household vulnerability to climate change and health, aiding policymakers in establishing community-based adaptation plans.

**O211: Impact of fine particulate matter on latent tuberculosis infection and active tuberculosis in older adults: a population-based multicentre cohort study**

by Sifan Tian | Xu Gao | Tonglei Guo | Lei Gao | Peking University | Peking University | Peking Union Medical College | Peking Union Medical College

Evidence showed that air pollution was associated with an increased risk of tuberculosis (TB). This study aimed to study the impact of long-term exposure to ambient particulate matter with an aerodynamic diameter less than 2.5  $\mu\text{m}$  ( $\text{PM}_{2.5}$ ) on the acquisition of LTBI and on the risk of subsequent active disease development among rural older adults from a multicentre cohort, which have not yet been investigated to date. A total of 4790 older adults were included in a population-based, multicenter, prospective cohort study (LATENTTB-NSTM) from 2013 to 2018. The level of long-term exposure to  $\text{PM}_{2.5}$  for each participant was assessed by aggregating satellite-based estimates. Logistic regression and time-varying Cox proportional hazards models with province-level random intercepts were employed to assess associations of long-term exposures to  $\text{PM}_{2.5}$  with the risk of LTBI and subsequent development of active TB, respectively. Out of 4790 participants, 3284 were LTBI-free at baseline, among whom 2806 completed the one-year follow-up and 127 developed newly identified LTBI. No significant associations were identified between  $\text{PM}_{2.5}$  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  $\mu\text{g}/\text{m}^3$  in 2-year moving averaged  $\text{PM}_{2.5}$  was associated with a 50.6% increased risk of active TB (HR = 1.506, 95% CI: 1.161-1.955). Long-term air pollution might be 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.

**O213: Climatic, environmental, and sociodemographic risk factors for cholera: A retrospective longitudinal study in Sabah, Malaysia, 2015-2020**

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Understanding the environmental and sociodemographic drivers of cholera is important for developing contextually relevant public health interventions. Evidence on risk factors is limited despite the record number of recent global outbreaks and re-emergence of cholera in many areas. The state of Sabah accounts for most (>90%) of Malaysia's cholera cases; however, the underlying risk factors driving spatiotemporal variation are unknown. This retrospective longitudinal study investigated risk factors for monthly-cholera incidence at the district level in Sabah from 2015-2020. The analyses included 705 culture-confirmed symptomatic cholera cases notified to the Ministry of Health, Malaysia integrating remote sensing-derived environmental, water supply source, and sociodemographic variables. Methods included (1) assembling dataset (2) deriving descriptive statistics and spatiotemporal distribution, (3) conducting bivariate analyses and assessing time lags, (4) fitting multivariable negative binomial model. The highest overall annual cholera incidence in Sabah per 100,000 persons was 6.63 in 2015 and lowest incidence was 0.05 in 2017 with spatial heterogeneity in the district-level annual incidence. Temporal variation was observed; cholera cases generally peaked during June-July though there were two peaks observed in 2015. Coastal district (aRR 5.873; 95% CI 2.016-20.16), El Niño 3.4 Anomaly at 2-month lag (aRR 1.837; 95% CI 1.452-2.343), permanent waterbody size (aRR 1.241; 95% CI 0.996-1.564), daily minimum precipitation (aRR 1.558; 95% CI 1.277-1.917), topographic wetness index (aRR for 4th quartile 2.607; 95% CI 1.349-5.056), high income inequality/disparity Gini coefficient >0.4 (aRR 3.05; 95% CI 1.838-5.126) were positively associated with monthly cholera incidence, while 25-50% water supply proportion from other source (aRR 0.402; 95% CI 0.212-0.760) was protective in the multivariable negative binomial model. This study provides insights into the risk factors for cholera in Sabah which will inform the prioritisation of areas for prospective environmental sampling/surveillance, field research, and community studies to enable appropriate public health interventions.

**O214: Wastewater sars-Cov-2 monitoring in a university hospital forecasts multilevel epidemic curves in Taipei city, Taiwan**

by Chung-Yen Chen | Yu-Hsiang Chang | Chang-Chuan Chan | Pau-Chung Chen | Ta-Chen Su | Department of Occupational and Environmental Medicine, National Taiwan University Hospital Yunlin Branch | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University | Department of Occupational and Environmental Medicine, National Taiwan University Hospital

During the ongoing pandemic, monitoring wastewater at targeted institutions is crucial for early detection, yet its application in predicting



epidemics remains constrained. This study aimed to establish the wastewater surveillance platform for SARS-CoV-2 in a University Hospital to forecast the epidemic at the hospital, the surrounding community, and the city levels. During April and October 2022, we conducted routine wastewater sampling at seven sampling wells across the campus twice weekly. The direct capture method was adopted for the pretreatment, concentration, and extraction of viral RNA. The presence of SARS-CoV-2 RNA in the wastewater samples was detected and quantified with RT-qPCR targeting N1, N2, and E-gene. SARS-CoV-2 signals relative to pepper mild mottle virus were calculated. Simple linear regression models were used to model the future moving averages of cumulative confirmed cases per 100,000 population at the hospital, community, and city levels. High consistency was observed in the E, N1, and N2 gene targets. Even with only eight new cases in the Zhongzheng District and 145 cases in the entire city, the virus can be detected in sewage, indicating promising sensitivity. The relative viral signals in the wastewater were strongly associated with future epidemiological indicators at the hospital, community, and city levels. Wastewater sampling and quantification of SARS-CoV-2 is proven to be an efficient and robust method for the tracking and forecasting of infection trends within and beyond hospital settings. Our study uniquely contributes not only to forecasting epidemic curves at the hospital level but also to extending the model to the community and city levels. To our knowledge, this is the first study that has attempted to project epidemiological indicators on a larger scale using building-level wastewater surveillance data.

### **O215: Impact of infectious source variability on respiratory exposure dosage**

by Yifan Li | Mengjie Duan | Li Liu | Tsinghua University | Tsinghua University | Tsinghua University

Understanding the characteristics of respiratory droplets exhaled by infectious sources and their impact on the exposure dosages to susceptible individuals is a crucial prerequisite for effectively preventing respiratory diseases. This study recruited human participants as infectious sources, using vitamin B2 as the traces to their exhaled respiratory droplets. This study involving human participants were reviewed and approved by the Tsinghua University Science and Technology Ethics Committee. Simultaneously, the *in vitro* respiratory tract model was employed as the susceptible individuals to measure the respiratory exposure dosages. A breathing airflow simulator was connected the *in vitro* respiratory tract model for mimicking periodic respiratory airflow. Furthermore, vitamin B2 reaching small airways within the respiratory tract model was collected and the dosage of vitamin B2 was measured using fluorescence spectrophotometry. When different participants are labeled with the same mass of vitamin B2, there is a significant difference in the dosage of vitamin B2 reaching the small airways of the same susceptible individual when participants exhale while speaking, with differences of up to tenfold. It analyzed the differences in the levels of droplet emission among different individuals, establishing a platform for detecting individual levels of respiratory droplet emission. This facilitated the development of a rapid quantification method for interpersonal transmission of respiratory droplets in indoor environments. The research identified influencing factors contributing to variations in individual levels of respiratory droplet emission. It provided scientific and technical support tailored to the protection and control of respiratory diseases, serving as a reference for addressing newly emerging and sudden respiratory communicable diseases in the future.

### **O221: Examining the relationship between greenness and personal exposure based on different methods of measuring greenness in South Korea**

by Won Kyung Kim | Goen Jung | Dongook Son | Kyumin Kim | Seokmin Ji | Soril Kim | Chol Shin | Miji Kim | Hyunji Kim | Sun-Young Kim | Department of Cancer AI and Digital Health, National

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Previous research has found that greenness can potentially mitigate air pollution and its associated health effects. However, these studies primarily relied on ambient air pollution and greenness at residences, along with vegetation indices as the measurement for greenness. Personal activities and their locations could significantly impact on individual exposure to air pollution via greenness. Although vegetation indices are available on the extensive spatial range and temporal resolution at regular intervals over an extended period, the effectiveness of mitigating air pollution and promoting human health through greenness may vary depending not only on vegetation vitality and scale but also on green space types, forest composition and age-class, and local condition. Therefore, the purposes of this research include 1) assessment of PM<sub>2.5</sub> personal exposure related to personal greenness and 2) application of various types of greenness data other than vegetation indices. The study population consisted of 57 senior participants residing in Ansan and Chuncheon from the Korean Genome and Epidemiology and Korean Frailty and Aging Cohort Studies. Each participant carried a MicroPEM to measure PM<sub>2.5</sub> and a GPS data logger to track their locations. For greenness, we obtained tree and grass land covers with forest types, parks, and ecological nature grades in addition to vegetation indices including Normalized Difference Vegetation Index (NDVI) and Enhance Vegetation Index (EVI). Then, we identified types of green space or computed the level of greenness at all participants' locations and compared PM<sub>2.5</sub> concentrations across different types or levels of greenness. We observed generally lower PM<sub>2.5</sub> concentrations in the areas covered by trees (median=8.19µg/m<sup>3</sup>) than those covered by grass (10.24µg/m<sup>3</sup>). Furthermore, broad-leaved forests showed slightly lower PM<sub>2.5</sub> (7.66µg/m<sup>3</sup>) than coniferous and mixed forests (9.87µg/m<sup>3</sup>). This research highlighted the significance of employing diverse data and techniques to assess greenness for identifying personal exposure to greenness and assessing the relationship with personal exposure to air pollution.

### **O222: Green space proximity and cognitive benefits: community health center study in urban Beijing**

by John S. Ji | Tsinghua University

The relationship between urban green space and built environments is associated with positive health outcomes. Our study examines the impact of community-level proximity to green spaces and parks on cognitive function screening in Beijing, China. We focused on areas within the Fifth Ring Roads, covering 114 communities and 62,333 participants (mean age 70.9 years (SD 6.5), 60.5% female). Cognitive function was assessed using an adapted version of the Mini-Mental State Examination (Mini-MMSE) and the Episodic Memory Test (EMT). We measured green space exposures of the community: accessibility (distance to large green spaces and parks), availability (Normalized Difference Vegetation Index [NDVI] and proportion of green space), and visibility (green view ratio). Multilevel linear and logistic regression models adjusted for demographic and environmental factors were used to analyze the data from 324 community healthcare centers. The mean scores for the cognitive test were 12.3 (SD 1.3) out of 13 in the Mini-MMSE and 90.6 (9.2) out of 100 in the EMT. Each year increase in age is associated with a 0.025 (0.023-0.027) decrease in Mini-MMSE scores and 0.143 (0.132-0.155) in EMT scores. Male and female differences

in Mini-MMSE and in EMT scores are 0.022 and 0.111, respectively. Our findings reveal that greater access to green spaces is associated with improved cognitive function scores for all indicators, with distance to park above 500m associated with a decline in cognitive function scores. These results highlight the potential of community-level green space planning to enhance cognitive function in the older population of urban China.

### **O223: Interaction between built environment and distance to green space on cognitive function among older adults in high-density urban areas of Beijing**

by Weiju Zhou | He Li | Xiangwei Dai | Yaojing Chen | Zhanjun Zhang | John S. Ji | Vanke School of Public Health, Tsinghua University, Beijing, China | Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, Beijing, China | Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, Beijing, China | Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China | Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China | Vanke School of Public Health, Tsinghua University, Beijing, China

The built environment, including factors such as building and road density, influences the health of older citizens. However, the effects of these factors, as well as their interactions with exposure to green spaces, on cognitive function among older adults in a high-density urban setting, are not understood. We used data from the Beijing Community-based Cognitive Function Screening (CCFS) program, which encompassed the entirety of urban Beijing (within the 5<sup>th</sup> ring road) and 114 communities. Cognitive function screenings were conducted by each community health center in 2019, using an adapted version of the Mini-Mental State Examination (Mini-MMSE). Within each community, we computed the average building density and road density, as well as the straight-line distance from the centroid of each community to the nearest green space. We employed multivariable linear regression models to estimate the associations between building density, road density, distance close to green space, and their interaction effects with cognitive function. There were 61,818 participants, with a mean age of 70.9 years (SD 6.5), and 60.5% were female. The mean cognitive test scores were 12.3 (SD 1.3) out of 13 in the Mini-MMSE. In the fully adjusted model, each 0.01-unit increase in building density was associated with a decrease of 0.561 (0.408 to 0.716) in cognitive function scores, each 0.1 km<sup>2</sup> increase in road density was an increase of 0.003 (0.001 to 0.005), each 0.01 km increase in distance close to green space was an increase of 0.471 (0.424 to 0.518), and the interaction term is significant with a p-value of <0.001. Our study demonstrated that greater access to green spaces and higher road density positively influence cognitive function scores in high-density urban environments. The findings suggested the potential benefits of community-level planning for green spaces and road density in enhancing cognitive function among older adults residing in densely populated urban areas of Beijing, China.

### **O224: Impact of greenspaces and park spaces on cognitive domains among middle-aged and older adults in Beijing, China**

by Yanxi Zeng | Weiju Zhou | Yaojing Chen | He Li | Xiangwei Dai | Zhanjun Zhang | John S. Ji | Vanke School of Public Health, Tsinghua University, Beijing, China | Vanke School of Public Health, Tsinghua University, Beijing, China | Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China | Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China | Beijing Aging Brain Rejuvenation Initiative (BABRI) Centre, Beijing Normal University, Beijing, China | Beijing

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Little is known about the benefits of park spaces for the cognitive function of older adults residing in urban areas. We aimed to examine the impact of greenspaces and park spaces on cognitive function of middle-aged and older adults. We analyzed data from 7,214 participants aged over 45, who were enrolled in the ongoing Beijing Aging Brain Rejuvenation Initiative (BABRI) and did not exhibit cognitive impairment at baseline in 2009. Normalized Difference Vegetation Index (NDVI), density of parks, and distance to parks were calculated based on each participant's residential address. A battery of standardized cognitive tests was used to measure participants' global cognition and five specific domains: memory, attention, execution, visuospatial function, and language. Multivariable regression models, adjusted for key covariates, were employed to examine the associations between cognitive functions, greenspace, and urban parks. Greater greenspace exposure, represented by a one-unit increase in NDVI, was associated with improved memory (measured by Auditory Verbal Learning Test, AVLT: beta 13.26 [95% CI 8.56, 17.98]) and attention (Stroop Test part A: 1.45 [0.25, 2.65]; Symbol Digit Modalities Test, SDMT: 16.23 [10.99, 21.48]). Higher density of park space (one-unit increase) was correlated with better global cognition (Mini-Mental State Examination, MMSE: 0.18 [0.11, 0.25]), memory (AVLT: 0.98 [0.70, 1.26]), and attention (SDMT: 0.72 [0.41, 1.04]), but associated with poorer execution (Stroop Test part B: -0.11 [-0.21, -0.01]; Stroop Test part C: -0.21 [-0.38, -0.05]). The nearest distance of park spaces exhibited no significant effect on cognitive function. Visuospatial function and language showed insensitivity to variations in greenspaces and park spaces. Our findings highlight the significant impact of greenspace exposure and park density on various cognitive domains among middle-aged and older adults in Beijing. These findings emphasize the need for urban planning that prioritizes accessible greenspaces and park spaces for cognitive well-being in aging populations.

### **O225: Prenatal phthalate exposures in indoor settled dust and its association with anogenital distance of Chinese boys**

by Mengfang Wan | Yuexia Sun | School of Environmental Science and Engineering, Tianjin University | School of Environmental Science and Engineering, Tianjin University

Phthalates comprise a large class of chemicals used in a variety of consumer products. Several have anti-androgenic properties, and in rodents prenatal exposure to phthalates has been associated with reduced anogenital distance (AGD)—the distance from the anus to the genitals in male offspring. Few human studies have been conducted, but inconsistent associations between the anti-androgenic phthalates and male AGD have been reported. In the CHEMical Exposure and Children's Health (CHECH) study, dust-phase concentrations of seven phthalates (i.e., diethyl phthalate (DEP), di-n-butyl phthalate (DnBP), diisobutyl phthalate (DiBP), di(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBzP), diisononyl phthalate (DiNP), and di-2-ethylhexyl terephthalate (DEHT)) were measured in homes of pregnant women during first trimester. In the following cohort, AGD and weight of 78 boys were measured after their birth. Associations between prenatal phthalate and AGD were estimated using linear and logistic regression model with adjustment for age and weight-for-age. Significant associations were found of reduced AGD measures (anoscrotal distance; AGDas) with higher DiBP and BBzP concentrations (P<0.05). Unexpectedly, the exposure to DEHT was associated with longer AGD. We found indoor phthalates exposure during pregnancy was a risk factor for shorter AGD in boys in northern of China. This study support the hypothesis that prenatal phthalate exposure at environmental levels can adversely affect male reproductive development in humans.

### O231: The association between per- and polyfluoroalkyl substances (PFASs) and brain, esophageal, melanomatous skin, prostate, and lung cancer using the 2003-2018 US National Health and Nutrition Examination Survey (NHANES) datasets

by Jinyoung Moon | Ewha Womans University Seoul Hospital

This study aimed to investigate the potential associations between four per- and polyfluoroalkyl substance (PFAS) exposures (perfluorooctanoic acid [PFOA], perfluorooctane sulfonic acid [PFOS], perfluorohexane sulfonic acid [PFHxS], and perfluorononanoic acid [PFNA]) and each type of cancer using the US National Health and Nutrition Examination Survey (NHANES) datasets. A logistic regression analysis was performed. A directed acyclic graph was plotted to adjust for the potential confounders. The odds ratio (OR) of brain cancer for a one-unit increase in ln (PFHxS) was 8.16 (95% confidence interval [CI] 2.98–68.89). The OR of esophageal cancer for one unit increase of ln (PFOA) and ln (PFOS) was 5.10 (95% CI 1.18–17.34) and 3.97 (95% CI 1.24–11.42), respectively. The OR of melanoma for one unit increase of ln (PFOA) and ln (PFHxS) was 1.65 (95% CI 1.07–2.58) and 1.55 (95% CI 1.07–2.25), respectively. The OR of prostate cancer for one unit increase of ln (PFOS) and ln (PFNA) was 1.21 (95% CI 1.00–1.48) and 1.27 (95% CI 1.00–1.62), respectively. The OR of lung cancer for one unit increase of ln (PFOS) and ln (PFNA) was 2.62 (95% CI 1.24–5.83) and 2.38 (95% CI 1.00–5.52), respectively. Considering that brain, esophageal, and melanomatous skin cancers have not been targets of epidemiologic studies regarding PFAS exposure, future studies could target these cancers as outcomes of interest.

### O232: Risk of renal injury exposed to BPA and its substitutes in the general Taiwanese adults

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In 2023, the EU EFSA issued a new tolerable daily intake (TDI) of BPA, 0.2 ng/kg/day. Meanwhile, BPA and its substitute (bisphenol S, BPS and bisphenol F, BPF) has been reported as a risk factor for kidney damage. Urinary *N*-acetyl- $\beta$ -D-glucosaminidase (NAG) is a sensitive indicator of proximal tubular cell injury. We aimed to identify the exposure risk and evaluated the association between BPA and its substitute's exposure and renal functions in the general Taiwanese adults. We collected urine samples including 271 adults from the Taiwan Environmental Survey for Toxicants 2013, and analyzed for three bisphenols by ultraperformance liquid chromatography-tandem mass spectrometry. The health-based guidance value of bisphenols were used to calculate the hazard index (HI) for cumulative risk. Besides, we measured by the indicators of renal function, included urine creatinine (crea), NAG (IU/L), etc. We found the median levels were 9.45 for BPA, 9.63 for BPF, and 2.43 ( $\mu$ g/crea) for BPS, respectively, and yielded median estimate daily intakes (DIs) were 2.29 (BPA), 2.35 (BPF), and 0.58 (BPS) (ng/kg/day), respectively, in the Taiwanese adults. The median DI of BPS was significantly higher in male than in female (0.69 vs. 0.49;  $p = 0.032$ ). Most HI<sub>BPA</sub> in 99% of the participants has exceeded 1 based on new EFSA's TDI. We found the risk of NAG/crea was increased, by 5 to 10 times, with DI<sub>BPA</sub> and showed a dose-response trend (Aadjust OR<sub>tertile2</sub>: 4.89; AOR<sub>tertile3</sub>: 10.21,  $p=0.002$ ;  $p_{\text{trend}} < 0.001$ ). Exposure risk of BPA analogues is at high concern in Taiwanese based on new TDI, and varied by age and sex. Meanwhile, BPA analogues exposure may increase the risk of renal

tubular injury. In Taiwan, chronic kidney disease is characterized by high incidence, prevalence, and healthcare costs. We identify the potential environmental risk factors associated with early kidney damage.

### O233: Association between prenatal exposure to phthalates and second to fourth digit ratio and reproductive hormones in adolescents: the Hokkaido Study

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Phthalates are commonly referred to as “everywhere chemicals” due to their ubiquitous nature in the environment. Phthalate exposures can disrupt the endocrine system, which regulates hormones. The ratio of the lengths of the second and fourth digits (2D:4D) is used as a non-invasive retrospective index of prenatal exposure to reproductive hormones. This study aimed to elucidate the association between prenatal exposure to phthalates and the 2D:4D and the reproductive hormones in adolescents. This study is based on an ongoing, prospective birth cohort of the Hokkaido Study on Environment and Children's Health. The 2D:4D ratios were determined using Vernier calipers from photographs of palms provided by 153 children aged 14-17 years. Multiple linear regression and mediation analysis were used to examine the associations between the 2D:4D, 5 metabolites of prenatal phthalate, and 14-17-year-old reproductive hormones. The highest concentration of phthalate metabolites was MnBP (Median: 31.0 ng/ml). The average of 2D:4D was not significantly related to the prenatal phthalate metabolites in both boys and girls. An inverse association was observed between log MiBP concentrations and log INSL3 concentrations in boys [regression coefficient ( $\beta$ ) = -0.246; 95% confidence interval (CI): -0.392, -0.100;  $p=0.001$ ]. There was no significant mediation effect of 2D:4D on the association between phthalates and hormones. INSL3, a major secretory product of Sertoli and Leydig cells, may be adversely affected by MiBP exposure in utero, as indicated by this study. Such exposure aligns with findings from animal studies, suggesting potential detrimental impacts on male Sertoli and Leydig cell development. Experimental rat evidence demonstrated that maternal phthalate exposure reduced fetal INSL3-gene expression, altered gubernacular development, and led to cryptorchidism. Exposure to phthalates during prenatal development may lead to reproductive disruption extending into puberty. Urgent comprehensive human studies on phthalate exposure and its long-term reproductive effects are imperative.

### O234: The association EDC exposure and pregnancy and fetal outcomes among reproductive-aged women at a Philippine tertiary hospital: a prospective cohort study

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Endocrine disrupting chemicals (EDCs) are environmental pollutants found in items people use every day such as plastic bottles, cleaning materials, pesticides, among others. EDCs affect hormone functions

that adjust metabolism and reproduction. To determine the association of EDCs Bisphenol A (BPA), 2,4-dichlorophenoxyacetic acid, phthalates, and parabens with maternal and fetal outcomes. Pregnant women participants in a Philippine tertiary hospital had serum and urine sample analysis and follow up of their pregnancy, maternal and fetal outcomes. Liquid chromatography mass spectrometry (LC-MS) was used to detect the EDCs. Prevalence and association of each EDCs detected with each maternal and fetal outcome were determined. Descriptive statistics and Spearman rank correlation was performed. Some maternal complications, and intrauterine growth restriction were associated with 2,4-dichlorophenoxyacetic acid detection. Phthalate is associated with low birth weight and preterm delivery. BPA was associated with premature delivery. The study's findings suggest that pregnant women and their neonates with exposure to EDCs can experience maternal complications, intrauterine growth retardation, low birth weight, and prematurity.

### **0235: Carbon monoxide (CO) nano-drug delivery system for cancer radiodynamic therapy via affecting mitochondrial function**

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Breast cancer accounts for 11.7% of all cancers and causes 6.9% of all cancer deaths worldwide. This study aimed to design a carbon monoxide nano-drug delivery system and combined with radiation to release carbon monoxide by radiodynamic way for cancer treatment, and tried to understand the effect of carbon monoxide on the mitochondrial function. In vivo, a Patient-derived xenograft model was used to confirm the efficacy of the carbon monoxide nano-drug delivery system for radiodynamic cancer therapy. In vitro, human breast cancer cell MDA-MB-231 was applied to determine cell viability, mitochondrial reactive oxygen species (mtROS), autophagy and changes in protein expression. The results indicated that the carbon monoxide nano-drug delivery system can release carbon monoxide via radiation activation. The growth of human breast tumors in animals was inhibited. The mtROS were increased, the mitochondrial membrane potential was decreased in the cells. This leads to a decrease in the survival rate of breast cancer cells and achieves the effect of cancer treatment. In addition, the expression of LC3 was decreased, and the expression of PDK1 and Bax, Cytochrome C, and caspase 3 were increased. In conclusion, studies have shown that after the treatment of carbon monoxide nano-drug delivery system combined with radiation, the released carbon monoxide affects the function of mitochondria and regulates the expression of related intracellular molecular machinery. Through radiodynamic methods, it achieves a synergistic effect of enhancing anti-cancer efficacy and specificity.

### **0241: Dietary exposure to perfluoroalkyl and polyfluoroalkyl substances in 7-year-old children in Shandong, China**

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Per- and polyfluoroalkyl substances (PFAS) have been recognized as endocrine disrupting chemicals. Based on Laizhou Wan Birth Cohort (LWBC) conducted in Shandong, China, we observed notably higher PFAS levels as well as a shared exposure source within families, highlighting the importance of appraising critical exposure sources to PFAS and health risks, especially for vulnerable population in this area. It is commonly agreed that dietary intake, especially animal-origin foods may contribute most to PFAS exposure for general population. However, it is unclear which type of food has the highest PFAS levels and how legacy and emerging PFAS are distributed in different food categories. Therefore, we investigated PFAS levels in local foods, especially seafood and meat, and further estimated dietary exposure risk in school-age children in LWBC. Ten PFAS were quantified in the serum of 7-year-old children, as well as the most consumed ten seafood species and five meat species purchased from local markets (n = 45). Seafood was widely contaminated by both legacy PFAS and their alternatives, especially for PFOA and 6:2 chlorinated polyfluoroethersulfonic acid (6:2 Cl-PFESA). The concentration of PFOA (median, 87.80 ng/g) in *Zoarces longatus* (a kind of marine fish) was appropriately 10-100 times that in other seafood species. Furthermore, children who frequently consumed *Zoarces longatus* had a higher serum PFOA level than those who did not. Seafood intake accounted for 76.7% of ΣPFAS exposures among different foodstuffs. The dietary estimated weekly intake values of Σ<sub>4</sub> PFAS (including PFOA, Perfluorooctanesulfonic acid (PFOS), Perfluorononanoic acid (PFNA), and Perfluorohexanesulfonic acid (PFHxS)) for children (7.88 ng/kg bw/week) exceeded the tolerable weekly intake as recommended by the European Food Safety Authority in 2020 (4.4 ng/kg bw/week). Children may face health risks at this level of exposure.

### **0242: Modification of prenatal exposure to per- and polyfluoroalkyl substances by maternal vitamin D status on neurodevelopment in 2-year-old children**

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Pregnant women in the Shanghai Birth Cohort (SBC) faced the dual threats of per- and polyfluoroalkyl substances (PFAS) exposure and vitamin D (VD) insufficiency that may both affect offspring neurodevelopment. However, the modifying role of maternal VD status in the effect of prenatal PFAS exposure on childhood neurodevelopment

remains unexplored. In this study, a total of 746 mother-child pairs were included from SBC. Ten PFAS congeners and VD levels were measured in maternal blood samples collected during the first and second trimester respectively. At 2 years of age, toddlers underwent neurodevelopment assessments using Bayley-III Scales. Multivariate linear, logistic regression, and weighted quantile sum approach were used to estimate associations between of Bayley-III scores with individual and PFAS mixture. We stratified participants into VD sufficient/insufficient groups to evaluate its modifying role. Nearly half (46.5%) of pregnant women were VD insufficient (<30 ng/mL). PFAS exposure was associated with negative language scores and an increased risk for neurodevelopmental delay. Unexpectedly, adverse associations were mainly presented in the VD sufficient group. Meanwhile, higher PFAS concentrations were found in the VD insufficient group compared to those in the VD sufficient group, therefore, we further counterbalanced PFAS differences between the dichotomous VD groups by simultaneously matching all PFAS levels. Most results were reversed after matching, shown as adverse associations in the VD sufficient group were nullified, whereas in the VD insufficient group, adverse associations becoming more pronounced. High prenatal PFAS exposure and low maternal VD levels collectively heighten the risk of adverse childhood neurodevelopment in this Chinese birth cohort. However, disentangling PFAS and VD interrelationships is crucial to avoid paradoxical findings.

#### **O243: Seasonal variations in acute exacerbations and phenotypic characteristics of pediatric asthma**

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Seasonal variations have a profound impact on pediatric asthma exacerbation. This study was to examine associations of hematological examinations result and asthma phenotypes with acute exacerbations of pediatric asthma in different seasons. A case-control study was conducted on 32,160 pediatric asthma patients recruited from 3 hospitals in Taipei and New Taipei City between January 2008 and December 2021. The seasons was divided into winter (December-February), spring (March-May), summer (June-August), and autumn (September-November). Asthma phenotypes were based on low (L) and high (H) blood (B) eosinophil (E) (LBE/HBE:  $</\geq 0.25 \times 10^9/L$ , respectively) and neutrophil (N) (LBN/HBN:  $</\geq 5 \times 10^9/L$ , respectively) cut-offs. Logistic regression was used to examine the odds ratio (OR) of patient characteristics with seasonal exacerbations between non-hospitalization pediatric asthma patients (reference group) and hospitalization pediatric asthma patients. We observed associations of eosinophils and neutrophils with respective increase of 0.017 and 0.061 asthma exacerbations among hospitalized pediatric asthma. An increase in neutrophils was associated with respective increases of 0.014 and 0.035 in asthma exacerbations during the winter and spring seasons. An eosinophils increase of  $1 \times 10^9/L$  increased the asthma exacerbations during the summer and autumn seasons by 0.109 and 0.082, respectively. An increase of HBE/LBN phenotypes was associated with an increase of 0.130 in asthma exacerbations, whereas an increase in LBE/LBN phenotypes decreased asthma exacerbations by 0.125. An increase in HBE/LBN phenotypes was associated with increases in asthma exacerbations by 0.220, 0.166, and 0.248 during the winter, summer and autumn, respectively. Moreover, an increase in HBN/LBE phenotypes was associated with an increase in asthma exacerbations by 0.172 during spring seasons and decrease in asthma exacerbations by 0.157 during autumn seasons. Eosinophils and neutrophils were associated with changes in acute exacerbations in pediatric asthma patients. The seasons influence asthma exacerbations in

different phenotypes of pediatric asthma. Exposure to different seasons can potentially influence asthma phenotypes and severity.

#### **O244: Directional associations between screen time and performance on developmental screeners in toddlerhood: the Japan Environment and Children's Study**

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It is unclear whether increased television/digital versatile disc (TV/DVD) viewing in early childhood from age 1 year decreases development or whether poor development increases TV/DVD viewing. We aimed to examine the bidirectional association between TV/DVD screen time and developmental milestones during early childhood. This longitudinal study analyzed data from 57,980 children and mothers from a national birth cohort, the Japan Environment and Children's Study. The mothers were recruited between January 2011 and March 2014. Children with missing developmental scores and screen time data aged 1–3 years, those with an autism spectrum disorder were excluded. We examined the longitudinal and directional associations between TV/DVD screen time and development scores for children aged 1, 2, and 3 years using a random intercept, cross-lagged panel models. Child development was assessed via the mother's or guardian's report using the Ages and Stages Questionnaire, third edition. Increased TV/DVD screen times at 1 and 2 years of age were associated with lower developmental scores at 2 and 3 years of age ( $\beta_2$  [95% CI] =  $-0.05$  [ $-0.06, -0.04$ ] and  $\beta_3$  [95% CI] =  $-0.08$  [ $-0.09, -0.06$ ]), respectively. An inverse association was observed from the ASQ-3 score in the communication domain at 1 and 2 years to subsequent screen time ( $\gamma_2$  [95% CI] =  $-0.03$  [ $-0.04, -0.02$ ] and  $\gamma_3$  [95% CI] =  $-0.06$  [ $-0.07, -0.04$ ]). Negative associations between screen time at 2 years and the developmental scores in gross motor, fine motor, and personal-social domains at 3 years were observed. Increased TV/DVD screen time from 1 year of age negatively impacted later development. To reduce the negative consequences of excessive media use, researchers and healthcare providers should encourage family media management and recommend social support for parents who tend to rely on the media.

#### **O245: Depression symptoms and associated factors among infertility women patient in the Northern city, Vietnam: A cross-sectional study**

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Infertility is a severely distressing experience for many couples. Depression is considered one of the main psychological disorders associated with infertility and it may significantly not only influence mental wellbeing but also affect the effectiveness of infertility treatment. To date, little attention has been given to prenatal depression, especially in low and middle-income countries. The objective of the study was

to determine the depression prevalence and associated factors among infertile female patients. A cross-sectional study was conducted during February–April 2023 with 202 infertile women visiting the Center of Infertility Support in a private hospital in the Northern city of Vietnam. The Patient Health Questionnaire (PHQ-9) scale was used to assess depression symptoms. Face-to-face interviewing was conducted using a structured questionnaire. Participants were also inquired about demographic characteristics, socio-economic status, infertility-related characteristics, and family and social relationships. The depression prevalence was 10.39% with a cut-off score  $\geq 10$  on the PHQ-9 scale. Depression in infertile female patients was associated with infertility caused by infertility disease history (OR=3.51, 95% CI=1.12–10.99),  $>3$  IVF/IUI cycles (OR=15.28 (95%CI=3.01–77.49); and alcohol-addicted husband (OR=2.99, 95% CI=1.01–8.84) Assessment of depressive symptoms should be assessed at an early stage among infertile female patients for timely mental health support. The initial results of the study help treating doctors collaborate with families to support infertile women to improve their mood, prevent stress, and improve treatment effectiveness.

**0246: Association between maternal serum essential trace element concentration in early pregnancy and the risk of gestational diabetes mellitus**

by Jinlang Lyu | Peking University

Studies evaluating the association between maternal essential trace element (ETE) levels in early pregnancy and gestational diabetes mellitus (GDM) are sparse and few consider co-exposure. This study aimed to evaluate the association between maternal ETE levels and risk of GDM. We conducted a nested case-control study including 200 cases of GDM and 200 controls based on the Peking University Birth Cohort in Tongzhou. Blood samples were collected in early pregnancy ( $<14$  weeks), and serum levels of ETE, including copper (Cu), zinc (Zn), selenium (Se), molybdenum (Mo), cobalt (Co), and chromium (Cr), were measured using inductively coupled plasma mass spectrometry (ICP-MS). The associations between serum ETEs and the risk of GDM were assessed using conditional logistic regression, Bayesian kernel machine regression (BKMR) and Quantile g-computation (Qgcomp) models. The serum Co concentration of pregnant women with GDM were lower than that of pregnant women without GDM ( $P = 0.014$ ). Maternal serum Co levels were negatively related to the risk of GDM after full adjustment. The ORs (95% CI) of GDM for each unit increase of ln-transformed serum Co was 0.46 (95% CI: 0.22, 0.93). Compared with the lowest tertile of Co levels, the second (OR = 0.56) and third tertile (OR = 0.39) were associated with a decreased risk of GDM. The BKMR and Qgcomp analyses revealed a negative overall association between the ETE mixtures and the risk of GDM, with Co accounting for the majority of the overall effect. Our findings suggested that maternal Co level during early pregnancy were negatively associated with the risk of GDM. These results might provide epidemiologic evidence on the protective role of maternal Co levels for GDM. Given the high prevalence of GDM, this study will contribute to the existing literature of environmental influencing factors of GDM. It also shed light on the potential protective effect Co on GDM.

**0251: Urine manganese, cadmium, lead, arsenic, and selenium among autism spectrum disorder children in Kuala Lumpur**

by Muhammad Ridzwan Bin Rafi'i | Universiti kebangsaan Malaysia

Exposure to environmental pollutants such as heavy metals is always associated with the development of autism spectrum disorder (ASD). The primary objective of this study is to determine the role of heavy metals of concern such as manganese (Mn), cadmium (Cd), lead (Pb), arsenic (As), and essential trace element selenium (Se) among ASD children in Kuala Lumpur, Malaysia. Preschoolers in Kuala Lumpur between the ages 3 to 6 were the 155 subjects of an unmatched case-control study

with 81 ASD children recruited from an early intervention program for autism, and 74 normal children recruited from public preschools. Urine samples were collected at home, delivered to the samples at the study site, and transported to the environmental lab within 24 hours. The method of Inductively coupled plasma mass spectrometry (ICP-MS) was applied to measure the concentration of heavy metals in the samples. This study demonstrated that Cd, Pb, and As urine levels were surprisingly and significantly greater in normal children than in ASD children ( $p < 0.05$ ). There is no significant difference between Se and Mn between both groups Mn ( $p = 0.659$ ) and Se ( $p = 0.875$ ). Mn and Se are much lower in ASD children than in normal children. The majority of children in both groups have urine heavy metals that are lower than normal values (As  $< 15.1 \mu\text{g/dL}$ , Pb  $< 1.0 \mu\text{g/dL}$ , Cd  $< 1.0 \mu\text{g/dL}$ ). The significant ASD risk factors in this study were firstborn, male, and higher parental education levels (adjusted odds ratios (aOR)  $> 1$ ,  $p < 0.05$ ). Children with ASD had much lower (Pb, Cd, and As) urine levels than normal children. These findings may relate to diminished capacity to excrete heavy metals among ASD children which may cause further accumulation of heavy metals in the body.

**0253: Hormonal, liver, and renal function associated with electronic waste (e-waste) exposure in Bangladesh**

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Electronic waste (e-waste) contains heavy metals and organic pollutants which has detrimental impacts on human health. The purpose of this analysis is to evaluate the impact of blood lead (BPb), Cd (BCd), and total hair mercury (THg) on hormonal, liver and renal parameters, and the role of DNA oxidative damage in mediating the relationship between exposures and outcomes. We studied a total of 199 e-waste recycling workers and 104 non-exposed workers; collected and analyzed blood, urine and hair samples to measure heavy metals, hormonal, renal, and hepatic parameters. Among exposed and non-exposed individuals, we found elevated median blood Pb (11.89 vs 3.63  $\mu\text{g/dl}$ ), moderate blood Cd (1.04 vs 0.99  $\mu\text{g/l}$ ) and lower level of total Hg in hair (0.38 vs 0.57 ppm). In the exposed group, median concentrations of total triiodothyronine ( $\text{TT}_3$ ) were significantly higher than non-exposed group ( $p \leq 0.05$ ). The exposed group had significantly higher median aspartate aminotransferase (AST) and alkaline phosphatase (ALP). The median concentrations of urinary albumin, albumin-creatinine ratio (ACR) and estimated glomerular filtration rate (eGFR) were significantly higher in exposed than non-exposed group ( $p \leq 0.05$ ). After accounting for confounding effect using Inverse Probability of Treatment Weighting (IPWT), quantile regression model revealed that BPb was associated with a 3.67 unit increase in the ALP (95% CI: 1.53, 5.80), 0.01 unit increase in urinary albumin (95% CI: 0.002, 0.01), and 0.07 unit

increase in ACR (95% CI: 0.01, 0.13). No hormonal, renal, and hepatic parameters were associated with BCd and THg. Oxidative DNA damage did not mediate exposure-outcome relationships (all  $p \geq 0.05$ ). Our data indicate e-waste exposure impairs liver and renal functions due to elevated levels of BPb. Continuous monitoring, longitudinal studies to evaluate the dose-response relationship and effective control measures are required to mitigate the exposure and protecting health.

#### **O254: The impact of bauxite-derived heavy metals on the respiratory health and exposure biomarkers of primary school children in Malaysia**

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Mining activities pose a significant threat to human health and the environment in Malaysia and globally. This study aimed to assess the correlation between heavy metals in school environments and health indicators among primary students. A comparative cross-sectional study included 148 students in the studied group and 122 students in the comparative group. Heavy metals in air, dust, and soil of school environments were monitored using Gillian personal sampling pumps and 400W vacuum cleaner. Questionnaires gathered health symptom data, while lung function was measured using Chestgraph HI-105. Inductively Coupled Plasma Mass Spectrometry analyzed heavy metals. PM10 and heavy metals were significantly higher in the studied area, with Ni being the most concentrated metal. Reported symptoms like cough with flu, nasal congestion, runny nose, and headache were more prevalent in the studied group. Lung function abnormalities were significantly higher in the studied group, and heavy metal accumulation in biomarkers was also elevated. Pb and Ni were the predominant metals in hair and toenails, respectively. PM10 and heavy metal exposure correlated with health symptoms and reduced lung functions. The study identified school proximity to mining areas and Ni concentrations in indoor air and dust as risk factors. Proper zoning, adherence to standard operating procedures by mining companies, and emphasis on cleanliness are crucial near schools to mitigate health risks.

#### **O255: Comparative study on hair mercury level and associated factors among islander and highlanders in Sabah**

by Rudy Petrus | Sahipudin Saupin

The presence of mercury in the environment poses significant health concerns due to its accumulation in various elements like fish and human tissues. A recent study in Sabah aimed to assess mercury levels in the hair of islanders and highlanders, revealing differences between the two groups. This introduction highlights the importance of understanding mercury exposure and its implications for communities reliant on fish consumption. A study was conducted in Sabah to investigate mercury levels in the hair of islanders and highlanders. The study involved 140 participants, from Kg. Mantanani (Islanders) and Kg. Gusi Ranau (Highlanders). Hair samples were analysed for mercury content, and statistical analysis using SPSS indicated a significant difference in mercury levels between the two groups. Specifically, the mean mercury concentration in hair was higher in Kg. Mantanani compared to Kg. Gusi Ranau. Compared Mean Of Mercury Between Kampung Gusi Ranau and Mantanani. The results of the independent t-test revealed a significant difference in PPM scores between Kampung Gusi Ranau and Mantanani [DF=138,  $t=-4.0669$ ,  $p<0.05$ ]. Examining the mean scores,

the PPM score for Kampung Mantanani ( $1.979 \pm 0.974$ ) was significantly higher than that for Kampung Gusi Ranau ( $1.238 \pm 0.683$ ). Dietary habits revealed that fish consumption was prevalent among the population, with a significant percentage consuming fish daily. However, uncertainty existed regarding the origin of the fish purchased, with many acquiring it from local markets. The majority of respondents were aware of the rivers or areas where the fish they consumed were caught. Regarding drinking water sources, respondents varied in their preferences, with a notable percentage obtaining water from wells. Neurological and mental disorders were reported by a small proportion of respondents. Overall, the study suggests a need for further attention to mercury exposure, particularly among communities reliant on fish consumption, and emphasises the importance of understanding dietary and environmental factors influencing mercury levels.

#### **O311: Associations of meteorological factors and dynamics of scrub typhus incidence in South Korea: A nationwide time-series study**

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Scrub typhus, also known as Tsutsugamushi disease, is a climate-sensitive vector-borne disease that poses a growing public health threat. However, studies on the association between scrub typhus epidemics and meteorological factors in South Korea need to be complemented. Therefore, we aimed to analyze the association among ambient temperature, precipitation, and the incidence of scrub typhus in South Korea. First, we obtained data on the weekly number of scrub typhus cases and concurrent meteorological variables at the city-county level (Si-Gun) in South Korea between 2001 and 2019. Subsequently, a two-stage meta-regression analysis was conducted. In the first stage, we conducted time-series regression analyses using a distributed lag nonlinear model (DLNM) to investigate the association between temperature, precipitation, and scrub typhus incidence at each location. In the second stage, we employed a multivariate meta-regression model to combine the association estimates from all municipalities, considering regional indicators, such as mite species distribution, Normalized Difference Vegetation Index (NDVI), and urban-rural classification. Weekly mean temperature and weekly total precipitation exhibited a reversed U-shaped nonlinear association with the incidence of scrub typhus. The overall cumulative association with scrub typhus incidence peaked at  $18.7\text{ C}^\circ$  (with RRs of 9.73, 95% CI: 5.54-17.10) of ambient temperature (reference  $9.7\text{ C}^\circ$ ) and 162.0 mm (with RRs of 1.87, 95% CI: 1.02-3.83) of precipitation (reference 2.8 mm), respectively. These findings suggest meteorological factors contribute to scrub typhus epidemics by interacting with vectors, reservoir hosts, and human behaviors. This information serves as a reference for future public health policies and epidemiological research aimed at controlling scrub typhus infections.

#### **O312: Evaluating the Benefits of Low-Carbon Intervention Among Cyclists in Taipei**

by Man-Ni Wang | Kang Lo | Chang-Fu Wu | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University | Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University

Urban areas face PM2.5 and carbon emissions from traffic and industry, impacting climate change. Promoting low-carbon transport

such as cycling and electric vehicles is crucial, as it reduces emissions and improves public health. The study aims to evaluate the impact of transportation interventions on carbon emissions, health, and PM<sub>2.5</sub> at the National Taiwan University campus. We recruited students who regularly commute by fuel motorcycles for a two-stage intervention involving cycling and electric scooter use. In the cycling phase, participants wore smart devices and low-cost sensors on weekdays to gather health and pollution data for two weeks. The final phase tracked their use of shared electric scooters, assessing willingness to change post-intervention. Carbon emissions were compared across both stages, and surveys before, during, and after the study. After the intervention, a total of 92% of participants in the second phase switched to electric motorcycles, resulting in an overall of 31% reduction in transportation emissions (21.1 kgCO<sub>2</sub>e). Surveys showed over half of the participants were willing to change their commuting habits, leading to a 46% emission reduction for them in phase two, compared to 15% for the unwilling. Distance from school was influential, with willing participants living closer (3.7 km vs. 4.8 km). The heart rate variability indicator (root mean square of successive differences between normal heartbeats, RMSSD) also significantly increased on day ten, amidst varying air pollution levels (5.27 to 26.14 ug/m<sup>3</sup>). Extrapolating the participants' carbon emissions to the entire student body, it is estimated that transitioning to low-carbon transport could reduce campus emissions by hundreds of tons annually. We recommend including private transportation in sustainability reports for accurate carbon accounting. Prior research shows physical activity's health benefits. Notably, our short-term study indicated potential health improvements from behavioral changes, specifically shifting from motorcycles to bicycles.

**0313: Non-optimal temperature-attributable mortality and morbidity burden by cause, age and sex under climate and population change scenarios: A nationwide modelling study in Japan**

by Lei Yuan | Lina Madaniyazi | Paul L.C. Chua | Ana M. Vicedo-Cabrera | Chris Fook Sheng Ng | Kazutaka Oka | Kayo Ueda | Aurelio Tobias | Yasushi Honda | Masabiro Hashizume | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Institute of Social and Preventive Medicine (ISPM), University of Bern, Bern, Switzerland; Oeschger Center for Climate Change Research (OCCR), University of Bern, Bern, Switzerland | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Center for Climate Change Adaptation, National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan | Department of Hygiene, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido, Japan | School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan; Institute of Environmental Assessment and Water Research (IDAEA), Spanish Council for Scientific Research (CSIC), Barcelona, Spain | School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan; Center for Climate Change Adaptation, National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan; School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan

Limited studies have projected future effects of temperature on mortality and morbidity in the same study setting. Their findings revealed possible differences in future temperature effects on mortality and morbidity. However, these studies did not consider future population change, human adaptation, or the variations in subpopulation susceptibility. We aimed to simultaneously project temperature-related mortality and morbidity by cause, age, and sex under climate and population

change scenarios in Japan, an iconic super-aged society. We collected daily time-series data on mean temperature, mortality, and morbidity in 47 prefectures in Japan during 2015 and 2019. Mortality and morbidity data were disaggregated by cause (all-cause, circulatory, respiratory), age (< 65 y, ≥ 65 y), and sex. We applied a two-stage time-series regression to obtain prefecture-specific exposure-response relationships. Prefecture- and national-level mortality and morbidity rates due to non-optimal temperatures for the period 2010 to 2099 were projected, considering multiple. A future temporal decline in mortality burden attributable to non-optimal temperatures was observed, driven by greater cold-related mortality than heat-related. In contrast, increased temperature-related morbidity, primarily driven by heat, was evident over time. In the 2050s and 2090s, under a moderate scenario, there were 77.76 (95% empirical confidence interval [eCI] 36.79–115.06) and 72.43 (95% eCI 35.43–106.12) all-cause mortality per 100 000 population, and 276.09 (95% eCI 193.74–358.15) and 306.56 (95% eCI 212.25–413.63) all-cause morbidity associated with non-optimal temperatures. These trends were largely consistent across causes, age, and sex groups. Spatial variations are observed for the mortality and morbidity burden across prefectures. Future heat-attributable health burden is projected to increase substantially, with spatiotemporal variations and is particularly pronounced among individuals ≥ 65 y. Our findings contribute to the pursuit of stronger healthcare investments in ambulance dispatch and hospital preventive measures during heat periods, particularly custom-tailored to address specific health outcomes and vulnerable subpopulations.

**0314: Systematic review of regional interactions of Australia and Pacific Nations: Security and health in climate change**

by Nathan George | David J Heslop | Nicholas J Osborne | University of New South Wales | University of New South Wales | University of Queensland

Examination of the literature has revealed few studies use a transdisciplinary focus to explore how climate change will interact with health and security in the Pacific region. While the identified risks to human health and growing threats to international and national geopolitical security, there are few systematic exploring the interaction of these areas. This shortfall in evidence, guiding response to the intricate and rapidly intensifying consequences of climate change across Australia and the Pacific, exposes institutions generating strategic planning and policy creation to increasing risk. To understand the transdisciplinary influences on the past, present, and future health and security consequences of climate change in the Western Pacific region (including Australia), we conducted a systematic study of the literature, spanning both peer reviewed and grey literature. Impacts of climate change on health were found to have the potential to significantly undermine population health and increase demand of strategic response of countries throughout the region. Key risk areas identified were food and water security, disease proliferation and migration, and extreme weather events. Military personnel were identified as more likely to respond to extreme weather. Information was collected identify metrics which can be used to examine the frequency and scale of strategic responses in the region. Finally, a confined set of parameters were identified to inform researchers of areas of highest risk based on impact scale, frequency, or population impact. Results of this nature can be used to predict future demand on organisations based on historic patterns of response.

**0315: The effect modification of air pollution on heat-related mortality in Bangkok, Thailand**

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Climate change poses a significant threat to human health, particularly for individuals living with chronic diseases. Research indicates that heat and humidity exacerbate the disease burden of cardiovascular diseases (CVD). However, limited studies have explored this relationship in southeast Asian countries, despite their high apparent temperatures due to the tropical climate zone. This research project aims to investigate the heat effect on cardiovascular health in Segamat District of Malaysia, as part of the South East Asia Community Observatory Health and Demographic Surveillance System (SEACO HDSS). Over a six-month period, 150 participants with known CVD utilized consumer-grade wearable devices to collect health data, including heart rate, blood pressure, steps, sleep, and oxygen saturation (SPO2). Additionally, we assessed heat exposures from local weather stations and indoor sensors to understand the impact of heat on human health, with a particular focus on cardiovascular health. Similar to previous studies examining heat impacts on CVDs, we anticipate significant changes in selected health parameters due to exposure to heat in the current climate. For instance, mid-day step counts are expected to decrease with a higher heat index, while heart rates may elevate. We will present the study in detail and the first preliminary results. This study aims to provide robust evidence of impacts of health and humidity on a vulnerable population in community. The findings will contribute to informing policymakers and stakeholders and guiding effective strategies for the future.

**0321: Temporal trends of the association between ambient temperature and hospitalisations for cardiovascular diseases in Queensland, Australia from 1995 to 2016: A time-stratified case-crossover study**

by Peng Lu | Binzhou Medical University

Most studies have only focused on hot temperature and mortality. We aim to investigate the temporal variations in the association between ambient temperature and hospitalisations for cardiovascular diseases in Queensland, Australia from 1995 to 2016. We obtained data on 1,855,717 cardiovascular hospitalisations (mean age: 65.9 years, 42.7% female) from all 443 postal areas in Queensland, Australia between January 1, 1995 and December 31, 2016. Grid-level meteorological data were downloaded from scientific information for landowners. We used a time-stratified case-crossover design fitted with a conditional quasi-Poisson regression model and time-varying distributed lag non-linear model (DLNM) to evaluate the association between temperature and cardiovascular hospitalisations and the temporal trends of the associations. Stratified analyses were performed in different age, sex, and climate zones. In all groups, relative risks (RRs) of cardiovascular hospitalisations associated with high temperatures (heat effects) increased, but cold effects showed a decreasing trend from 1995 to 2016. The increasing magnitude of heat effects was larger ( $p = 0.002$ ) in men than in women and larger ( $p < 0.001$ ) in people aged  $\leq 69$  years than in those aged  $\geq 70$  years. There was no apparent difference amongst different climate zones. The study was limited by the switch from ICD-9 to ICD-10 coding systems, by being unable to separate first-time hospitalisation

from repeated hospitalisations, and possibly by confounding by air pollution or by influenza infections. The impacts of cold temperatures on cardiovascular hospitalisations have decreased, but the impacts of high temperatures have increased in Queensland, Australia. The findings highlight that Queensland people have adapted to the impacts of cold temperatures, but not high temperatures. The burden of cardiovascular hospitalisations due to high temperatures is likely to increase in the context of global warming.

**0322: Effects of rainfall on emergency medical service response time in Kyushu region, Japan: A modification effect by flood areas**

by Athicha Uttajug | Xerxes Seposo | Vera Ling Hui Phung | Muhammad Abdul Basit Ahmad Tajudin | Asuna Arai | Kayo Ueda | Department of Hygiene, Graduate School of Medicine, Hokkaido University, Japan | Department of Hygiene, Graduate School of Medicine, Hokkaido University, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

Patients with severe or acute conditions require prompt emergency medical service (EMS) to prevent further deterioration of their health. However, EMS response time can be adversely affected by weather factors, such as rain and heavy rainfall. In Japan, heavy rainfall often causes floods in the southwestern region such as Kyushu. In light of the projected increase in the intensity and frequency of rainfall due to climate change, understanding the association between EMS time and rainfall could help in preparing the emergency response facilities and systems in the future. We examined the effect of rainfall on EMS response time, as well as a modification effect by flood area in the Kyushu region, Japan. We used a distributed-lag model with gamma distribution to examine the effect of hourly rainfall on EMS response time for 7 prefectures across the Kyushu area, Japan during 2015-2018. The model was adjusted to multiple factors such as temperature, public holiday, day of week, hourly number of dispatched, and rush hour. Pooled effect estimates were then performed using meta-analysis. We also investigated the modifying effect of flood area on the rainfall-EMS response time association. A total of 2,294,044 emergency records were included in this study. The average EMS response time ranged from 8.3 to 9.5 minutes. We found that an increase in 1 mm of hourly rainfall was significantly associated with a delay of 2 (95% CI, 1.8, 24) seconds of EMS response time across the Kyushu region, and the effects are greatest at the current hour and lasted for 3 hours in some prefectures. The effects are more pronounced in flooding areas, but not significantly different compared to non-flood areas. Rainfall was found to be significant in affecting the EMS response time in the Kyushu region, Japan. The findings might help to develop effective interventions for reducing EMS response time.

**0323: Assessing heat vulnerability across life-cycle: Differential impacts on human health**

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Extreme heat is known to have harmful impacts on health; however, little is known about how these impacts differ depending on the life-cycle. We aimed to estimate the association between heat exposure and hospitalization via emergency departments (ED admission) by life cycle. We collected claims data for 18 years (2002–2019) from the Korean National Health Insurance Service-National Sample Cohort. We applied a time-stratified case-crossover design and performed a conditional logistic regression to estimate the association between heat and ED admission. A total of 221,926 ED admissions were recorded in the warm season (June to September) from 2002 to 2019. The heat odds ratio (OR) for ED admission was highest among young adults (aged 19–34) at 1.18 (95% confidence interval (CI): 1.07–1.31), followed by middle-aged adults (aged 35–49) with ORs 1.15 (95% CI: 1.05–1.26) and elderly (aged ≥65) with ORs of 1.10 (95% CI: 1.04–1.17). Furthermore, each age group demonstrated varying susceptibility depending on the cause of admissions, with preschoolers and young adults showing elevated risks for admissions by neoplasm, school-age individuals for mental diseases, middle-aged adults for genitourinary diseases, and senior-aged adults (aged 50–64) and the elderly for respiratory diseases. Our study estimated the risk of ED admission attributable to heat by life-cycle on a national scale and uncovered different risk sizes and major causes of admissions. It underscored the importance of different approaches by age group and causes of admissions.

### **O324: The impact of extreme temperatures on emergency medical service response time in Japan**

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Timely emergency medical service (EMS) is essential for patients with severe or acute conditions to avoid further health deterioration. However, extreme temperatures can influence the EMS response time by changing the demand for ambulance services and the traffic situations. This study aims to quantify the association between hourly ambient temperature and EMS response time in Japan, where the climate varies widely across regions and seasons. We obtained hourly data on ambulance dispatches, response times, and meteorological variables from 47 prefectures in Japan from 2015 to 2020. We used the distributed lag non-linear model (DLNM) with Gamma distribution to examine the overall pattern and compare the temperature-EMS response time relationship across prefectures. We adjusted for rainfall, snowfall, snow depth, day of week, holiday, rush hour, time of day, and total calls per hour. We performed a random-effects meta-analysis to pool the effect estimates. A total of 29,678,642 emergency records were included in this study. The average EMS response time ranged from 7.02 to 9.60 minutes while the overall hourly temperature range for Japan was between -14 to 41°C. Extreme cold and heat were defined as the 5<sup>th</sup> and 95<sup>th</sup> percentile of the temperature distribution respectively. We found that extreme cold (-11.25 with an increase in EMS response time by 53.4 seconds (95% CI: 39, 67.8) while extreme heat (38.25°C) was associated with an increase in EMS response time by

37.2 seconds (95% CI: 33 – 41.4). The effect of extreme cold lasted for approximately 6 hours while the effect of extreme heat lasted for approximately 3 hours. This study shows how extreme temperatures influence the speed of emergency medical services in Japan. The results can inform policy interventions to minimize ambulance delays and improve patient outcomes.

### **O325: Temperature related all-cause, cardiovascular and respiratory mortality in a tropical climate country: a time series analysis**

*by Fadly Syah Arsad | Rozita Hod2 | Norfazilah Ahmad2 | Rohaida Ismail | Norlen Mohamed | Mohd Firdaus Mohd Radi | Yelmizaitun Osman | Mazni Baharom | Fredolin Tangang | Environmental Health Research Centre, Institute for Medical Research, National Institute of Health, Ministry of Health Malaysia | Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur 56000, Malaysia 3 Environmental Health Unit, Disease Control Division, Ministry of Health Malaysia, Putrajaya 62000, Malaysia | Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur 56000, Malaysia 3 Environmental Health Unit, Disease Control Division, Ministry of Health Malaysia, Putrajaya 62000, Malaysia | Environmental Health Research Centre, Institute for Medical Research, National Institute of Health, Ministry of Health Malaysia | Environmental Health Unit, Disease Control Division, Ministry of Health Malaysia, Putrajaya 62000, Malaysia | Hospital Management Service Unit, Medical Development Division, Ministry of Health Malaysia, Putrajaya 62000, Malaysia | Occupational and Environmental Health Unit, Kelantan State Health Department, Ministry of Health Malaysia, Kota Bharu 15590, Malaysia | Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak, Kuala Lumpur 56000, Malaysia 3 Environmental Health Unit, Disease Control Division, Ministry of Health Malaysia, Putrajaya 62000, Malaysia | Department of Earth Sciences and Environment, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia*

Extreme temperatures pose negative impacts on human health, resulting in an increased of mortality rates. This study investigated the correlation between temperature and mortality in the tropical climate areas of two northern Peninsular Malaysia states. The relationship between temperature and mortality was assessed using a generalised linear model with a distributed lag non-linear model. Cumulative effects of high temperature (90–99<sup>th</sup> percentile) and low temperature (1–10<sup>th</sup> percentile) on all-cause mortality were stratified by age groups (0–14, 15–64, and ≥65 years), sex (males and females), and causes of death (cardiovascular and respiratory). High temperature-related mortality showed a stronger association at shorter lags, whereas low temperature-related mortality exhibited a stronger association at longer lags. Elevated temperature-mortality risk was observed among vulnerable groups, including the elderly for high temperature effect with relative risk (RR)=1.09, 95% confidence interval (CI): 1.04, 1.13, and low temperature effect: RR=1.64, 95% CI: 1.47, 1.83; females for high temperature effect: RR=1.10, 95% CI: 1.05, 1.15, and low temperature effect: RR=1.44, 95% CI: 1.28, 1.63; respiratory disease patients for high temperature effect: RR=1.10, 95% CI: 1.03, 1.18, and low temperature effect: RR=1.78, 95% CI: 1.30, 2.44; and cardiovascular disease patients for low temperature effect: RR = 1.37, 95% CI: 1.11, 1.69. Temperature variation was linked to a significantly increased of mortality risk among vulnerable groups particularly for the elderly, females, respiratory and cardiovascular disease patients. These findings could serve as a basis for the development of appropriate policies and intervention strategies to address the health effects of temperature at local and regional levels. Understanding the relationship would be helpful

for stakeholders to efficiently strategies the public health intervention including early warning systems and health promotion.

### **0326: Evaluation of the relative importance of climate indicators for heat stroke cases in Japan**

by Kazutaka Oka | Jinyu He | Yasushi Honda | Yasuaki Hijioka | National Institute for Environmental Studies | National Institute for Environmental Studies | National Institute for Environmental Studies | National Institute for Environmental Studies

Heatstroke caused by the heat island effect and climate change, has become a serious issue in Japan. From a preventive perspective, finding important and predictive climate indicators to assess heat stroke risk is crucial. In this study, we analyzed the relative importance of climate indicators for each location of occurrence of heat stroke cases in Japan. Subsequently, we evaluated the prediction accuracy when the most important climate indicator was adopted as an explanatory variable in the heatstroke prediction model. Analysis was conducted for each of 47 prefectures in Japan. Seven categories of location of occurrence of heatstroke cases, including residence and workplace, were analyzed. The climate indicators considered were the maximum/mean/minimum temperature, precipitation, solar radiation, wind speed, relative humidity, and maximum/mean WBGT of incidence day of heatstroke. Furthermore, the lag and cumulative effects in the climate indicators, and heat acclimatization presented using the climate indicators, were employed. To analyze the relative importance among these climate indicators, a conditional permutation method through the random forest approach was applied. Thereafter, we evaluated the prediction accuracy when the most important climate indicator was adopted as an explanatory variable in the heatstroke prediction model. The relative importance of the climate indicators was ranked for each location of occurrence, and the number of appearances in each ranking was tabulated for each climate indicator. The results showed that, for every location of occurrence, the relative temperature, presenting heat acclimatization, was rated as the most important in more than half of the prefectures among all climate indicators. Relative temperature was also found to yield higher accuracy in more than half of the prefectures, compared to those obtained using daily maximum WBGT, which is commonly employed as explanatory variable in the heatstroke prediction model. The importance of considering heat acclimatization was demonstrated.

### **0327: Health risk after summer flood**

by Yasushi Honda | National Institute for Environmental Studies

Previously, we investigated the increase of heatstroke ambulance visits after the typhoon in Chiba prefecture, which caused the power outage. Here, we investigated the mortality pattern after the July 2018 flood in Japan. We concentrate the area to Okayama prefecture, where the number of casualties was highest among the influenced prefectures. For heatstroke ambulance visit, we observed the relation between the daily number of ambulance visits and daily maximum temperature in each year from 2015 to 2019 by month. Here, we used a simple generalized linear model with log link. We did not take lag effect into account, because our lag evaluation using distributed lag non-linear model showed virtually no lag effect. For the mortality, we selected two cities, i.e., Kurashiki and Okayama; the former experienced a devastating flood, whereas the latter had no direct death due to flood. Then, we calculated the daily mortality ratio, number of deaths in Kurashiki divided by number of deaths in Okayama, for the observation period. The ambulance visit risk in July was lower 2018 compared with the corresponding risk in the other years. The daily mortality ratio was on average less than 0.8, but on the day when the flood occurred, it was 5.7; excluding this day yielded less than 0.8 in July. In August, the ratio was 0.8 and slightly higher than usual, but similar value was observed even in May, before the flood. In Kurashiki-city, almost 60 thousand homes experienced power outage, but the power of 90% of the houses

was restored within 72 hours. This fast restoration would have contributed to no higher risk after the flood. After the summer flood, we did not find obvious increase in post-disaster risk. We added the knowledge about the cascade environmental risk.

### **0331: COVID-19 infectivity through air pollution**

by Samsuri Abdullah | Universiti Malaysia Terengganu

Airborne fine particulate matter (PM<sub>2.5</sub>) is the main pollutant that exists in the urban setting, linked to the infectivity of Coronavirus Disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This research investigates the presence of SARS-CoV-2 genes in PM<sub>2.5</sub> as an environmental indicator to curb public health and infectious disease. Fourteen samples of PM<sub>2.5</sub> were collected between 8 December 2022 - 21 December 2022 in Cheras Kuala Lumpur, Malaysia on quartz filters (20.3 cm × 25.4 cm, Whatman, Kent, UK) by using a high-volume sampler (HVS, PM<sub>2.5</sub> samplers, HVS3000, Ecotech, Australia) for sampling PM<sub>2.5</sub>. RNA extraction and amplification were performed according to the protocol recently set by MACHEREY-NAGEL (A025752/0302). Up to three highly specific molecular marker genes (N, E, and RdRP) were used to test the presence of SARS-CoV-2 RNA. After RNA extraction and expression measurements of N, E, and RdRP genes from all the collected filters, negative results of SARS-CoV-2 RNA were observed. Control tests to exclude false-positive results were accomplished. Further, this research proceeds by correlating the PM<sub>2.5</sub>, COVID-19 data, and meteorology and received prominent results. The intended research significantly provides a baseline in curbing infectious diseases via air quality indicator.

### **0332: Assessing the impact of mobility on PM2.5 variability: Insights from time-activity diary and GPS data**

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Exposure to particulate matter with diameters ≤ 2.5 micrometers (PM<sub>2.5</sub>) has been reported to be associated with a range of individual health issues. The diverse location and activity patterns in daily life could influence on individual exposure to PM<sub>2.5</sub>. The examination of the difference in personal exposure based on spatial-temporal dynamics and activities could help assess the accurate health effect of exposure to PM<sub>2.5</sub>. This study aims to examine the influence of individual activities, locations, and transportation on the variability of PM<sub>2.5</sub> concentration, using time-activity diaries and Global Positioning System (GPS) trajectory. This study performed PM<sub>2.5</sub> monitoring campaign for 66 elderly residents who participated in the Korean Genome and Epidemiology Study and the Korean Frailty and Aging Cohort Study in South Korea from March 31 through June 20, 2023. Cohort participants carried bags equipped with GPS devices and RTI MicroPEMs, providing real-time PM<sub>2.5</sub> measurements every 10 seconds for five days. Participants recorded their activities, locations, and transportation modes in hourly time-activity diaries, which were complemented by GPS data for accuracy. The hourly median PM<sub>2.5</sub> concentrations and the proportional duration of each individual's activities, locations, and modes of transportation were calculated. We examined whether

there were differences in the PM<sub>2.5</sub> median concentrations according to the types of activities, locations, and modes of transportation using the Kruskal-Wallis test. Stepwise regression analyses were then conducted on individual PM<sub>2.5</sub> concentrations. The mean of individual medians of hourly average PM<sub>2.5</sub> concentrations for 66 people in spring and summer was 12.07 µg/m<sup>3</sup> (standard deviation=6.13). The analysis revealed that for every 1% increase in duration sleeping and eating, the median PM<sub>2.5</sub> concentration for individuals decreased by an average of 0.38 µg/m<sup>3</sup> and 0.42 µg/m<sup>3</sup>, respectively. These findings highlight the need to assess PM<sub>2.5</sub> exposure in a way that reflects an individual's activities and travel patterns.

### **O333: Effect of mobile application-based air quality alert system on behaviour and practices related to Ambient Air Pollution in National Capital Region, India**

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National Capital region in India is exposed to higher levels of Ambient Air Pollution (AAP). Mobile based air quality alert system is a relevant intervention for communicating risk among the general population. System of Air Quality and Weather Forecasting and Research (SAFAR) AIR application as the air quality alert system was launched by the Government of India. This study aimed to assess the effect of SAFAR Air application on behavior and practices of people related AAP. A community based cross-sectional follow up study was conducted among urban population belonging to lower socio-economic status in South-east District of Delhi. Baseline assessment using interview schedule of behavior and practices related to AAP was done. An education-based intervention related to SAFAR AIR App use was developed and shared with the participants. Follow-up assessment was done after three months. Descriptive statistical analysis was done. Total 300 subjects recruited in the study of which 53.7% were females. Mean age (SD) of the participants in the study was 36.7 years (13.2). In baseline assessment, only one participant had heard about SAFAR AIR App. In follow up assessment, 17% participants had installed SAFAR AIR App but only 7.6% used it. Only one third of the participants understood about the Air Quality Index using the App. One-third of users changed behavior such as avoiding sending children outdoors, monitored air quality going outside, reduced vehicle use, used face mask, reduced outdoor activities and avoided busy roads. Not able to understand the technical information, non-seriousness towards health hazard of APP were reported barriers to use the App. Use of Mobile based Air Quality Monitoring App was minimal among highly exposed population in Delhi NCR. However, interventions targeting towards awareness generation with user-friendly digital technologies for air quality monitoring might improve the practices at the community level in India.

### **O334: Association between air pollution exposure and epigenetic age acceleration: insights from the Taiwan Biobank**

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Exposure to air pollution has been associated with various health outcomes, but its impact on epigenetic age acceleration (EAA) remains inconclusive. The study aims to assess the relationship between air pollution exposure and EAA in a Taiwanese cohort. The Taiwan Biobank (TWB) has been recruiting community-based adults aged between

30 and 70 years since 2012, with a total of 173,806 participants enrolled by the end of 2022. Among them, 2,469 were selected for blood DNA methylation (DNAm) analysis using the Illumina Infinium MethylationEPIC BeadChipEPIC. DNAm ages were estimated through penalized elastic net regression, and residuals were qualified as TWB Epigenetic Age Acceleration (TWBEAA). Additionally, four EAAs were calculated using Horvath's online DNA Methylation Age Calculator, namely DNAmAgeEAA, DNAmAgeSkinBloodClockEAA, PhenoEAA, and GrimEAA. Air pollution exposure levels at participants' residential townships were estimated from pre-1 day through pre-1 year using a kriging-based spatial interpolation method. Associations were assessed using multiple linear regression models. The TWB epigenetic age-predicting model contained 179 CpG sites with an R-Squared of 0. Mean (SD) and median (IQR) EAA were 0.00 (2.37) and -0.08 (3.01) years, respectively. In the single-pollutant model, we observed significant positive associations between long-term exposure to PM<sub>2.5</sub> ( $\beta = 0.39$  [0.22–0.56], every IQR = 12.4 µg/m<sup>3</sup>), SO<sub>2</sub> ( $\beta = 0.14$  [0.05–0.23], every IQR = 0.91 ppb), O<sub>3</sub> ( $\beta = 0.15$  [0.03–0.27], every IQR = 2.76 ppb), and TWBEAA. In the two-pollutant model, only PM<sub>2.5</sub> remained robust, while other pollutants did not exhibit consistent associations. Similar adverse effects of air pollution exposure were observed for DNAmAgeEAA and DNAmAgeSkinBloodClockEAA. This study represents one of the first attempts to quantify epigenetic clocks using an Asian population-based predicting model. Findings suggest that exposure to air pollution may accelerate epigenetic aging, particularly to PM<sub>2.5</sub>.

### **O335: Short-term effect of ozone exposure on out-of-hospital cardiac arrest risk: a nationwide case-crossover study in Japan from 2012 to 2019**

by Zhesi Yang | Chris Fook Sheng Ng | Kayo Ueda | Sunao Kojima | Shin Araki | Hikari Shimadera | Satoru Chatani | Takanori Ikeda | Yoshio Tahara | Naohiro Yonemoto | Masahiro Hashizume | the JCS-ReSS Group | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan | Department of Hygiene, Graduate School of Medicine, Hokkaido University, Sapporo, Japan | Graduate School of Medical Sciences, Kumamoto University, Kumamoto, Japan | Graduate School of Engineering, Osaka University, Suita, Japan | National Institute for Environmental Studies, Tsukuba, Japan | The Japanese Circulation Society with Resuscitation Science Study (JCS-ReSS) Group, Tokyo, Japan

Ozone (O<sub>3</sub>) is a harmful air pollutant linked to cardiovascular problems. In Japan, O<sub>3</sub> levels remain high. However, current evidence on the association between daily O<sub>3</sub> exposure and cardiovascular risk is limited. Additionally, existing studies have not accounted for the heterogeneous spatial distribution of O<sub>3</sub>, which is a secondary air pollutant dependent on photochemical processes. This study aims to assess the short-term effect of O<sub>3</sub> exposure on the risk of Out-of-Hospital Cardiac Arrest (OHCA) using modeled and monitoring exposure in Japan from 2012 to 2019. We simulated daily maximum 8-hour O<sub>3</sub> data using Community Multi-scale Air Quality Model (CMAQ) at a 15km x 15km resolution across Japan and weighted the values by populations at a 1km x 1km scale in 47 prefectures from 2012 to 2019. Daily data on OHCA and average air temperature were sourced from The All-Japan Utstein Registry and Japan Meteorological Agency, respectively. In a two-stage analysis using a time-stratified case-crossover study, we applied a conditional quasi-Poisson model to estimate prefecture-specific O<sub>3</sub>-OHCA associations using single and multi-lag exposure up to 3 previous days (lag 0-2). Subsequently, prefecture-specific results were pooled using a multivariate random-effects meta-regression model. For sensitivity checking, we repeated the analysis using O<sub>3</sub> data from monitoring stations in the capital city of each prefecture. A total of 610,613 OHCA of cardiac origin were included in the final analysis. O<sub>3</sub> showed a significant association with OHCA from lag 0 to lag 2. The largest risk estimate was

at lag 0-2, with a relative risk (RR) of 1.006 (95% CI: 1.001-1.010) for every 10ppb increase in population-averaged O<sub>3</sub>. Analysis using O<sub>3</sub> data from ground monitors produced a higher RR of 1.016 (95% CI: 1.011-1.020), while the lag pattern remained consistent. Short-term exposure to O<sub>3</sub> was associated with an increased risk of OHCA.

### **O336: Evaluation of PM2.5 exposure contribution rate using similar cluster analysis and micro-environmental model**

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People do not stay in one place but move to various micro-environments where they are exposed to different indoor pollutants. Therefore, using time-activity patterns to accurately evaluate exposure to air pollutants, including PM<sub>2.5</sub> indoor and outdoor environmental concentrations, can be used in exposure assessment and prediction models. An exposure scenario was constructed through similarity cluster analysis of the entire weekday population from the 2019 Time-Use Survey of Statistics Korea. An active-simulation of PM<sub>2.5</sub>, according to the GPS-tracked exposure assessment of population pathway. As a result of K-means cluster analysis based on classifying weekday participants based on Jaccard similarity, 12 clusters were derived through silhouette scores. An exposure scenario for 24 hours per day was constructed according to the characterized clusters, and the researcher wore an PM<sub>2.5</sub> LSC (low-cost sensor) device and GPS tracker. The micro-environment in which people stayed the longest was at home, with some clusters including people who stayed at home for 40–80% of the day; the ratio of time spent indoors exceeded 0.90. The exposure contribution rate evaluation showed that the exposure contribution rate at home was high but decreased or remained constant when the concentration was low or the concentration in other indoor areas was high. Transportation time outdoors and on public transportation was short, and high exposure to other indoor areas affected the contribution rate. Residence time affected exposure to the micro-environment. Improvement measures should be prepared for each group by prioritizing them according to their exposure contribution rate. Time-activity patterns are influenced by the degree of urbanization of the residence, whether in or outside the city, age, gender, education level, and smoking habits. Sub-populations can be classified according to similar situations. This is very effective because it allows exposure management of the management target area according to the characteristics of the sub-population group.

### **O337: Excess deaths associated with long-term exposure to ambient PM2.5, O3, and NO2 in China**

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World Health Organization updated the target of annual mean PM<sub>2.5</sub> and NO<sub>2</sub> from 10 and 40 μg m<sup>-3</sup> to 5 and 10 μg m<sup>-3</sup>, respectively, in 2021 and added peak-season O<sub>3</sub> target as 60 μg m<sup>-3</sup>. Recent evidences proved that peak-season O<sub>3</sub> is related to increased death risk from non-accidental and respiratory diseases and long-term exposure to ambient NO<sub>2</sub> shows statistically independent effects on excess mortality. Based on these new evidences, we estimate excess deaths associated with long-term exposure to ambient PM<sub>2.5</sub>, O<sub>3</sub> and NO<sub>2</sub> in China following the counterfactual analytic framework from Global Burden Disease. Excess deaths from non-accidental diseases associated with long-term exposure to ambient O<sub>3</sub> in China reaches to 579 (95% confidential interval (CI): 93, 990) thousand in 2020, which has been significantly underestimated in previous studies. This is comparable to excess deaths from non-accidental diseases associated with long-term exposure to

ambient NO<sub>2</sub>; 279 (95% CI: 189–366) to 339 (95% CI: 231–442) thousand. In addition, the increased excess deaths associated with long-term O<sub>3</sub> exposure (234 (95% CI: 177, 282) thousand) in 2013–2020 offset three quarters of the avoided excess deaths (302 (95% CI: 244, 366) thousand) mainly due to PM<sub>2.5</sub> exposure reduction. In key regions (the North China Plain, the Yangtze River Delta and the Fen-Wei Plain), the former is even larger than the latter, particularly in 2017–2020. Health benefit of PM<sub>2.5</sub> concentration reduction offsets the adverse effects of population growth and aging on excess deaths attributed to PM<sub>2.5</sub> exposure. Considering the faster population aging process in the future, collaborative control, and faster reduction of PM<sub>2.5</sub>, O<sub>3</sub> and NO<sub>2</sub> are needed to reduce the associated excess deaths.

### **O341: The global burden of chronic obstructive pulmonary disease attributable to occupational exposure to particulate matter, gases, and fumes in 204 countries and territories, 1990-2019: a comparative study**

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The rising focus on chronic obstructive pulmonary disease (COPD) induced by occupational exposure to particulate matter, gases, and fumes (PMGF) highlights the need for thoroughly understanding its spatiotemporal trends to aid in preventing and controlling work-related respiratory diseases globally. Data on occupational PMGF-related COPD for 204 countries and territories from 1990 to 2019 were extracted from the 2019 Global Burden of Disease Study (GBD 2019). Estimated number of COPD deaths and disability-adjusted life years (DALYs), as well as the age-standardized mortality rate (ASMR) and age-standardized DALY rate (ASDR), was conducted by gender, age, region, and country. Joinpoint software was utilized to calculate the annual average percent change (AAPC) in ASMR and ASDR over time. In 2019, around 0.52 million deaths and 11.60 million DALYs globally were attributed to occupational PMGF-related COPD; males accounted for a majority of these cases. Looking at regions, the middle Sociodemographic Index (SDI) areas faced the most considerable burden. East Asia and South Asia ranked as the two geopolitical areas bearing the greatest burden, each contributing approximately 33% and 35% to the global figure, with China and India serving as representative countries, respectively. The worldwide burden of COPD attributed to PMGF exposure demonstrated a notable decline in age-standardized rate, evidenced by AAPCs in ASMR and ASDR of -2.10 (95% Confidence Interval: -2.20, -2.00) and -2.02 (95% CI: -2.11, -1.93), respectively. During the same period, the total COPD deaths and DALYs rose roughly 1.2-fold, with absolute reductions observed only in high SDI regions, East Asia, and Eastern-Southern Europe. The AAPCs for ASMR and ASDR were significantly negatively correlated with their respective standardized rates. Our study underscores the importance for local governments, particularly those in middle SDI-level East Asian and South Asian countries severely affected by industrial PMGF pollution, to continuously improve occupational health regulations during economic activities.

### **O342: Impact of heat hazards on outdoor workers: insights from a longitudinal study in Taiwan**

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Outdoor workers, including construction laborers and farmers, play crucial roles in infrastructure development and food production. However, they are highly vulnerable to the impacts of climate change. The increasing frequency of hot days raises concerns about potential heat-related risks for these workers. This study aims to assess the adverse effects of elevated temperatures, resulting in heat hazards on outdoor workers, using longitudinal data obtained from the Farmer and Labor Insurance Database. The study conducted a comprehensive analysis using records from the National Labor Insurance Research Database, Farmers' Health Insurance, and National Health Insurance Research Database Spanning from 2015 to 2020. Heat hazards were identified as individuals diagnosed with heat-related conditions such as heatstroke, heat exhaustion, and heat cramps (ICD10: T67). The cohorts included the "Construction industry workers" and "Farmers," while the comparison group comprised individuals from the "Manufacturing industry workers," classified through the International Standard Industrial Classification of All Economic Activities. Age-standardized incidence and trends were calculated based on the WHO2000 standard population. The study involved 211,642 construction workers, 153,188 farmers, and 3,641,221 employees in manufacturing. The construction worker cohort showed an increasing trend in the age-standardized incidence of heat hazards, from 119 per 100,000 individuals in 2015 to 219 per 100,000 individuals in 2020. Among farmers, a U-shaped correlation between temperature and heat hazard risk was observed. Optimal mean temperatures for preventing heat hazards varied regionally from 14°C to 29°C. Interestingly, the temperature considered optimal for human health gradually rose in southern regions. This research underscores the heightened risk of heat hazards faced by outdoor workers, particularly in the construction and farming sectors. The regional variability in optimal temperatures highlights the necessity for targeted intervention strategies to mitigate heat-related risks in these vulnerable groups.

#### **O344: Risk factors of workplace violence among female clinical nurses in Taiwan**

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Workplace violence is a global issue. Studies suggest that the health-care workers face higher risks, with nurses particularly vulnerable. Therefore, this study aims to investigate the experiences of workplace violence among nurses and explore the associated risk factors. This study adopted a cross-sectional design and employed geographically stratified random sampling of approximately 458 eligible hospitals nationwide. A total of 1,753 nurses were included in the analysis. Logistic regression analyzed risk factors correlation with workplace violence, while population attributable risk assessed the impact of risk factors on workplace violence. For the overall workplace violence, being single, working in the emergency department or psychiatric unit, working more than 48 hours per week, and being employed in a medical center were associated with increased risk of workplace violence (OR=1.37-2.82). Having hospital violence prevention measures reduced risk (OR=0.61). For verbal abuse, being single, working >10 years, emergency department, working more than 48 hours per week, and being employed in medical centers were associated with increased risk (OR=1.53-2.41). Verbal harassment risk was higher in emergency or psychiatric units (OR=3.27-7.40). For physical harassment, emergency department or psychiatric unit and working more than 48 hours per week faced higher risks (OR=1.84-6.87). The population attributable risks associated with working more than 48 hours per week accounted for 7.7% in the overall workplace violence,

8.8% in verbal abuse, and 14.4% in physical harassment. Lacking workplace violence prevention measures at the hospital accounted for 5.3% attributable risk in the overall workplace violence. Being single, emergency department or psychiatric unit, having more than 48 hours of work per week, and being employed in medical centers are associated with higher risks of workplace violence among nurses. This study provides risk factors associated with different types of workplace violence and underscores the importance of implementing relevant measures to reduce the occurrence of workplace violence.

#### **O345: Effectiveness of health belief model educational intervention on promoting ultraviolet radiation preventive practice towards skin cancer among paddy farmers in Kuala Selangor**

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Climate change is increasingly recognized as a significant cause of various health hazards, including the increase of non-ionizing radiation (NIR) levels in the environment. The elevation in NIR, particularly ultraviolet radiation (UVR), contributes to the rise in the number of skin cancer cases with the prevalence of 1 in 3 cancer cases worldwide. More than 1.5 million new cases of skin cancer were estimated in 2020. In Malaysia, the number of skin cancer cases percentage increased; 7.8% for malignant melanoma (MM) and 31.4% for other skin cancers including Non-Melanoma Skin Cancer (NMSC) from 2007 to 2016. Exposure to UVR has become an important external risk factor for skin cancer although it is preventable with good UVR preventive practice. Paddy farmers in Kuala Selangor face substantial UVR exposure due to their nature of long hours working outdoor, making them particularly vulnerable. The aim of this study is to develop, implement, and evaluate the effectiveness of educational intervention based on the health belief model (HBM); BIJAK MENTARI, on promoting UVR preventive practice towards skin cancer among paddy farmers in Kuala Selangor. The two-arm cluster randomized controlled trial involved 96 paddy farmers (control, n = 48; intervention, n = 48), with a structured intervention delivered over two weeks followed by three months of reinforcement through a weekly WhatsApp message. The effectiveness of the intervention was analyzed using a generalized linear mixed model (GLMM). This study achieved a 100 percent participation rate. At 3 months post-intervention, the intervention groups showed significantly improved knowledge, attitude, perceived susceptibility, perceived severity, perceived benefit, perceived barrier, cues to actions, self-efficacy, and UVR preventive practices ( $p < 0.001$ ) compared to the control group. The BIJAK MENTARI module effectively improves the participants' knowledge, attitude, perceived susceptibility, perceived severity, perceived benefit, perceived barrier, cues to actions, self-efficacy, and UVR preventive practices.

#### **O346: Factors associated with heat strain among security personnel in Kota Kinabalu, Sabah**

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The outdoor personnels has often been associated with frequent and prolonged heat exposures, particularly in tropical countries like Malaysia. Apparently, populations like security personnel who are stationed outdoors are being exposed to heat and are at risk of developing

heat-related illnesses. This study was undertaken to investigate the prevalence and the associated factors with heat strain among security personnel in Kota Kinabalu, Sabah was conducted. Screening for heat exposing activities at posting location and the subsequent heat strain score index (HSSI) was assessed among the public university security personnel. Data analysis was conducted by using the SPSS version 29. Descriptive analysis and cross-tabulations were conducted, and statistical significance was considered at  $p < 0.05$ . Among 59 respondents participated, 35 (59.3%) were experiencing low heat strain, 18 (30.5%) were having the potential heat strain and 6 (10.2%) were having the onset of heat-related illnesses. Screening of activities revealed that at every posting location, risk of heat stress was prominent. Among respondents having low heat strain, demonstrated that heat mitigation control was practiced. As majority of respondents showed low heat strain, this indicates that moderately good occupational health practices are in place. In addition, surrounded with vegetation, greeneries and tall shady trees that canopied the environment were significant microclimate mitigations aid in cooling down the warm temperatures in the external surroundings. Control measures such as buddy system, shiftwork and post-location rotations contributed to overcoming the heat strain issues. Health deterioration led by heat strain could be controlled by continuous and prompt efforts in heat mitigation control measures.

**O347: The impact of antimicrobial resistance (AMR) educational module on knowledge and attitude towards the effect of AMR on Environment among primary school students in Kota Belud, Sabah, Malaysia**

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AMR not only threatens human and animal health but also affect the environment. Natural environments such as water, soil and air acts as an AMR reservoir. The spread of AMR in the environment poses risks to human health, socioeconomic system and ecosystems. Health education and interventions should be conducted which include the basic concepts of antimicrobials, the appropriate use and the impact of misuse. This study was designed to assess the impact of AMR education on knowledge and attitude in primary school students on the effect of AMR on environment. A quasi-experimental design which uses pre-test and post-test questionnaire with control and intervention groups was conducted at four primary schools in Kota Belud, Sabah. Primary school's students aged 10-12 years old were recruited in this study. The students were divided into control group and intervention group. A self-administered pre-test and post-test questionnaire was used to collect baseline information on participants' knowledge and attitude towards AMR. Participants in intervention group received the full program of AMR Module while the participants in control group were not exposed to any intervention. Paired t-test and independent sample t-test were used to analyse the data. 270 primary school's students participate in this study with 135 students in each group. The result showed that the mean score of knowledge towards AMR in the intervention group significantly increased from 17.48 to 21.71 ( $p < 0.001$ ), but no significant increase on the control group, 13.76 to 14.33 ( $p = 0.157$ ). Meanwhile, the attitude on AMR showed the mean score in intervention group were significantly increased from 27.90 to 32.13 ( $p < 0.001$ ), but no significant increased on the control group, 27.73 to 27.75 ( $p = 0.955$ ). Educational intervention is an effective way to improve the knowledge and attitude of primary school students towards AMR. The AMR Module develop can be used for future study to raise awareness on AMR in an effort to combat AMR.

**O352: The association between living environment and poor sleep quality among female workers in Hong Kong**  
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The increasing poor sleep in the global population has raised concerns regarding the well-being and sustainability of humans. Although recent studies showed significant association between sleep quality and environment, the findings were inconsistent among populations. The aim of the present study was to examine the association between poor sleep quality and living environment in Hong Kong, including living district, house type, home ventilation, etc. A cross-sectional study was conducted in Hong Kong from 2022.03-2023.02. Social demographic information, living environment and other related factors were collected from full-time female workers older than 18 years old. Sleep quality was assessed by Pittsburgh Sleep Quality Index (PSQI), with a cutoff point of six. Logistic regression model adjusting for relevant covariates was used to assess the association between sleep quality and living environment. Analyses were conducted by SAS 9.4. Ethics approval: CREC 2021.228. Responses were received from 754 full-time females workers. The average age of the workers was  $34.0 \pm 8.2$  years old, and they had worked  $9.9 \pm 8.1$  years averagely. There were 567 (75.2%) participants scored 6 points or higher on PSQI, with an average score of  $7.8 \pm 3.2$  points. The multivariate logistic regression model showed that the district of residence (West vs. East Cluster: OR=4.86, 95%CI: 1.54-15.26,  $p = 0.003$ ), the number of family members living together (1 vs. 2: OR=3.86, 95%CI: 1.63-9.11,  $p = 0.003$ ), and secondhand smoke at home (Yes vs. No: OR=2.72, 95%CI: 1.51-4.91,  $p = 0.001$ ) were associated with poor sleep quality. Interestingly, workers who were evening chronotype were likely to sleep poor compared with that of the morning type workers (OR=0.34, 95%CI: 0.19-0.63,  $p = 0.011$ ). Our findings provided preliminary evidence that living environment is linked to poor sleep among urban female workers. When trying to improve the urban living environment more accessible, policymakers may pay more attention to female workers' living needs.

**O353: Plastic waste composition and its management: A comparative study between rural and urban areas in a mountainous districts of Vietnam**

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In Vietnam, alongside population growth and economic development, plastic products are widely used. However, the plastic waste (PW) management situation in rural, particularly mountainous regions, has not been understood yet. Therefore, this study aims to describe the PW situation in rural (mountainous) areas compared with urban areas in the Vo Nhai district. In the study area (the total population: 69,792, rural population rate: 94%), we conducted a questionnaire survey (100 households) in 2023 to describe the existing waste management. We monitored 40 households for 15 days to measure the total amount of solid waste (SW) and the types of PW. Among rural participants, 100% of households lack access to waste collection services and their common method to manage the waste was self-processing through burning or burying waste (including plastic, organic waste and glass) in fields or gardens. In the 15-day measuring survey, the proportion of PW in SW is 7.03% (rural) and 9.52% (urban). The generation coefficients (kg/person/day) of PW were 0.023 (rural) and 0.038 (urban), and those of SW were 0.327 and 0.404, respectively ( $P < 0.001$ ). Among the seven categories of LDPE, major types were the largest component (rural: 25.87%, urban: 25.29%). Polypropylene (11.90%, 14.19%) and Polystyrene



(10.89%, 13.38%) were higher in urban, and others are not significantly different in composition. Although the daily amount of PW in rural was significantly lower than that in urban, it was only 0.015 kg difference per person. With 94% of the population living in mountainous without access to waste collection services, PW was not appropriately managed in the areas. The study described the PW situation in rural areas in Vietnam and showed the importance of establishing a waste management system in rural areas and reducing plastic waste in their daily life.

### **O354: Ventilation as a protective measure: investigating the relationship between indoor air quality and cardiovascular health**

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Indoor air pollution and the state of indoor ventilation have become increasingly pressing public health issues. This study aims to investigate whether effective indoor ventilation can mitigate the association between indoor air pollution and cardiovascular hemodynamics. We assessed the cardiovascular hemodynamics of 73 participants residing in 60 households and simultaneously conducted a 24-hour indoor pollution monitoring. Households with a 24-hour average CO<sub>2</sub> concentration above 600 ppm were categorized as having poor ventilation, while those with concentrations below 600 ppm were classified as having good ventilation. We employed mixed-effects regression models to investigate the relationship between real-time, hour-to-hour monitoring of indoor air pollution over 24 hours and the 24-hour cardiovascular function, stratified by ventilation status and incense burning habits, while controlling for relevant covariates. Among the participants living at homes with poor ventilation status, an IQR increase of CO, CO<sub>2</sub>, TVOC, formaldehyde, PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> concentration was associated with increments of 5.2, 2.9, 6.9, 7.5, 1.8, 1.9 and 2.0 mmHg in systolic blood pressure, 2.1, 1.4, 2.7, 2.7, 0.7, 0.8 and 0.8 mmHg in diastolic blood pressure, 2.9, 2, 2, 4.5, 1.1, 1.2 and 1.2 beats per minutes in heart rate, and 0.13, 0.12, 0.09, 0.01, 0.06, 0.06 and 0.07 L/min/m<sup>2</sup> in cardiac index, respectively. The estimated effects of indoor air pollution on cardiovascular function were attenuated in households with good ventilation status and deteriorated in those with incense burning habit. Maintaining indoor CO<sub>2</sub> levels below 600 ppm helped reduce the impact of indoor air pollution on cardiovascular health, especially among individuals who have a habit of burning incense. This approach can be considered a potential strategy for safeguarding cardiovascular well-being in the future. Provide a robust evidence of adverse cardiovascular effects of indoor air pollution.

### **O355: Measurement and analysis of intra-urban environmental noise in Melbourne, Australia**

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This study assessed the performance of a cost-effective, accessible, and adaptable model of environmental noise exposure across Melbourne, Australia. Environmental noise levels were estimated using a lower resolution version of Common Noise Assessment method in Europe (CNOSSOS-EU), which was modified to predict road traffic noise for epidemiological studies. Using this model and inputting Melbourne-related land-use and traffic volume data, the CNOSSOS-Melbourne model estimated large-scale spatial estimates of daily, daytime, and

nighttime traffic-related noise levels (LAEQ in decibels (dB)). Modelled estimates were examined against 161 observed short-term (20-minute roadside sites: LAEQ<sub>day</sub>) and 141 long-term (7-day residential and traffic sites: LAEQ<sub>daily</sub> and LAEQ<sub>night</sub>) around Melbourne. Relationships and congruency were analysed using scatterplots, correlations, Bland-Altman plots and intraclass correlations (ICC). Multilevel linear regression models assessed if differences between modelled and observed methods were explained by external factors rather than limitations within the modelling. The ICC indicated moderate reliability (0.5-0.75) between short- and long-term observed and modelled LAEQ. Bland-Altman plots illustrated that short-term observed LAEQ<sub>day</sub> had a bias of -0.6 dB with 88% of readings within 95% confidence intervals (95%CI); long-term observed LAEQ<sub>daily</sub> had a bias of +1.1 dB with 97% of readings within 95%CI. Regression models indicated that the strongest predictors of short-term modelled noise measures were traffic (coefficient=11.41, 95%CI 7.70-15.13) and commercial land-use areas (8.29, 95%CI 3.24-13.33); and for long-term noise measures noise monitor placement being located further from the street (-0.24, 95%CI -0.35—0.13) or on a multi-storey building (5.10, 95%CI 0.22-9.98). These results indicate that the CNOSSOS-Melbourne model performs well with low levels of bias and error using observed short-term and long-term measurements. Utilisation of this accessible, adaptable, and cost-effective noise model can help identify the spatial variations in environmental noise in cities with different urban planning than is typically found in Europe.

### **O356: Assessment of indoor air quality in school classrooms using internet of things based air monitoring sensors**

by *Youngtae Choe | Jihun Shin | Gihong Min | Sanghoon Lee | Daehwan Kim | Wonho Yang | 1Department of Occupational Health, Daegu Catholic University, Gyeongbuk, 38430, South Korea | 1Department of Occupational Health, Daegu Catholic University, Gyeongbuk, 38430, South Korea | 1Department of Occupational Health, Daegu Catholic University, Gyeongbuk, 38430, South Korea | 1Department of Occupational Health, Daegu Catholic University, Gyeongbuk, 38430, South Korea | 1Department of Occupational Health, Daegu Catholic University, Gyeongbuk, 38430, South Korea*

School classrooms have one of the highest population densities per unit compared to indoor environments such as houses or commercial buildings. Students are likely to be exposed to indoor air pollutants because they spend most of their time in the classroom. Consequently, effective IAQ management in classrooms is crucial for students who spend extended periods in school. This study aims to evaluate the indoor air quality in school classrooms and propose management methods. This study was conducted in 32 classrooms from 24 schools located in Daegu, the third-largest city in Korea, between July and December 2019. Target schools were selected within a radius of 1 km from a fixed ambient air monitoring site to measure outdoor PM concentrations. Sensor-based instruments were installed in each classroom to measure concentrations of pollutants, including PM<sub>10</sub>, PM<sub>2.5</sub>, and CO<sub>2</sub>. Moreover, the efficiency of the air purification system was evaluated. Questionnaire surveys were conducted online four times among 2511 students to assess students' perceived air quality in the classroom. The PM<sub>10</sub> concentration in the classroom was lower than the school health act standard concentration of 75 µg/m<sup>3</sup>. In contrast, the average concentration of PM<sub>2.5</sub> was higher than the school health act standard concentration of 35 µg/m<sup>3</sup>. CO<sub>2</sub> concentrations in most classrooms exceeded 1000 ppm, indicating an insufficient ventilation rate. Considering the perceived IAQ according to satisfaction and health effects, students felt that they were significantly more affected by CO<sub>2</sub> than PM in the classrooms. As an

assessment result of the efficiency of the air purification systems, the PM concentration was reduced by 30%. However, CO<sub>2</sub> concentrations in most classrooms exceeded 1000 ppm, thereby indicating an insufficient ventilation rate, suggesting the simultaneous control of PM and CO<sub>2</sub>.

### **O357: Navigating risk communication dynamics: Insights from remote communities amidst the COVID-19 pandemic in Sabah, Malaysia**

by *Sahipudin Saupin* | *Mahjom M.* | *Universiti Malaysia Sabah* | *Ministry of Health, Malaysia*

Given the significant impacts wrought by the COVID-19 pandemic, especially in remote regions, this study examines the intricacies of risk communication within such locales. Employing a nuanced approach melding quantitative and qualitative methodologies, the investigation centers on remote communities nestled in Sabah, Malaysia. A two-phase stratified sampling methodology was deployed, incorporating surveys spanning four distinct stages of data collection. Quantitative data underwent rigorous analysis utilizing SPSS, while qualitative data underwent comprehensive processing via ATLAS.ti 23 software, entailing transcription, coding, thematic development, and subsequent reporting. Our investigation reveals that within remote communities, COVID-19 information predominantly emanates from traditional media channels (television and radio) alongside social media platforms. Notably, the West Coast Division heavily relies on television and radio (91.5%) in conjunction with social media (78.6%), a trend mirrored in the Tawau Division (100% and 93.7%, respectively). Conversely, the Interior Division exhibits a preference for television and radio (91.4%) alongside interpersonal sources such as friends and family (47.8%). Similarly, the primary sources in the Kudat Division encompass television and radio (95.7%) complemented by social media (47.8%). In Sandakan, television and radio (91.7%) stand out as the principal sources, closely followed by social media (90.6%). Perceptions of understanding vary among these communities, with Sandakan residents feeling the most well-informed (91.7%) and those in the Interior Division reporting the lowest sense of awareness (34.8%). However, across all communities surveyed, there exists a unanimous consensus regarding the adequacy of the information provided (100%). Ultimately, the predominant avenue for risk communication in remote locales remains entrenched within traditional media platforms. This investigation contributes to elucidating efficacious strategies tailored for risk communication within such contexts.

### **O411: Thriving Together: Navigating Natural and Chemical Disaster Challenge with Community Resilience**

by *Loganathan Salvaraji* | *Johor State Health Office, Malaysia Ministry of Health.*

Disasters cause annual losses exceeding billions in over 100 countries, with approximately 1.5 million lives lost over a 20-year period. Bottom-up strategies is crucial to strengthen the community's capacity to handle and mitigate disasters, enhance their risk awareness, and reduce vulnerability. Community Based Disaster Risk Management (CBDRM) was conducted at Kampung Sungai Cengkeh, Johor which is located near to oil and gas industrial area and Pulai River. Mixed method approach combining key information from community leaders, document analysis, secondary data analyses and local disaster management. Disaster risk analysis calculate the potential hazard occurrence (PHO) and severity due to disaster (S) in the community involved. The program was explained to government officials and community leaders. Twenty-nine (29) villagers participated in a briefing session by an industrial team about company profiles, compliance with regulations and acts, emergency plans and communication to nearby communities. Town hall session was held with 62 participants divided into four zones. High (Disaster Risk  $\geq 10$ ) and very high (Disaster risk  $\geq 20$ ) potential disaster hazards are oil spillage, flood, air pollution, farm fire and wildlife. Safe evacuation areas, communication strategies and resource management

were identified for early survival of the community. Additional survival skill and knowledge were introduced to the community including grab bag establishment, cardio-pulmonary resuscitation, and firefighting skills. The key for a successful community resilience during disaster lies in creating awareness of the hazards and maintaining momentum for good practices at the community level.

### **O412: The long-term effect of oil spill exposure on dyslipidemia: follow-up in the Hebei spirit oil spill cohort study**

by *Ji-young Lee* | *Yun-Hee Choi* | *Da-An Huh* | *Kyong Whan Moon* | *Min-Sung Kang* | *Yong-Jin Lee* | *Department of Health and Environmental Science, Korea University, Seoul, Korea* | *Department of Ophthalmology, Korea University College of Medicine* | *Institute of Health Sciences, Korea University* | *Department of Health and Environmental Science, Korea University, Seoul, Korea* | *Institute of Environmental Medicine, Soonchunhyang University Cheonan Hospital, Cheonan, Korea* | *Institute of Environmental Medicine, Soonchunhyang University Cheonan Hospital, Cheonan, Korea*

The Hebei Spirit oil spill was the largest marine pollution accident in Korea, resulting in the release of 12,547kL of crude oil. Residents lived close to the accident area and participated in oil clean-up work for up to 15 months, causing them to be exposed highly to crude oil. Several studies suggested that polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) in crude oil could cause metabolic syndrome through endocrine disturbance. Despite the long exposure to oil and its effects on lipid metabolism, only a few studies explored their long-term effects. Thus, we aim to investigate the longitudinal associations of oil spill exposure on dyslipidemia. Health Effects Research of Oil Spill (HEROS) is a prospective cohort study that was conducted from 2009 to 2018. In this study, 1,713 adults ( $\geq 19$  years old) who had not been diagnosed with dyslipidemia at the baseline survey were included. Two indicators were used to evaluate oil exposure: the distance of residence from the contaminated shoreline; and the duration of oil clean-up work. We used the Robust Poisson regression model to estimate the long-term effects of exposure to oil spills on the incidence of dyslipidemia. After adjusting all covariates, high-exposure areas close to the shoreline had a higher risk for dyslipidemia than the low-exposure group [risk ratio, RR (95% confidence interval, CI) = 1.67 (1.26, 2.22)]. Furthermore, oil clean-up work duration was associated with the increased risk of dyslipidemia in the longest duration group ( $>150$  days) [RR (95% CI) = 1.54 (1.04, 2.27)] and a significant linear relationship was observed ( $p$  for trend = 0.023). Oil exposure was associated with an incidence of dyslipidemia in adults after the oil spill. These findings suggest that continuous monitoring and management of dyslipidemia is required in nearby residents.

### **O413: Association between tropical cyclones and cause-specific mortality in Korea**

by *Changwoo Han* | *Chungnam National University*

While the adverse health effects of natural disasters are gaining public interest, evidence regarding the mortality effects of tropical cyclones in Korea remains scarce. Therefore, utilizing detailed cyclone moving routes and cause-specific mortality data in fine administrative units of Korea, this study evaluated the mortality effects of cyclones using a natural-experiment framework. Region (si, gun, gu) specific mortality data (all, non-accidental cardiovascular, cancer, respiratory, accidental mortality) and cyclone data (date, moving route, storm and wind range) from 2002 to 2023 were obtained from the governmental database. Generalized synthetic control analysis coupled with meta-analysis were used to estimate the average mortality effect of tropical cyclone exposure during the two weeks following the event in cyclone exposed region. Among the 21 cyclones that made landfall on the Korean peninsula, nine tropical cyclones (2007 Nari, 2010 Dianmu, 2010 Kompasu,

2012 Khanun, 2012 Tembin, 2016 Chaba, 2019 Mitag, 2020 Jangmi, 2021 Omais) with clearly defined exposed and non-exposed regions were selected for analysis. During the two weeks following each cyclone, there was a daily increase of 0.02 (95% CI: 0.01, 0.04) persons in mortality in each cyclone-exposed region compared to non-exposed regions. For cause-specific analysis, there were changes of 0.02 (95% CI: -0.01, 0.05) persons for cardiovascular, 0.02 (95% CI: -0.02, 0.07) for respiratory, 0.01 (95% CI: -0.01, 0.04) for cancer, and 0.03 (95% CI: -0.01, 0.07) for external injury mortalities in cyclone-affected regions. There was a clear increase in mortality in cyclone-exposed subregions in Korea. Further analysis of vulnerable populations and changes in hospital usage after the cyclone is warranted.

#### **O414: Pollution control strategies using scenarios modelling in tropical river**

by *Tengku Nilam Baizura Tengku Ibrahim* | Department of Environmental Health, Faculty of Health Sciences, Universiti Teknologi MARA, Cawangan Pulau Pinang, Kampus Bertam

In river water quality management, there are various uncertainties that need to be studied, which include complicated hydrodynamic conditions, the process of the pollutant transport in the flow, and the degradation of the pollutant due to the biochemical action. The research used the QUAL2K model to simulate the water quality in the study region. This was done by assessing the physicochemical parameters and analyzing the data acquired from the Sembilang River, which is impacted by point and non-point source pollution. The model was applied to simulate the dissolved oxygen (DO), biochemical oxygen demand (BOD5) and ammoniacal nitrogen (AN) profiles of the river. The results of calibration and validation of the model for BOD and DO at six monitoring locations showed that the values predicted by the model were in close agreement with measured values except at few locations. Two different model scenarios were simulated to observe the impacts of pollution sources on the Sembilang River water quality. The simulation showed that increased levels of DO, BOD and AN in few stations and some are remained under same classes. The results showed the regression in the water quality in terms of DO, BOD and AN. Due to the discharge of the landfill effluent to the Sembilang River, DO came under Class III at the upper stream and Class II at the downstream. While BOD remained at Class I at the upstream of the river and Class II and III at the downstream. However, AN level remained under Class V at downstream which may due to the landfill effluent and non-point source pollutants including domestic sewage and agricultural non-point source pollutants. Water quality modeling provides better understanding of the physical and chemical processes. Models can play a crucial role in accurately depicting surface waters, offering valuable support for water quality management and decision-making.

#### **O422: Characterizing composition and sources of legacy & alternative plasticizer exposure through diet**

by *Sohyeon Choi* | *Aram Lee* | *Jae-Eun Lim* | *Nayoun Park* | *Sungkyoon Kim* | *Kyungho Choi* | *Hyo-Bang Moon* | *Younglim Kho* | *Jeongim Park* | *Soonchunhyang University, Asan, Republic of Korea* | *Soonchunhyang University, Asan, Republic of Korea* | *Hanyang University, Ansan, Republic of Korea* | *Eulji University, Republic of Korea* | *Seoul National University, Seoul, Republic of Korea* | *Seoul National University, Seoul, Republic of Korea* | *Hanyang University, Ansan, Republic of Korea* | *Eulji University, Republic of Korea* | *Soonchunhyang University, Asan*

Legacy and alternative plasticizers (LPs and APs) are widely recognized as endocrine-disrupting chemicals, commonly found in plastic products and food packagings. This study aimed to analyze plasticizers and investigate their sources in dietary samples. Forty-eight households (comprising 124 individuals) provided duplicate diet samples over 3 days (n=370). Using GC-MS/MS, twenty-one plasticizers were analyzed,

revealing twelve plasticizers with a detection rate  $\geq 70\%$  (range 0.017~14.1ng/g dw), and concentrations (median) ranging from 0.73 to 106ng/g dw. LPs constituted 53.3% of the composition in dietary samples, slightly higher than APs at 46.7%. DEHP (median: 105ng/g dw) was the predominant LPs, followed by DCHP (28.7ng/g dw) and DBP (16.2ng/g dw). Among APs, DiNP (69.8ng/g dw) was most abundant, followed by DEHA (13.6ng/g dw) and DEHTP (22.1ng/g dw). When analyzing total plasticizer concentrations in dietary samples across six intervals, the group with the highest concentration exhibited APs 8 times higher than LPs (median: 5.20 vs. 0.67 nmol/g) ( $p < 0.05$ ). This group displayed notably elevated levels of DINCH and DEHA, potentially linked to food delivery or dining out, as indicated in the food diary. A positive correlation emerged between AP levels and the consumption of greasy delivery foods—such as fried chicken ( $\beta$ : 1.56), hamburger ( $\beta$ : 3.57), boiled pork ( $\beta$ : 2.01), pork/chicken cutlet ( $\beta$ : 5.57). Conversely, except for fried chicken ( $\beta$ : 0.957), no correlation was found for LPs. The study highlighted the composition of dietary LPs and APs, revealing a noticeable trend: a significant increase in APs with higher plasticizer contamination. This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government (MSIT) (No. 2022R1A2C2011685).

#### **O423: Role of temporally-varying geographic predictors in estimating long-term exposure to air pollution for epidemiology**

by *Sun-Young Kim* | *Monju Jeong* | *Goeun Jung* | *National Cancer Center* | *Seoul National University* | *National Cancer Center*

Many cohort studies investigated the health effect of long-term exposure to air pollution relying on exposure prediction models, given the unavailability of individual measurements. In these models, the characterization of individual exposures at the fine spatial scale was based on hundreds of geographic variables that represent potential pollution sources such as traffic and land use. However, most studies constructed these variables from a fixed period without representing the changes over time, possibly resulting in exposure misclassification and biased or imprecise health effect estimates. This study aimed to investigate the improvement of prediction model performance for PM10, NO2, and ozone using temporally-aligned geographic characteristics for 2001-2019 in South Korea. From hourly measurements of PM10, NO2, and ozone at 200-600 regulatory air quality monitoring sites in South Korea for 2001-2009, we computed annual-average concentrations at each site. We also computed more than 300 geographic variables related to traffic, land use, vegetation, elevation, emissions, and population in 2001, 2005, 2010, 2015, and 2019 to be matched to the closest year of air pollution. Then, we constructed spatial prediction models including a few predictors estimated from geographic variables by partial least squares and spatial correlation in a universal kriging framework. Here, we applied two sets of variables: temporally-aligned geographic variables, and time-constant variables calculated from the one year in 2010. Finally, we compared the performance between the two sets of models using temporally-aligned and constant covariates. Cross-validated R2s of prediction models for PM10 and NO2 were higher with temporally-aligned covariates than constant geographic variables. While PM10 showed constant improvement over time, the improvement for NO2 was larger in early years than recent years. Ozone did not show the improvement. Our findings suggest the significant role of temporal changes of geographic characteristics in estimating long-term exposure to air pollution of individuals for cohort studies.

#### **O424: Health risk assessment of water vending machine on aluminium and ferum concentration among adult and children in Johor Bahru, Johor**

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The increasing demand for drinking water from water vending machines is attributed to their affordability and the vendors' guarantees regarding water treatment quality. However, failure to adhere to safe water quality standards poses health risks to consumers due to direct water contamination, impurity, and irregular maintenance. The study aims to evaluate the health risk assessment of aluminium (Al) and iron (Fe) ingestion through water vending machine among Johor Bahru residents in Johor. A total of 434 water vending machines in Johor Bahru were involved in the sampling which occurred between 2021 to 2023. The drinking water samples were taken at each sampling points for chemical parameters. The average daily dosage (ADD) and hazard quotient (HQ) were calculated based on the formula provided by the United States Environment Protection Agency (US EPA). Among the 434 samples analysed, 13 samples were detected with aluminium (Al), while nine samples were found to have iron (Fe) concentrations in violation of the guidelines. However, Hazard Quotient (HQ) calculation showed that all respondents had "HQ" of less than 1. The potential for negative health consequences stemming from the consumption of aluminium and iron in drinking water appeared minimal for both adults and children. Nonetheless, it was imperative to implement measures aimed at diminishing the levels of aluminium and iron detected in drinking water across all examined locations. This study holds critical importance as it seeks to ensure the safety and health of the population by addressing and mitigating the risks associated with aluminium and iron content in drinking water vending machine.

#### **O425: Integrated risk assessment of heavy metals (lead, cadmium) and volatile organic compounds (benzene, toluene) in South Korea**

*by Gihong Min | Chaekwan Lee | Wonho Yang | Department of Health and Safety, Daegu Catholic University | Institute of Environmental and Occupational Medicine, Inje University | Department of Health and Safety, Daegu Catholic University*

Heavy metals and volatile organic compounds (VOCs) are naturally occurring substances that are widely distributed in the environment, including in soil, water, and air. However, human activities have resulted in higher levels of exposure to heavy metals such as lead (Pb) and cadmium (Cd), as well as VOCs like benzene and toluene. This study aims to compare adults residing in Yeosu, an environmentally vulnerable area in Korea, with the average Korean adult through integrated risk assessment. The study was conducted on Korean men aged 19 to 64, women aged 19 to 64, and seniors aged 65 or older. The literature survey was conducted to identify exposure factors for use in exposure and risk assessment. The contribution rate was calculated by applying three exposure algorithms for ingestion, inhalation, and dermal exposure. The contribution rates of Pb and Cd were highest in food consumption, ranging from 78.03% to 79.62% and 88.39% to 92.89%, respectively. However, an environmentally vulnerable area of Yeosu, the contribution rate from food was 10% lower, while the contribution rate from the ingestion of indoor dust was 10% higher. The comparison of average values between Korean adults and those from the Yeosu area revealed that the contribution rate of inhalation exposure to benzene and toluene was similar, exceeding 95%. As a result of the risk assessment, cadmium and benzene were found to pose a potential health risk with a total cancer risk (TCR) of more than  $1 \times 10^{-6}$ . Integrated exposure to heavy metals and VOCs could help assess the main exposure pathways, and

this methodology could be applied to manage exposure. This methodology can be applied to manage exposure, thereby enhancing awareness of environmental pollution and human health and aiding in risk management and reduction efforts.

#### **O431: Temperature variability and cardiorespiratory mortality: Effect modification by season and spatial synoptic weather types across five South Africa cities**

*by Malebo Makunyane | Hannes Rautenbach | Janine Wichmann | University of Pretoria, South African Weather Service | University of Pretoria | University of Pretoria*

This study investigated the effects of temperature variability (TV) on cardiorespiratory mortality and its modification by season in five South African cities located in different Köppen-Geiger climatic zones. City-specific daily death counts, meteorological data and daily SSC weather-type calendar were obtained from 2006 to 2016. Quasi-Poisson generalised linear regression and distributed lag non-linear model (DLNM) were used to estimate the association between the TV and cardiorespiratory (CVD: I00-I99 and RD: J00-J99) mortality. The study further examined vulnerability by age (<65 or ≥65) and gender (females or males). In total, 328,762 deaths occurred during the study period in the five cities. At the national level, a 1°C increase in TV at lag 0 was associated with a significant increase of 1.08 (95% CI: 1; 1.17) in cardiorespiratory mortality. Higher effects of TV were observed in the warm season (RR=1.15, 95% CI: 1; 1.29). Stratified analysis showed individuals ≥ 65 years and females were more sensitive to TV in the warm season, while individuals < 65 years and males were more vulnerable during the cold season. For the entire study population, greater association was observed during moist tropical (MT) weather conditions in Bloemfontein (1.87 95% CI: 0.96-3.63), dry tropical (DT) weather conditions in Cape Town (1.27 95% CI: 0.83-1.95), moist moderate (MM) weather conditions in Johannesburg (1.35, 95% CI: 0.51-3.56), and during transitional (TR) weather conditions in both Durban (1.17, 95% CI: 0.63-2.19) and Gqeberha (1.35, 95% CI: 0.51-3.56). Our findings demonstrate that mortality risks of TV differ by season and SSC weather types. It is anticipated that the results presented in the present study will increase awareness among the public health community and policymakers regarding climate-related factors that make it challenging to provide a straightforward assessment of the effects of temperature changes on human health.

#### **O432: Driving cities to transformative climate change actions: The climate-health risk management (CHARISMA) project in India**

*by Bejo Jacob Raju | Raf Theunissen | Jente Broeckx | Richa Sharma | Surender N. Sharma | Ibrahim Hafeezur Rehman | Cedric Marsboom | Alan Juache | Guy Hendrickx | Poornima Prabhakaran | Centre for Environmental Health, Public Health Foundation of India, Delhi, India | Flemish Institute for Technological Research (VITO), Boeretang, Belgium | Flemish Institute for Technological Research (VITO), Boeretang, Belgium | The Energy and Resources Institute (TERI), Delhi, India | Avia-GIS, Zoersel, Belgium | Flemish Institute for Technological Research (VITO), Boeretang, Belgium | Avia-GIS, Zoersel, Belgium | Avia-GIS, Zoersel, Belgium | Avia-GIS, Zoersel, Belgium | Centre for Health Analytics Research and Trends, Trivedi School of Biosciences, Ashoka University, Sonipat, India*

Rising vulnerability to heat waves and infectious diseases due to climate change necessitates urgent action in urban areas. Effective urban policies, strategic city planning, regulated infrastructure development and planned expansions will determine the extent of the impact of climate change, and the vulnerability or resilience of citizens to it. The current work focused on the development of a web-based climate-health information dashboard for 50 cities in India, aiming to aid the

formulation of climate adaptation plans for managing health issues caused by climate change. The platform offers the ability to download and visualize data and maps at city-level on urban climate conditions, including heat vulnerability and vector-borne diseases. The dashboard has been developed through co-creation by bringing together a wide spectrum of stakeholders ranging from national to city-level experts to collaboratively address the challenges of climate change. The design of the platform was customized to the requirements of each location by calculating different analytics and indicators based on local data combined with city-specific simulations of urban growth, heat stress, and vector-borne diseases. The dashboard integrates simulated climate data for the periods 2011-2020 and 2041-2050, considering various climate change scenarios accounting for urban growth. This unique combination offers spatially explicit land use and coupled climatic information at a 100m resolution. Additionally, the dashboard incorporates the decadal evolution of urban expansion up to 2070, providing insights into the rate and extent of urban growth. For vector-borne diseases, a detailed line-listing for the years 2020-2022 was utilized to characterize dengue hotspots and coldspots. In the foreseeable future, the convergence of climate change, rapid urbanization, and population growth will render integrated climate action planning indispensable for cities. Thus, the development of this climate-health information dashboard is conceived as a guiding framework to assist Indian cities in devising customized interventions for innovative and integrated climate action planning.

#### **O433: Climate change impacts perceptions and coping mechanisms of urban children from a low-income community in Malaysia**

by Zul-Izzat Ikhwan Zaini | Norhafizah Karim | Siti Nor Ismalina Isa | Hidayatulfathi Othman | Siti Nur Hanis Mahmood | Syamimi Omar | Yanti Rosli | Mazrura Sahani | Faculty of Health Sciences, University Teknologi MARA Cawangan Pulau Pinang, Kampus Bertam, Pulau Pinang, Malaysia | Department of Community Health, Universiti Kebangsaan Malaysia Fakulti Perubatan, Cheras, Federal Territory of Kuala Lumpur, Malaysia | Faculty of Health Sciences, University Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, Selangor, Malaysia | Centre for Toxicology and Health Risk Studies, Universiti Kebangsaan Malaysia Fakulti Sains Kesihatan, Kuala Lumpur, Malaysia | Centre for Toxicology and Health Risk Studies, Universiti Kebangsaan Malaysia Fakulti Sains Kesihatan, Kuala Lumpur, Malaysia | Centre for Toxicology and Health Risk Studies, Universiti Kebangsaan Malaysia Fakulti Sains Kesihatan, Kuala Lumpur, Malaysia | Centre for Toxicology and Health Risk Studies, Universiti Kebangsaan Malaysia Fakulti Sains Kesihatan, Kuala Lumpur, Malaysia

Climate change is a long-standing issue that is becoming more severe, leading to more frequent and extreme natural disasters. This is exacerbated by Malaysia's rapid development, which is causing the problem to worsen and poses a serious threat to vulnerable urban poor children. This study aimed to investigate how urban children's socio-demographic characteristics and coping mechanisms relate to their perception of climate change's impact. A needs assessment was carried out in the localities, and discussions with experts were held purposefully to better understand the populations and develop the study's tools. A total of 62 children aged 10 to 18 years old from B40 (bottom 40% low-income group) families in the People's Housing Project (PPR Sungai Bonus, Kuala Lumpur) were purposively chosen. The information was gathered through piloted questionnaires. IBM SPSS Statistics version 27.0 software was used to analyse the data. The mean total score of the perceived impact of climate change was 35.65 (SD = 10.54), with the perception of less influence of climate change on health, accessibility, and mobility, but a greater impact on home safety. The mean total score

for coping strategies was 39.55 (SD = 10.53), with most item statements suggesting an effective coping process. There were no significant mean differences in children's perception of climate change by age group, gender, race, education, family income, household size or home ownership ( $p > 0.05$ ). The finding found a significant correlation with moderate strength ( $r = 0.551$ ,  $p < 0.001$ ) between children's coping mechanisms and the perceived impact of climate change. Urban poor children in this study felt climate change impacted their home safety more than their health, accessibility, and mobility. Communicating about climate change could help them better cope.

#### **O434: Association between temperature variation and mortality during extreme cold events in a subtropical setting**

by Yuchen Wei | Janice Ying-en Ho | Kehang Li | Jinjian Chen | Marc Chong | The Chinese University of Hong Kong | The University of Hong Kong | The Chinese University of Hong Kong | The Chinese University of Hong Kong | The Chinese University of Hong Kong

Effects of inter-day and intra-day temperature variations (TVs) on mortality during cold spells in subtropical settings remain underexplored. We aim to delineate the impacts of TVs on overall and cause-specific mortality in Hong Kong under extreme cold conditions. We used a case-crossover design stratified by space and time to assess the influence of inter-day and intra-day TVs on overall and cause-specific mortality in Hong Kong between 2000 and 2020. Conditional logistic regressions were used to quantify the risks (i.e., odds ratio, OR) of TVs on the outcomes. Significant associations were observed between increased TVs and all-cause mortality during extremely cold days. Specifically, the intra-day TV had an adverse impact at one-day lag (OR: 1.19, 95% CI: 1.14 to 1.24), diminishing over time, whereas the inter-day TV showed no significant effects on the outcomes. Adverse impacts of TV were significantly associated with mortality due to respiratory and cardiovascular diseases, evident at 1-day (OR: 1.14, 95% CI 1.06 to 1.23) and 2-day lags (OR: 1.43, 95% CI: 1.10 to 1.86) respectively. Notably, we observed that the effect of intra-day TV on cardiovascular mortality lasted for a 6-day lag (OR: 1.25, 95% CI: 1.03 to 1.53). The differential effects of TVs on mortality during extreme cold weather suggest varied acclimatization responses to cold spells, particularly among individuals with different chronic conditions.

#### **O435: The association between difference historical average temperature and non-accidental mortality in seven major Korean cities**

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Due to climate change, the global temperature has risen by approximately 1°C compared to the pre-industrial level. The present study aimed to investigate the association between differences historical average temperature and mortality in seven major Korean cities. Our data includes daily non-accidental mortality counts, daily mean humidity (%) daily mean temperature (°C) for the period between 2010 and 2019, and the 30-year average temperature (°C) for the period between 1960 and 1990, representing historical temperatures, in seven major Korean cities. We defined mortality as ICD-10 codes A00-R99, and difference historical average temperature as the difference between the temperatures of 2010-2019 and the 30-year average of daily mean temperature for the period between 1960 and 1990. Utilizing distributed lag non-linear models, we examined the association between the difference historical average temperature and mortality rate, as well as the minimum mortality temperature. The minimum mortality temperature was estimated between 22 to 26(°C) across the seven Korean cities. Under the minimum mortality temperature, a flat curve was observed between

the difference historical average temperature and mortality rates, indicating no significant association during colder periods. Over the minimum mortality temperature, during warmer seasons, an increase in difference historical average temperature was observed to be associated with an increased mortality risk, while a decrease in difference historical average temperature also showed an increase in mortality risk, although these associations were not statistically significant. These results suggest that the association between difference historical average temperature, resulting from past and present temperatures due to climate change, and mortality is only evident during warmer seasons. The present study examined the health effects of climate change using current and historical temperature differences.

#### **O441: Human biomonitoring of environmental chemicals among Chinese elderly and the risk prioritization using EPA's ToxCast database**

by Mengyi Wang | Lulu Wang | Tao Jing | School of Public Health, Tongji Medical College, Huazhong University of Science and Technology | School of Public Health, Tongji Medical College, Huazhong University of Science and Technology | School of Public Health, Tongji Medical College, Huazhong University of Science and Technology

Following the “healthy aging” principle, environmental considerations emerge as vital tools for enhancing elderly health. Human biomonitoring represents the gold standard for evaluating individuals' exposure to environmental chemicals. Utilizing combined gas/liquid-mass spectrometry technology, we determined blood levels of 7 phthalates (PAEs), 7 polychlorinated biphenyls (PCBs), 16 polycyclic aromatic hydrocarbons (PAHs), 2 bisphenols (BPs), 5 parabens (PBs), 13 per- and polyfluoroalkyl substances (PFASs), 19 organochlorine pesticides (OCPs), 23 organophosphorus pesticides (OPPs), 18 herbicides, and 8 synthetic pyrethroids (SPs) in a population of 918 elderly individuals from Wuhan, China. We identified clusters sharing exposure profiles and examined influencing factors by cluster analysis. Leveraging the EPA's ToxCast database, risk indexes (RI) and bioanalytical equivalence percentages were calculated for each chemical. The detection rates for 87 compounds exceeded 70%. The median concentrations of  $\Sigma$ BPs,  $\Sigma$ PCBs,  $\Sigma$ PAEs,  $\Sigma$ PFASs,  $\Sigma$ PAHs,  $\Sigma$ OCPs,  $\Sigma$ OPPs,  $\Sigma$ SPs and  $\Sigma$ Herbicides concentrations were 0.23 ng/mL, 6.89 ng/mL, 0.54 ng/mL, 331.00 ng/mL, 21.08 ng/mL, 266.04 ng/mL, 18.51 ng/mL, 9.86 ng/mL, 53.74 ng/mL, 5.64 ng/mL, respectively. DEHP, DiBP, Naphthalene, Phenanthrene, DnBP, Pyrene, Anthracene, Permethrin, Fluoranthene, and PFOS were the top 10 environmental chemicals with the highest concentrations. Exposures to most fat-soluble pollutants varied across lifestyles, with higher concentrations observed in smokers or drinkers compared to non-smokers or non-drinkers. Pesticides emerged as the most active environmental chemicals in peroxisome proliferator-activated receptor gamma antagonist, thyroid hormone receptor (TR) antagonist, TR agonist, and androgen receptor agonist activity assays. Additionally, PAEs and PAHs played significant roles as active contaminants for the corresponding targets of androgen receptor antagonists and estrogen receptor alpha. We proposed a list of major pollutants and characteristic contaminants linked to endocrine receptor-mediated toxic effects in the elderly, which may lay the groundwork for further research into environmental etiology.

#### **O442: Impact of hypohydration and temperature on urinary biomarkers and related pathophysiological susceptibilities among people on the tropical coast of Bangladesh**

by Rizwana Khan<sup>1</sup> | Momenul Haque Mondol<sup>3,4</sup> | Mahbubur Rahman<sup>2,5</sup> | Supta Sarker<sup>2</sup> | Abu Mohd Naser<sup>6</sup> | <sup>1</sup>Infectious Diseases Division, International Centre for Diarrhoeal Disease Research, Bangladesh (icddr), Dhaka-1212, Bangladesh | <sup>3</sup>Department of

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The risk of kidney disease is amplified by high ambient temperatures, yet we currently lack a comprehensive understanding of individual-level physiological susceptibilities to heat exposure. Our study sought to explore the association between ambient temperature and 24-hour urinary volume (24h-UV), electrolyte levels, and protein excretion (24h-UTP) within the population aged 20 years and above in coastal Bangladesh. We analyzed data from 5,550 person-visits in tropical coastal Bangladesh from December 2016 to April 2017. The data included information on participants' 24-hour urinary volume, electrolyte concentration and excretion, and protein excretion (24h-UTP). We linked individual's data to daily ambient temperature from local weather stations without any day lag. We employed confounder-adjusted linear mixed effect models with random intercepts at individual, household and community levels to assess the relationship between daily average ambient temperature and urine biomarkers. Each 5 °C increase in daily ambient average temperature was associated with -12.24 (95% CI: -20.92, -3.55) centiliter change in 24h-UV; -13.52 (95% CI: -20.84, -6.21) mmol/24hr sodium change, -2.18 (95% CI: -4.12, -0.23) mmol/24hr potassium change; 0.75 (95% CI: 0.70, 0.81) GMR 24h-UTP change; 1.09 (95% CI: 1.06, 1.13) mmol/L sodium change; and 1.07 (95% CI: 1.03, 1.11) mmol/L potassium change. Higher ambient temperature is associated with signs of hypohydration, which could be due to urinary compensatory responses for electrolyte loss due to sweating, evident by lower 24-hour excretion of sodium and potassium. These results highlight the importance of understanding individual-level vulnerabilities to ambient heat and implementing appropriate preventive measures to safeguard kidney health in high-temperature regions. The study's significance lies in its potential to deepen our understanding of how dehydration and temperature impact health in tropical coastal regions, guiding public health efforts and interventions to improve outcomes for vulnerable populations in similar settings.

#### **O443: Solution for non-compliance of portable spirometry measurements for assessing the accurate health effect of air pollution**

by Jeewuan Kim | Sun-Young Kim | Hee-Young Yoon | Jin Woo Song | Department of Statistics and Data Science, Yonsei University | National Cancer Center, Korea | Soonchunhyang University | Asan Medical Center

A pulmonary function is a common biomarker for assessing the adverse effects of air pollution. Specifically, diurnal fluctuation in lung function is crucial for studying the short-term effects of air pollution. Portable spirometry offers a practical solution to investigate these variations and has begun to be widely applied to clinical practice. However, the use of portable spirometers faces challenges of non-compliance with measurement frequency, which may result in less representative lung function of individuals and lead to biased and/or imprecise health effect estimates. Based on our indoor monitoring campaign for particulate matter with diameter and portable spirometry in the Korea Idiopathic Pulmonary Fibrosis Cohort (KICO), we aim to determine the optimal number of portable spirometry measurements to achieve representative individual lung function with the ultimate goal of assessing the effect of PM<sub>2.5</sub> on lung function. 108 KICO patients provide samples of 1-12 portable spirometry measurements across the four visits from July 2021

to December 2023. Although the protocol requests twice-daily spirometry for five days per visit, over 45% of samples did not meet this frequency. We consider the samples with  $\geq 10$  measurements adhering to the requested frequency as the complete sample. From each of the 222 complete samples, we randomly select reduced samples of 1-10 measurements and compute the mean differences between these and the complete samples. Finally, we identify the optimal measurement count where the median of absolute mean differences in lung function exceeds the 50th percentile of the differences. The median of absolute mean differences in lung functions between reduced and complete samples decrease with increasing measurement count, showing a higher decreasing rate with smaller counts. Reduced samples with  $\leq 4$  measurements exceed the 50th percentile difference. Our finding of addressing non-compliance frequency in portable spirometry provides practical guidance to future epidemiological studies of air pollution.

#### **O444: Spatio-temporal analysis of leptospirosis hotspot areas in Selangor (2011 to 2019)**

by *Muhammad Akram bin Ab Kadir* | *Universiti Putra Malaysia*

Leptospirosis is an illness caused by the bacteria *Leptospira* spp. It is considered a neglected disease prevalent in temperate countries, such as Southeast Asia, Southern Asia, and Central America. Selangor, a region in Malaysia, is recognized for its higher incidence of leptospirosis. The objective of the study is to utilize Geographical Information System (GIS) techniques and the Hotspot Analysis (Getis-Ord  $G_i^*$ ) tool to identify locations in Selangor that are more susceptible to leptospirosis from 2011 to 2019. The data on incidents of leptospirosis were acquired from the Selangor State Health Department and the National Notifiable Disease Surveillance System. The Hotspot analysis tool within the ArcGIS Pro software was employed to compute the Getis-Ord  $G_i^*$  statistic for every subdistrict region in Selangor. The identification of hotspot sites involved determining places exhibiting high positive z-scores, which serve as indicators of a higher incidence of leptospirosis cases. The analysis was performed monthly from 2011 to 2019 to investigate the spatiotemporal distribution patterns of leptospirosis hotspot areas. The findings indicated that the subdistricts located in the Hulu Langat, Petaling, and Klang districts consistently exhibited identification as hotspot regions for leptospirosis in Selangor. These regions showed elevated positive z-scores, suggesting a greater concentration of leptospirosis cases than other subdistricts in Selangor. The research revealed variability in the distribution of hotspot locations over different months, indicating that particular subdistricts showed higher incidences of leptospirosis at certain months. The study demonstrates the efficacy of employing spatiotemporal analysis, namely hotspot analysis, to identify areas of high leptospirosis incidence in Selangor. The findings can be utilized to identify its association with climate variability and by public health authorities for the implementation of focused prevention and control strategies to mitigate leptospirosis spread in the region.

#### **O451: Forecasting health benefits of air pollution reduction on lower respiratory infections among children in Klang Valley, Malaysia**

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Exposure to ambient air pollution is a leading contributor to the global burden of disease. However, very few studies had projected

the potential health benefits of reducing ambient air pollution. This research is aimed to forecast the potential health benefits of air pollution reduction on lower respiratory infections (LRIs) among children in Klang Valley, Malaysia. The modelling framework comprised of three steps: a time series analysis of the association between ambient air pollution ( $PM_{2.5}$ ,  $PM_{10}$ ,  $SO_2$ ,  $NO_2$ ,  $CO$  and  $O_3$ ) and LRIs among children from 2010 to 2019 using distributed lag models; estimations of LRIs burden attributable to air pollutants from 2010 to 2019; and the projections of the future burden of LRIs attributable to air pollutants in a reference and reduction scenarios (15%, 25% and 35% concentration reduction) by 2025. The time series analysis observed significant associations between LRIs cases and a  $10 \mu\text{g}/\text{m}^3$  increase in  $NO_2$ ,  $SO_2$ , and  $O_3$ . Between 2010 and 2019, the estimated trend in disability-adjusted life-years (DALYs) attributable to  $NO_2$ ,  $SO_2$  and  $O_3$  was inconsistent, with  $SO_2$  exposure being identified as the largest contributor to the LRIs burden among children in Klang Valley. In 2019, exposure to  $NO_2$ ,  $SO_2$  and  $O_3$  caused 5.60 (95% CI 1.06 – 20.04), 22.79 (95% CI 15.86 – 72.99) and 2.81 (95% CI 1.06 – 9.54) DALYs per 100,000 population, respectively. In the reference forecast, the DALYs rate attributable to  $NO_2$ ,  $SO_2$ , and  $O_3$  were predicted to increase by 22.5%, 22.5% and 31.1%, respectively, by 2025. Notably, only reduction scenarios of 25% and 35% are projected to effectively lower the DALYs rate by 2025. In conclusion, the burden of LRIs associated with ambient air pollution is projected to increase, necessitating effective air pollution reduction measures to safeguard the respiratory health of children in Klang Valley.

#### **O452: Industrial-related fine particulate matter elements associated with elevated blood pressures and arterial stiffness in young Taiwanese individuals**

by *Szu-Ying Chen* | *Chang-Fu Wu* | *Chang-Chuan Chan* | *Ta-Chen Su* | *E-Da Hospital* | *National Taiwan University* | *National Taiwan University* | *National Taiwan University Hospital*

The relationship of fine particulate matter ( $PM_{2.5}$ ) with blood pressure (BP) and arterial stiffness in the young population remains inconclusive. This study investigated associations of BPs, brachial artery pulse wave velocity (baPWV), and  $PM_{2.5}$  along with elements in young Taiwanese individuals. 779 adolescents and young adults residing in Taipei Metropolis since school age were included into this study. Measurements of systolic and diastolic BPs and baPWV were conducted. A land use regression model estimated residential annual mean concentrations of  $PM_{2.5}$  and eight elements. Associations of  $PM_{2.5}$  and elements with BPs and baPWV were assessed using regression analyses. Mediation analyses explored the role of baPWV in linking relationships between  $PM_{2.5}$  elements and BPs. Stratified analyses examined whether associations of  $PM_{2.5}$  elements with BPs and baPWV were influenced by individual characteristics. Manganese (Mn) and zinc (Zn) were associated with higher systolic and diastolic BPs and baPWV, and associations of Mn and Zn with BPs were mediated by baPWV. Logistic regressions demonstrated odd ratios of elevated BP (systolic BP  $\geq 130$  mmHg or diastolic BP  $\geq 80$  mmHg, or both) and higher baPWV ( $\geq 75$  percentile of baPWV) as 1.002 (1.001, 1.004) and 1.014 (1.001, 1.027) for an IQR increment of Mn ( $2.2 \text{ ng}/\text{m}^3$ ), and 1.014 (1.001, 1.027) and 1.017 (1.004, 1.030) for an IQR increment of Zn ( $20.7 \text{ ng}/\text{m}^3$ ), respectively. Stratified analyses indicated increased odd ratios of elevated BP and higher baPWV with Mn and Zn exposures in subjects who aged  $\geq 18$  years, with household income  $\geq 50\text{K}$  NTD/month, non-obese, or non-hyperglycemic. Industrial-related  $PM_{2.5}$  elements, Mn and Zn, are positively associated with BPs through the mediation of arterial stiffness in the young population. Subjects with higher socioeconomic status, non-overweight, or non-hyperglycemic are more susceptible to elevated BPs and arterial stiffness related to Mn and Zn exposures.

### O453: Assessing PM2.5 exposure and disease mortality in Malaysia: a half-decade population-weighted analysis

by Mohamad Iqbal Mazeli | Mohd Shahrol Abd Wabil | Chan Yee Mang | Mohd Faiz Ibrahim | Ahmad Riadz Mazeli | Anis Salwa Kamarudin | Thahiratul Asma' Zakaria | Imanul Hassan Abdul Shukor | Lim Jyh Hann | Norlen Mohamed | Institute for Medical Research, National Institute of Health Malaysia, Ministry of Health Malaysia, 40170 Shah Alam, Selangor Darul Ehsan | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya | Institute for Public Health, National Institute of Health Malaysia, Ministry of Health Malaysia, 40170 Shah Alam, Selangor Darul Ehsan | Institute for Medical Research, National Institute of Health Malaysia, Ministry of Health Malaysia, 40170 Shah Alam, Selangor Darul Ehsan | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya | Institute for Medical Research, National Institute of Health Malaysia, Ministry of Health Malaysia, 40170 Shah Alam, Selangor Darul Ehsan | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya | Institute for Medical Research, National Institute of Health Malaysia, Ministry of Health Malaysia, 40170 Shah Alam, Selangor Darul Ehsan | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya | Disease Control Division, Ministry of Health Malaysia, 62590 Putrajaya, WP Putrajaya

The World Health Organization (WHO) reported approximately 4.2 million premature deaths worldwide in 2019, attributable to exposure to ambient fine particulate matter 2.5 microns (PM<sub>2.5</sub>). However, there was limited mortality assessment due to ambient air pollution at the national level in Malaysia. This study aimed to estimate the mortality attributable to PM<sub>2.5</sub> for excess deaths due to all-natural causes, cardiovascular diseases (CVD), respiratory diseases, and acute lower respiratory infections (ALRI) in children under five. The Population-weighted Exposure Level (PWEL) of PM<sub>2.5</sub> concentrations was calculated from 2016 to 2020 using air quality data from the Department of Environment, mortality data from the Institute of Public Health, and the mid-year population count from the Department of Statistics, Malaysia. AirQ+ version 2.2 software was employed to compute excess deaths based on the 2016 to 2020 National Burden of Disease data. The average PWEL for annual PM<sub>2.5</sub> from 2016 to 2020 ranged between 13µg/m<sup>3</sup> to 21µg/m<sup>3</sup>. The estimated average excess deaths estimated from the year 2016 to 2020 for all-natural causes were between 10,607 to 14,766 (95% CI: 3,308-24,150); Ischemic Heart Disease (IHD) was between 4,965 to 6,164 (95% CI: 2,156-9,272); stroke was between 2,149 to 2,868 (95% CI: 636-5,122); Chronic Obstructive Pulmonary Disease (COPD) was between 239 to 813 (95% CI: 94-1,344); lung cancer was between 412 to 650 (95% CI: 212-993) and ALRI (below five years old) was between 21 to 70 (95% CI: 8-115). These findings suggested that PM<sub>2.5</sub> has a more pronounced impact on IHD and stroke mortality compared to respiratory mortality. Therefore, it is crucial to develop targeted strategies to reduce the PM<sub>2.5</sub> attributable burden, primarily focusing on mitigating environmental exposure.

### O454: Association between prenatal exposure to air pollution and onset of Kawasaki disease in young children of South Korea: Big Children's Environmental health Study

by Jongmin Oh<sup>1,2,3,4\*</sup>, Hwan-Cheol Kim<sup>5</sup>, Kyoung Sook Jeong<sup>6</sup>, Yi-Jun Kim<sup>1</sup>, Yun-Chul Hong<sup>3,7</sup>, Ji Hyen Lee<sup>2,8</sup>, Eunhee Ha<sup>1,2,9</sup> †, Ko-CHENS Study group<sup>10,11</sup>. <sup>1</sup>Department of Environmental Medicine, College of Medicine, Ewha Womans University, Seoul, Republic of Korea. <sup>2</sup>Institute of Ewha-SCL for Environmental Health (IESEH), College of Medicine, Ewha Womans University, Seoul, Republic of Korea. <sup>3</sup>Department of Human Systems Medicine, College of Medicine, Seoul National University, Seoul, Republic of Korea. <sup>4</sup>Integrated Major in Innovative Medical Science, Seoul National University Graduate School, Seoul, Republic of Korea. <sup>5</sup>Department of Occupational

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Kawasaki disease (KD) is vasculitis of unknown origin. Recent epidemiology studies have reported association between exposure to air pollution and KD. However, the evidence regarding the relationship between prenatal exposure to air pollution and incidence of KD in children remains limited. Therefore, our study aim is to evaluate the association between exposure to during pregnancy and incidence of KD in young children. We used the Big Children's ENvironmental health Study (Big-CHENS) from 2015 to 2020. This data covers mother-child pairs based on the National Health Insurance Service data. We defined the onset of KD using 10<sup>th</sup> revision of International classification of Disease (ICD-10; M30.3) and immunoglobulin (IVIG) prescription. We followed up children from birth to the onset of KD between 2015 to 2020. For evaluate the association of exposure air pollution during pregnancy and KD in children, we used multivariate Cox proportional hazard model. The model adjusted for maternal age, gender, mother's job, gestational age, birth weight, and year of birth. The hazard ratio (HR) and 95% confidence intervals (CI) were evaluated for PM<sub>2.5</sub> and PM<sub>10</sub> per 10 µg/m<sup>3</sup> increase, SO<sub>2</sub>, NO<sub>2</sub> and O<sub>3</sub> per 1 ppb increase, CO per 0.1 ppm increase. We analysed 1,486,631 mother-child pairs in this study. Of these, 9,320 cases (0.6%) of onset of KD in children have been identified. Exposure to PM<sub>2.5</sub> (HR: 1.012, 95% CI: 1.008, 1.015), PM<sub>10</sub> (HR: 1.007, 95% CI: 1.005, 1.009), SO<sub>2</sub> (HR: 1.061, 95% CI: 1.041, 1.082), NO<sub>2</sub> (HR: 1.009, 95% CI: 1.007, 1.012) during third trimester was positively associated with the onset of KD, except for ozone. We found that exposure to during pregnancy with risk of Kawasaki disease in children were significantly associated.

### O455: Assessing the correlations between MISR fractional aerosol optical depth and ground-level particulate matter components

by Chau-Ren Jung | Li-Hao Young | weitingc@ntu.edu.tw | Ta-Chih Hsiao | Department of Public Health, China Medical University | Department of Occupational Safety and Health, China Medical University | Department of Atmospheric Science, National Taiwan University | Graduate Institute of Environmental Engineering, National Taiwan University

Toxicities of particulate matter (PM) components vary greatly depending on the sources. The exposure assessment of PM components is still challenging due to its dramatic spatio-temporal variations. In-situ measurements, land use regression, and numerical air quality model have been applied to assess the concentrations of PM components. The Multiangle Imaging Spectroradiometer (MISR) device onboard the Terra satellite has been used to estimate PM components concentrations in the US. It remains unknown whether the MISR product can be applied to estimate PM components in an island with complex terrain. We assessed the correlations between MISR product and PM main components, namely sulfate (SO<sub>4</sub><sup>2-</sup>), nitrate (NO<sub>3</sub><sup>-</sup>), organic carbon (OC), and element carbon (EC). The in-situ measurements were performed in six sites in central Taiwan between 2013 to 2022. The version 23 level 2 aerosol data were downloaded from the NASA Earthdata portal. Eight fractional aerosol optical depth (AOD) were derived from 74 mixtures AODs. All the AOD data were interpolated to the 1-km grid centroid using the inverse distance weight. The Pearson's correlation was used to assess the correlations between MISR fractional AOD



and in-situ measurements. Additionally, Multi-Angle Implementation of Atmospheric Correction (MAIAC) AOD was used to evaluate correctness of MISR AOD. We found that the MISR total AOD was highly correlated with the MAIAC AOD ( $r = 0.91$ ). The Pearson's correlations of  $\text{SO}_4^{2-}$  with AOD1 and AOD21 were 0.201 and 0.265, respectively. The correlations of  $\text{NO}_3^-$  with AOD6 and AOD21 were -0.157 and -0.267, respectively. The correlations of EC with AOD14 and AOD21 were -0.365 and -0.396, respectively. AOD1 was moderately and positively correlated with OC ( $r = 0.422$ ). Overall, the fractional AOD showed stronger correlations with PM components than the total AOD. The results can serve as a reference for constructing PM components estimation models.

## POSTER PRESENTATION

### P001: Disparity in health burden attributable to air pollution amongst Indian sub-population

by Sagnik Dey | Debajit Sarkar | IIT Delhi, India | IIT Delhi, India

Disease burden attributable to air pollution in India is one of the highest in the world. The Global Burden of Disease study estimated mortality burden attributable to ambient PM<sub>2.5</sub> in India at state level; however, such estimates consider uniform baseline mortality rates for non-communicable diseases in a state across sub-population. Whether the air pollution burden varies amongst Indian sub-population, and if yes, how, are not known. Here we used hierarchical multivariate regression model to estimate the association between the odds of four health outcomes (diabetes, hypertension, COPD, and heart disease) from the National Family Health Survey and ambient PM<sub>2.5</sub> exposure (derived from satellite data) and its sectoral contributions, stratified by gender, wealth, and ethnic sub-group categories. We adjusted our model using various potential confounders and also estimated the combined effects of unhealthy diet and poor lifestyle-related risk-factors on these health outcomes. We further estimated the health benefits for the sub-groups attributable to exposure mitigation targets. We found that the association varies across the population sub-groups where females, wealthy, and ethnic-minors were at higher risks as compared to their sub-group counterparts. Energy, road dust, and domestic would be the three largest sectors posing health risks in India and contributing to large disparity. We found that comorbidity and unhealthy diet elevate the health risk of air pollution, but we could not find any significant enhancement in air pollution health risk due to poor lifestyle-practices. If India succeeds to meet the clean-air targets, the estimated health benefits would be heterogeneous across the population sub-groups; and lastly, PM<sub>2.5</sub> exposure needs to be reduced by 20-35% for the less-privileged ones to meet health equity. Targeted policies to mitigate air pollution exposure among the deprived sub-groups, and prioritising policies to address dietary and other risk-factors simultaneously would help India achieving the SDG-3.8 goal.

### P002: Evaluation of Individual Exposure Levels Based on Indoor and Outdoor PM<sub>2.5</sub> Concentration Prediction Models

by Shin-Young Park | Hyeok Jang | Cheol-Min Lee | Seokyeong university | Seokyeong university | Seokyeong university

This study utilized GPS and outdoor environmental data (PM<sub>10</sub>, PM<sub>2.5</sub>, temperature, relative humidity, wind speed, precipitation) to predict individual PM<sub>2.5</sub> concentrations through indoor and outdoor PM<sub>2.5</sub> concentration prediction models, and real-time PM<sub>2.5</sub> measurements were conducted using a light-scattering-based portable monitor (Park et al., 2023). In order to compare the predicted values on a daily basis, Time-Weighted Average (TWA) concentrations were calculated and compared with the daily average concentrations of measured values. The data used for model training were based on real-time location information from 44 individuals residing in Seoul, along with nearby

fine dust (PM<sub>10</sub>, PM<sub>2.5</sub>) measurements and weather data. This study predicted individual PM<sub>2.5</sub> concentrations using a GPS and outdoor environmental data-based indoor and outdoor PM<sub>2.5</sub> concentration prediction model, and real-time PM<sub>2.5</sub> measurements were conducted using a portable monitor (Park et al., 2023). The data used for model training were based on real-time location information from 44 individuals residing in Seoul, along with nearby fine dust (PM<sub>10</sub>, PM<sub>2.5</sub>) measurements and weather data. The results of calculating the daily average concentrations of measured values and predicted values through indoor and outdoor prediction models showed a statistically significant difference between the two. However, among the total of 44 subjects, excluding 2 individuals with measured concentrations exceeding 100, no statistically significant difference was observed between the measured and predicted values for the remaining 42 subjects. Furthermore, performing a paired-sample t-test on the average concentrations of all subjects during the measurement period revealed no statistically significant difference between the predicted and measured values. In other words, this confirms the utility of indoor and outdoor prediction models in assessing individual exposure levels and health risks.

### P003: Association between mid-term exposure to ambient particulate matter and high sensitivity C-reactive protein: A nationwide study in South Korea, 2015–2018

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Evidence suggests that exposure to ambient particulate matter (PM) causes various adverse health outcomes through systemic inflammation. We explored how PM exposure is associated with high-sensitivity C-reactive protein (hs-CRP) in Korea. This cross-sectional study comprised a representative sample of 21,154 Koreans linked to modeled air quality data spanning from 2015 to 2018. Concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> were estimated for 2-, 4-, and 6-month moving averages. The association between log-transformed hs-CRP and PM exposure was assessed using linear regressions, and effect sizes were expressed as percent changes along with their corresponding 95% confidence intervals (CIs). The association was stronger with a longer exposure window. The percent change (95% CI) in hs-CRP per a 10- $\mu\text{m}^3$  increase in PM<sub>10</sub> according to moving averages was 4.67 (2.28, 7.12) for 0–60 day, 8.03 (4.74, 11.43) for 0–120 day, and 10.99 (6.62–15.54) for 0–180 day. The percent change (95% CI) in hs-CRP per a 10- $\mu\text{m}^3$  increase in PM<sub>2.5</sub> according to moving averages was 7.16 (2.47, 12.07) for 0–60 day, 13.79 (7.83, 20.08) for 0–120 day, and 19.80 (12.06–28.06) for 0–180 day. The relationship between PM exposure and hs-CRP remained independent after adjusting for various socio-demographic characteristics and other co-pollutants. Mid-term exposure to PM<sub>10</sub> and PM<sub>2.5</sub> is associated with an elevation of hs-CRP in Korea with a longer exposure window exhibiting a stronger association. Policy efforts are required to enhance air quality and alleviate the health impacts of PM exposure.

### P004: Investigating residential infiltration of ambient fine particulate matter (PM<sub>2.5</sub>) in a Korean elderly cohort

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Fine particulate matter (PM<sub>2.5</sub>) is a significant environmental health concern associated with adverse health outcomes including respiratory conditions. However, most studies have focused on outdoor PM<sub>2.5</sub>, neglecting the critical fact that people, particularly the elderly, spend about 90% of their time indoors. Our study aimed to assess the infiltration of outdoor PM<sub>2.5</sub> into indoor environments and identify the most suitable tracer element by focusing on calculating the Indoor/Outdoor (I/O) ratios of sulfur, nickel, and iron, which were used as tracers. In our air monitoring campaign from March to September 2023, we engaged 68 participants aged 60 and above from urban and suburban areas, drawn from both the Korean Genome and Epidemiology Study and the Korea Frailty and Aging Cohort Study. During this period, the concentrations of PM<sub>2.5</sub> and 33 inorganic elements were measured using MicroPEM™ portable PM sensor for five consecutive days. The criteria for a suitable tracer included sufficient presence in both environments, a predominantly outdoor origin, and physical and chemical behaviors similar to outdoor PM<sub>2.5</sub>, with an ideal elemental I/O ratio of 1 or less. This study found average PM<sub>2.5</sub> concentrations of 16.86 µg/m<sup>3</sup> outdoors and 11.44 µg/m<sup>3</sup> indoors. Sulfur showed sufficiently high concentrations (1.12 µg/m<sup>3</sup> outdoors, 0.87 µg/m<sup>3</sup> indoors), consistently above the minimum detection limit (MDL). In contrast, iron had lower concentrations (0.25 µg/m<sup>3</sup> outdoors, 0.15 µg/m<sup>3</sup> indoors) compared to sulfur, also remained above the MDL. Nickel, with 22% of its measurements below the MDL, exhibited significantly lower concentrations (0.002 µg/m<sup>3</sup> outdoors, 0.001 µg/m<sup>3</sup> indoors). The average I/O ratios for PM<sub>2.5</sub>, sulfur, nickel, and iron were found to be 0.76, 0.79, 0.64, and 0.69, respectively and overall results suggest sulfur as a suitable tracer. These findings provide a crucial basis to investigate the infiltrated PM<sub>2.5</sub> different by subpopulation and to assess the health effect of infiltrated PM<sub>2.5</sub>.

#### **P005: Joint effect of long-term exposure to ambient air pollution on the prevalence of chronic obstructive pulmonary disease**

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Little is known about the relationship between long-term joint exposure to mixtures of air pollutants and the prevalence of chronic obstructive pulmonary disease (COPD). We aimed to assess the joint impact of long-term exposure to ambient air pollution on the prevalence of COPD in Korea, especially in areas with high levels of air pollution. We included 22,387 participants aged 40 years or older who underwent spirometry tests in 2010–2019. The community multiscale air quality model was used to estimate the levels of ambient air pollution at residential addresses. The average exposure over the 5 years before the examination date was used to calculate the concentrations of air pollution. Forced expiratory volume in 1 second and forced vital capacity were used to define restrictive lung disease, COPD, and moderate-to-severe COPD. Quantile-based g-computation models were used to assess the joint impact of air pollution on COPD prevalence. A total of 2,535 cases of restrictive lung disease, 2,787 cases of COPD, and 1,399 cases of moderate-to-severe COPD were identified. In the individual pollutant model, long-term exposure was significantly associated with both restrictive lung disease and COPD. In the mixture pollutant model, the

odds ratios (ORs, 95% confidence intervals) for restrictive lung disease increased with each quartile increment in the 1- to 5-year average mixtures: 1.14 (1.01–1.29, 1 year), 1.25 (1.10–1.42, 2 years), 1.25 (1.10–1.43, 3 years), 1.32 (1.15–1.52, 4 years), and 1.37 (1.18–1.58, 5 years), respectively. The increase in ORs accelerated over time. By contrast, the ORs of COPD showed a decreasing trend over time. Long-term exposure to air pollutants, both individually and jointly, was associated with an increased risk of developing COPD, particularly restrictive lung disease. Our findings highlight the importance of comprehensively assessing exposure to various air pollutants in relation to COPD.

#### **P006: Association of long-term exposure to air pollutant mixture and incidence of all cancers: KNHANES (2007-2020)**

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Despite conducting studies that the associations between air pollutants and incidence of cancer, the mixture effects of air pollutants are limited. In this study, we aim to assess the association of long-term exposure to air pollutants and incidence of all cancers. This study included 60,670 individuals ≥19 years from the Korea National Health and Nutrition Examination Survey (KNHANES) 2007-2020. Among them, 2,876 individuals were diagnosed with cancers. To compare individuals with incidence of all cancers and without cancers, we used propensity score matching (1:4). Five-year average concentrations to air pollutants (PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO, O<sub>3</sub>) were calculated by Community Multiscale Air Quality (CMAQ) model. Conditional logistic regression was applied to estimate the associations between air pollutants and incidence of all cancers. Quantile g-computation was used to assess the mixture effects of air pollutants and adjusted for covariates such as age, BMI, education level, marital status, house income, alcohol consumption, smoking status, menopausal status, childbirth, and breastfeeding. In the single-pollutant model, high concentration of CO and O<sub>3</sub> was associated with a significantly increased risk of all cancer, after adjusting for confounders. In the mixture model, the coefficient indicates the mixture effect of the air pollutants and is interpretable as the effect of increasing for one quantile. A quantile increases in the mixture of PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO, O<sub>3</sub> was significantly associated with a 1.22 (95% CIs: 1.11, 1.34). The association between air pollutants and incidence of all cancer was 1.27 (95% CIs: 1.09, 1.46) for men and for was 1.17 (95% CIs: 1.03, 1.33) for women. Long-term exposure to air pollutants mixture increases the risk of all cancers. These results provide some evidence suggesting the adverse effects of air pollutant mixture in the development of all cancer.

#### **P007: Long-term exposure to ambient PM2.5 and cardiopulmonary diseases and diabetes incidence, benchmark concentration, attributable years lived with disability, and regulation level**

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Ambient air pollution has been estimated to account for more than two-thirds of the environmental burden worldwide, especially in PM<sub>2.5</sub>-attributed cardiopulmonary and metabolic-related diseases. However, studies on the benchmark concentration (BMC), extent of disease burden, temporal trend, and associated environmental policy remain limited. We aimed to estimate the concentration-response functions (CRFs)

between long-term exposure to  $PM_{2.5}$  and cardiopulmonary diseases and diabetes incidence, BMC, attributable years lived with disability (YLD), and their temporal trends. The goal was to serve as a guideline and suggestion for policy-makers to update the annual regulation level. Disease-free participants (aged 30 years, ranged 118,026-171,824) of the MJ Health Database were followed between 2008 and 2017 for the incidence of coronary heart disease (CHD), ischemic stroke, chronic obstructive pulmonary disease, lower respiratory infections, and type 2 diabetes (DM) in Taiwan. We used a time-dependent nonlinear weight transformation Cox regression model for the CRF between exposure to  $PM_{2.5}$  and disease incidence, with an address-matched 3-year mean exposure estimate. We then calculated the town/district-specific attributable YLD of the diseases based on the corresponding CRF and derived the ratio of the summation of the overall YLD over the mitigation cost to determine the optimal regulation level. The hazard ratio (HR) of all the cardiopulmonary diseases and DM monotonically increased with  $PM_{2.5}$  concentration. Women tended to be more vulnerable than men with higher HR except for CHD. The population-weighted  $PM_{2.5}$  concentration improved from 26.10 to 16.82 during 2011-2019 in Taiwan. As a result, the attributed YLD due to pulmonary diseases and DM reduced more than 50% from 323,318 person-years to 156,982 person-years. The annual mean  $PM_{2.5}$  concentration would be optimal by updating from the current regulation level of 15 to 12.5.

**P008: Bioclimatic and edaphic spatial distribution modeling of gynecologically therapeutic Philippine native medicinal plant *blumea balsamifera* (L.) DC. (Asteraceae) in response to climate change**

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*Blumea balsamifera* (L.) DC. (Asteraceae) is a native plant utilized by Indigenous Peoples (IP) in the Philippines as herbal medicine for postpartum concerns. However, studies exploring its vulnerability to natural disturbances, especially climate change, are limited. To predict the habitat suitability of *B. balsamifera* in the Philippines using the socioeconomic pathways (SSPs) 1-2.6 and 5-8.5 which corresponds to the best- and worst-case climate scenarios for 2041-2070. Eleven Philippine bioclimatic variables were sourced from the Climatologies at High Resolution for the Earth's Land Surface (CHELSA) v2.1 database, and three edaphic variables were obtained from SoilGrids. Species distribution modeling was performed using Maximum Entropy (MaxEnt) v3.4.4 based on occurrence points from the Global Biodiversity Information Facility (GBIF). Mean annual temperature and temperature annual range are the top contributors to *B. balsamifera*'s geospatial distribution, and areas with these elevated parameters were found to be unsuitable habitats. Predictions indicated that *B. balsamifera* distribution may exhibit a northward range shift, with niche gains observed mostly in the northernmost part of the country; while areas from Central and Southern Philippines may exhibit niche losses that intensifies southwards. IPs with recorded postpartum medicinal uses for *B. balsamifera* living in the south of the Philippines may observe reduced occurrences and accessibility of *B. balsamifera* for postpartum medical use. Findings can contribute to sustainable management, land use planning, and ex-situ cultivation of *B. balsamifera* for the benefit of IPs in specific areas. Anthropogenic factors such as land use conversions may also be incorporated in future research, given that aggressive urban development can drastically reduce or modify identified suitable habitats.

**P009: Fine particulate matter exposure and carbonic anhydrase genes polymorphisms associated with osteoporosis risk**

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The prevalence of osteoporosis among people over 65 years in Taiwan is 14.1%. Air pollution levels in Taiwan remain high, mainly from the burning of fossil fuels. Recent studies have shown that developing osteoporosis is significantly associated with inflammation caused by exposure to fine particulate matter ( $PM_{2.5}$ ) and modified by polymorphisms in carbonic anhydrase (CA) genes. Therefore, we aimed to explore the association between  $PM_{2.5}$  and osteoporosis, and the modification of CA gene polymorphisms. The study used data of bone mineral density (T-score) and CA gene polymorphisms (CA8 rs6984526 and CA10 rs2106329) collected in the Taiwan Biobank since 2012 and linked it with the data of Taiwan's air quality monitoring station (AQM). In this cross-sectional study, we included 1,847 osteoporosis subjects (T-score < -2.5) and 18,555 non-osteoporosis subjects (T-score  $\geq$  -2.5). The mean  $PM_{2.5}$  exposure levels were evaluated by 1, 3, 5, 7, and 10-years before the year of participant recruitment. The stepwise selection procedure was used to establish multivariate logistic regression models. The results shown that age of 60-70 years old [odds ratio (OR)=4.87, 95% confidence interval (CI)=3.34-7.12], and family history of osteoporosis (OR=1.60, 95% CI=1.36-1.88) were significant risk factors of osteoporosis, while regular exercise (OR=0.76, 95% CI=0.65-0.88) was a protective factor. Compared to  $PM_{2.5}$  <19.64  $\mu\text{g}/\text{m}^3$ ,  $PM_{2.5}$  in the range of 19.64-25.27  $\mu\text{g}/\text{m}^3$  was significantly associated with an increased risk of osteoporosis. The ORs for 1, 3 and 5-years mean  $PM_{2.5}$  levels were 1.64 (95% CI=1.43-1.89), 1.55 (95% CI=1.30-1.84), and 1.23 (95% CI=1.02-1.48), respectively. However, the CA gene polymorphisms were not significantly associated with osteoporosis risk. Our findings suggest that not only traditional risk factors but  $PM_{2.5}$  exposure are significantly associated with osteoporosis risk, which provide evidence for developing prevention strategies for osteoporosis in Taiwan.

**P010: Precipitation model using machine learning**

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The risks arising from precipitation are immediate and broad. Satellite data and the Korea Meteorological Administration also carry out predictions and observations on various parameter in Korea, but the results are inaccurate especially regarding the precipitation. Because precipitation in the north is not well matched and incorrect observations are made due to difficulties in identifying the surface. Prior to this, in predicting air pollution data using deep learning at the district levels in Korea, which is called si-gun-gu, we intend to construct accurate precipitation data by conducting analysis using a model with excellent performance. If highly influential precipitation data are properly secured, it is expected that it will benefit greatly from more accurate analysis of health effects. After collecting and refining data from 2015 to 2023 for about 30 detailed variables related to temperature, river, and snow using Google Earth Engine data, ASOS (Automated Synchronous Observing System) data from the Korea Meteorological Administration are collected in the same manner as in the relevant year and combined based on GeoID. ASOS data include data on temperature, precipitation, wind, atmospheric pressure, humidity, solar radiation, sunlight, snow, and clouds, and among them, precipitation data were used. The model is learned using precipitation ASOS data as ground truth and satellite data as input values. After that, samples without ground truth are calculated from model values. The model at this time mainly uses Random Forest(RF), XGB (Extreme Gradient Boosting) and other various models such as DNN and GAM Ensemble, and the best performance model is used as the final model. When the additional hyperparameter was not used, the R2 of the model using RF was the best at 0.65 which is a high

value compared to the Korea Meteorological Administration's result. It seems positive that there is room for increased accuracy by adjusting the hyperparameter.

**P011: Human biomonitoring reference values and characteristics of emerging chemicals exposure in the general population of Taiwan: Taiwan Environmental Survey for Toxicants 2013-2016**

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Human biomonitoring focusing on EDCs appears to be critical, which provide information to assess potential health risks to human populations. However, a few information study was conducted systematically for multiple emerging chemicals exposure in Asia using human biomonitoring. We aimed to establish reference values and exposure profiles of emerging chemicals using the Taiwan Environmental Survey for Toxicants (TESTs) 2013-2016. We enrolled 1871 participants (aged 7-97 years) from the Taiwan Environmental Survey for Toxicants (TESTs) 2013-2016. ICP-MS was used to determine the levels of 15 urinary metals (Cr, As, Cd, Pb, etc.). Levels of 11 phthalate metabolites and 3 bisphenols (bisphenol A [BPA], bisphenol F [BPF] and bisphenol S [BPS]) in each participant's urine samples were determined using LC-MS/MS, respectively. Urinary Cd, BPA, BPF and BPS levels in adults were significantly higher than those in the 7-17-year-old group (Cd: 0.69 vs. 0.49 µg/L; BPA: 8.89 vs. 5.80; BPF: 9.06 vs. 6.32; and BPS 2.18 vs. 1.50 µg/g creatinine,  $p < 0.001$ ). For all phthalate metabolites except for mono-methyl phthalate (MMP), mono-ethyl phthalate (MEP), and mono-ethylhexyl phthalate (MEHP), urinary median levels in the 7-17-year old group were significantly higher than those in adults. Most metals and bisphenols were increased with age, except for Cd. For most phthalate metabolites, the geometric mean decreased with increasing age. The reference values of 11 phthalate metabolites, 15 metals, and 3 bisphenols in the 7-17/≥18-year-old groups were higher in MEP (198.46/265.81 µg/L), Cd (1.41/2.21) and BPF (16.41/ 17.10), respectively. We concluded that emerging chemicals exposure of the general population in Taiwan varies by age. The RV of phthalate metabolites, metals and bisphenols in Taiwan were established. We provide information regarding urinary emerging chemicals levels based on human biomonitoring data for the general Taiwanese population.

**P012: The relationship between thyroid function and line-1 methylation: a cross-sectional study**

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Research has indicated that thyroid hormones are associated with DNA methylation of specific genes. To have further understanding of the relationship between global DNA methylation (using LINE-1 methylation as a surrogate) and thyroid hormones, this study aimed to investigate the association between thyroid hormones and LINE-1 methylation. Data from 714 participants in the Taiwan Biobank, a national database that recruited individuals from the adult general population between 2012 and 2023, were analyzed. All participants were divided

into three groups based on their level of thyroid stimulating hormone (TSH): hyperthyroidism (n=13), euthyroidism (n=683), and hypothyroidism (n=18). LINE-1 methylation levels were analyzed as continuous variable (the percentage of methylation) and categorical variable (divided into hypermethylation or hypomethylation groups by median). The univariate and multivariate models were performed to investigate the association between thyroid hormones and LINE-1 methylation level through  $\beta$  estimates and p-value for linear regression, and odd ratios (ORs) and 95% confidence intervals (CIs) for logistic regression. There was a negative correlation between hyperthyroidism and LINE-1 methylation level ( $\beta=-0.0062$ ; p-value=0.0327), which remained significant in the adjusted model ( $\beta=-0.0055$ ; p-value=0.0453). However, hyperthyroidism was not significantly associated with LINE-1 methylation groups using logistic regression analysis (OR=0.446; 95% CI=0.126-1.575; p-value=0.418). Our results suggest that hyperthyroidism may associate with lower level of global DNA methylation. However, future studies need to recruit more participants with hyperthyroidism to validate our findings.

**P013: Depression and anxiety associated with exposure to ambient PM2.5 in India: Insights from the National Mental Health survey**

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Depression and anxiety are a leading cause of health burden worldwide with complex etiology. However, little evidence is available for low- and middle-income countries (LMICs) like India, where air pollution levels are high. Therefore, to analyze the association of exposure to ambient PM<sub>2.5</sub> on depression and anxiety, a cross-sectional study has been carried out over 12 states in India. The National Mental Health Survey (2015–16) provides information on sociodemographic factors and mental disorders like depression and anxiety. A total of 34,151 individuals participated in the study. We employed 1-km X 1-km resolution indigenously developed satellite-based PM<sub>2.5</sub> exposure data and performed a mixed-effect logistic regression model to assess if increased PM<sub>2.5</sub> exposure is associated with a higher prevalence of depression and anxiety in India. In our study, exposure to PM<sub>2.5</sub> for periods of up to 3 months was significantly associated with an increased prevalence of current depression and anxiety. Thus, every 10 µg m<sup>-3</sup> increase in PM<sub>2.5</sub> was significantly associated with current depression (OR= 1.72, 95% CI: 1.62 to 1.81), with the largest increase observed for one month; while for every 10 µg m<sup>-3</sup> increase in PM<sub>2.5</sub> for three months was significantly associated with current anxiety (OR=1.81, 95% CI: 1.70 to 1.94), after adjusting for socio-demographic factors and diurnal temperature range (DTR). Further, the subgroup analysis showed that the

association was more prominent for individuals with lower household incomes and those with lower education. Our study reveals that short-term and seasonal exposure to ambient PM<sub>2.5</sub> may be a risk factor for developing current anxiety and depressive disorders. This research offers vital insights into the association between PM<sub>2.5</sub> exposure and mental health problems in India (as well as other LMICs of similar interest). Additionally, future cohort studies are suggested for establishing the causal relationship.

**P014: The association between air pollution factors and human liver function in southern Taiwan**

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With the rapid development of global industrialization and economy, the potential impact of air pollution on human health has attracted widespread attention. This study focuses on the correlation between air pollution factors and human liver function in southern Taiwan (Pingtung County), including particulate matter, nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and ozone (O<sub>3</sub>) on liver function indicators. Using air pollution data collected from southern Taiwan in July 2023 and physiological and biochemical indicators of 115 local residents, which carbon monoxide gas analyzers and blood tests were used to collect Glutamic Oxaloacetic Transaminase (GOT), Glutamic Pyruvic Transaminase (GPT), Alanine amino Transferase (ALT), Hepatitis C virus antibody (Anti-HCV), Hepatitis B surface antibody (Anti-HBs), Hepatitis B virus surface antigen (HBsAg). Applying logistic regression model, linear regression model, and linear mixed model to analyze the relationship between the above biochemical indicators and air pollution factors. The cross-sectional study recruited 115 subjects, including 51 males (44.3%) and 64 females (55.7%). The youngest subject was 34 years old and the oldest subject was 94 years old, with an average age of 63.7 years. There was significant positive association between air pollution (CO, O<sub>3</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>) and GOT in the blood. However, there were no obvious correlation between air pollution factors and liver function indicators (GPT, AFP, anti-HCV, HbsAg, and Anti-HBs). This study demonstrated the potential hazards of exposure to air pollutants on liver function effect. But, we still need further follow-up study to explore and figure out. The significance of this study is to gain an in-depth understanding of the effects of air pollutants on liver function. Through the interaction between liver function indicators and the environment, we are expected to better predict an individual's risk of disease and provide more precise treatment guidelines for the people.

**P015: Reduction in ambient PM<sub>2.5</sub> and the decreased risk of dyslipidaemia in adults: A longitudinal quasi-experimental study**

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Existing research suggests a significant correlation between long-term exposure to fine particulate matter (PM<sub>2.5</sub>) and an increased risk of dyslipidemia. However, the potential benefits of mitigating dyslipidemia risk through air quality improvement, specifically by reducing ambient PM<sub>2.5</sub> levels, have not been thoroughly investigated. We conducted a longitudinal quasi-experimental study utilizing data from the Taiwan MJ and Hong Kong MJ cohorts. Our study spanned from 2000 to 2018 and included 19,492 adults who consistently resided in areas with high PM<sub>2.5</sub> exposure, as well as 5,165 adults who relocated from areas of high PM<sub>2.5</sub> exposure to areas with lower exposure. These participants were included in the data analysis after conducting propensity score matching. We examined the associations between PM<sub>2.5</sub> reduction and the risk of dyslipidemia, as well as its components, namely total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C), using Cox proportional hazard regression. We also conducted stratified analyses to investigate the modifying effects of specific variables. Our findings indicate that a reduction in PM<sub>2.5</sub> levels correlates with a decreased risk of dyslipidemia (hazard ratio = 0.583, 95% confidence intervals: 0.545, 0.624), exhibiting a non-linear concentration-response relationship. Similar associations were observed in the reduced risk of elevated TC, TG, and LDL-C levels, as well as decreased HDL-C levels. Stratified analyses further revealed that the correlation between reduced PM<sub>2.5</sub> exposure and a decreased risk of dyslipidemia was more pronounced among males, current smokers, and individuals with overweight or obesity. Reducing exposure to PM<sub>2.5</sub> can significantly mitigate the risk of dyslipidemia. These findings underscore the importance of enhancing interventions and strategies aimed at improving air quality.

**P016: Exploring the correlation between particulate matter concentration and traffic accidents in major metropolitan areas in Taiwan**

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Traffic accidents have been a leading cause of death. Air pollution, especially particulate matter (PM) levels, may affect the environmental factors for road users to raise accident risks. This study aimed to analyze the differences in the injury severity and the types of road users affected by PM exposure. We collected Road Traffic Accident Investigation Reports for Taipei, Taichung, and Kaohsiung in 2020 and established a database focusing on the primary parties involved, excluding passengers, unlicensed, and drunk drivers. Hourly particulate matter (PM) concentrations at the time and location of each accident were estimated using visibility data and divided into quartiles (Q1 to Q4). Chi-square tests were used to analyze differences in the number of accidents, injury severity, and road user impact at different PM levels. Significant associations between PM<sub>10</sub> and PM<sub>2.5</sub> levels and injury severity. Higher concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> (Q4) led to more accidents with fatalities and injuries, whereas lower levels (Q1) had more non-injury accidents. Among road user types, a comparative analysis between Q4 and Q1, using cars as the control group revealed significant differences in accident counts. More accidents caused by motorcycles and bicycles increased at higher PM<sub>10</sub> and PM<sub>2.5</sub> concentrations, while pedestrian accidents significant increased only at higher PM<sub>10</sub> levels. Additionally,

a trend from Q1 to Q4 indicated that the number of motorcycles accidents gradually increased with higher PM10 and PM2.5 concentrations, while bicycle accidents increased with higher PM10 concentrations. The study revealed a significant correlation between high PM concentration and the severity of traffic accident injuries and types of road users affected, particularly motorcycles, bicycles, and pedestrians. Our results emphasize the impact of air quality on traffic accidents, suggesting the necessity for further investigation into both injuries severity and road users affected.

**P017: Air pollution and temperature interact to increase years of life lost due to suicide risk in Seoul, South Korea**

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Suicide is a leading cause of death worldwide, especially among young people. While the factors that contribute to suicide are complex and involve both social and biological factors, there is growing evidence that air pollution may play a role. We assessed the impact of air pollution exposure on Years of Life Lost (YLLs) due to suicide, in conjunction with the synergistic effects of temperature. This study investigated the association between air pollution exposure and YLLs due to suicide in Seoul, South Korea, 2002-2019. Using a generalized additive model, we analyzed air pollutants (PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, CO) on YLLs due to suicide with lag effects up to 7 days. We assessed synergies using air pollutants with a temperature dummy, stratifying them into low (below the 90th percentile) and high (above the 90th). Stratified analyses explored modifications by death method, place, season, and socio-demographics. During the study period, 43,642 completed suicide cases occurred, and the average daily YLLs due to suicide was 193 years. Our study found a significant positive association between NO<sub>2</sub> and O<sub>3</sub> and increased YLLs due to suicide. In the best-fitting models, NO<sub>2</sub> showed effects of 4.08 years at lag 5 and O<sub>3</sub> 5.72 years at lag 3. We found a synergistic effect between air pollution and high temperature on YLLs due to suicide, supported by statistical evidence. However, this effect was not observed at low temperatures. PM<sub>2.5</sub> (high: 10.74 years; *Pinteract* = 0.004); PM<sub>10</sub> (high: 11.83 years *Pinteract* = 0.004); NO<sub>2</sub> (high: 14.52 years; *Pinteract* = 0.01); SO<sub>2</sub> (high: 8.72 years; *Pinteract* = 0.04); O<sub>3</sub> (high: 10.02 years; *Pinteract* = 0.08); and CO (high: 11.42 years; *Pinteract* = 0.03). We found that exposure to air pollution, especially during high-temperature days, could serve as a trigger for suicide. Our findings hold promise for shaping essential strategies in suicide prevention.

**P018: The association between sleep quality, emotional stress, and pm2.5 exposure among residents in Taipei metropolitan area**

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Air pollution may lead to sleep disorders, but whether it affects the sleep quality in the early stages is still unclear. Sleep quality is often

influenced by personal stress or emotions. Therefore, this study aims to explore the relationship between sleep quality, emotional stress, and PM2.5 exposure. We recruited study subjects without major illnesses and conducted questionnaire in outpatient of family medicine in Taipei City Hospital from 2022 to 2023. We applied the Pittsburgh Sleep Quality Index and Depression Anxiety Stress Scales 21 on study subjects. The daily average PM2.5 concentration over the past one year for each study subject was estimated by local monitoring data and modeling. The Wilcoxon signed-rank test was used to analyze the associations between sleep quality, stress, anxiety, or depression. Furthermore, it was used to compare the differences on PM2.5 exposure between the study subjects with normal or bad sleep quality, stress, anxiety, or depression. Study subjects with bad sleep quality showed significantly higher scores in stress, depression, and anxiety when compared to normal ones. Then, subjects with bad sleep quality had significantly higher daily average PM2.5 exposure in past one year. After excluding subjects with bad stress, depression, and anxiety, the association between sleep quality and PM2.5 exposure still existed. In addition to stratified by age, subjects aged above or below 65 were both found that those with bad sleep quality were exposed to significantly higher PM2.5 concentrations when compared to normal ones. After controlling for emotional stress and other influencing factors, this study observed that exposure to PM2.5 in different age groups has the possibility of affecting sleep quality in big city. This study provides evidence of the impact of air pollution on sleep quality, and longer-term causal relationships can be further explored.

**P019: Evaluation of the PM2.5 exposure contribution rates by behavioral pattern**

by sanghoon Lee | Department of Health and Safety, Daegu Catholic University

The daily indoor residence time of modern individuals is approximately 80-90%, with the majority of the day spent at home, accounting for 62.9% of the total time. Among these, fine particulate matter (PM<sub>2.5</sub>) has been designated as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC), increasing the necessity for management related to PM<sub>2.5</sub> exposure. This study used data from the 2019 Time-Use Survey by Statistics Korea to understand exposure to PM<sub>2.5</sub> according to different behavioral patterns through cluster analysis and active simulation. We selected 1,718 people on weekdays in Daegu, one of the major cities in Korea, using Statistics Korea 2019 Time-Use Survey data. similar exposure groups (SEG) will be select by considering the time and behavior by location, The main behaviors that contribute to exposure will be classified by time zone and a PM<sub>2.5</sub> exposure assessment will be conducted for each behavior. The active simulation intends to be carried out for a month from March 2024. Inhalation exposure algorithms will be used for exposure assessment, and exposure factors will use Korean exposure factors and actual measured data. After classifying SEG and deriving 12 optimal clusters, we extracted exposure scenarios. Similar to previous findings, housewives who spend most of their time indoors and are easily exposed to the main sources of PM<sub>2.5</sub> (cooking, cleaning, household chemicals, etc.) are expected to have the highest exposure contribution rates. Time-activity patterns are basic data that estimate exposure according to individual behavior patterns and can be used as basic data that suggests an approach to exposure assessment. Time-activity patterns can be used to estimate an individual's exposure levels, and by identifying behaviors that substantially contribute to PM<sub>2.5</sub> exposure, it is possible to suggest management.

**P020: Environmental factors affecting the efficacy of anti-haze window screens and air purifiers in reducing indoor PM2.5 contamination**

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Climate change, including global warming poses a real challenge and has contributed to the rise of public health importance communicable diseases. Global warming of 1.5°C/2.0°C is defined as an increase in global average temperature of 1.5°C/2.0°C compared to the pre-industrial era (1850-1900) average temperature. Previous studies shown that changes in meteorological factors due to global warming are closely related to the incidence of climate-sensitive communicable diseases (CSCD), including dengue, malaria and leptospirosis. Studies of CSCD's projection on global warming of 1.5°C/2.0°C based on the Representative Concentration Pathway (RCP) scenario were actively conducted. However, such local studies are limited. This study aims to assess the impact of global warming 1.5°C/2.0°C and make a projection of CRCD cases based on RCP8.5 scenario ("high-emission scenario") and RCP4.5 ("intermediate-emission scenario") in Kedah, Malaysia. Generalized Additive Model used to project the number of CSCD cases based on the RCP8.5 and RCP4.5 scenarios, at global warming 1.5°C (expected to occur: 2021-2030) and 2.0°C (expected to occur: 2031-2040). The highest dengue incidence rate projected for Kedah is 40.7 per 100,000 (2033: 2°C/RCP8.5). Malaria cases are projected to increase by 35% at global warming 1.5°C (RCP4.5). The highest malaria incidence rate projected is 1.3 per 100,000 (2026: 1.5°C/RCP4.5). Leptospirosis cases are projected to increase by 3.7% at global warming 1.5°C (RCP4.5). The highest projected leptospirosis incidence rate is 41.7 per 100,000 (2025: 1.5°C/RCP4.5). In conclusion, the number of cases and incidence rates of CRCD are projected to increase under specific global warming and climate scenarios. These findings can be a reference for agencies involved in formulating policies and preparedness for CSCD's control on global warming of 1.5°C/2.0°C. Further studies addressing the confounding effects of urbanization, population growth, and human migration are essential to aid planning and mitigation strategies in dealing with the issue of global warming.

#### **P024: Climate change during one year before birth predicted child mental problems at age four**

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About 10% to 20% of children and adolescents suffer from mental health problems worldwide. Environmental exposure during early life may affect consequent health and induce disease occurrence in later life. Global climate change-related environmental exposure, including temperature rise, extreme weather events, and so on, poses risks to human health and even affects pregnant women and their fetuses. Therefore, we aim to investigate the association between temperature within the first year before birth and mental health at age four. A total of 568 participants from the Taiwan Maternal and Infant Cohort Study were followed between 2015–2017. Child behavior problems at age four were according to caregiver-reported DSM-oriented scales of the Child Behavior Checklist. We used maternal address during pregnancy to estimate the ambient temperature within 48 weeks before childbirth from the Taiwan ReAnalysis Downscaling data (TReAD). We applied the distributed lag non-linear model to predict the association between prenatal ambient temperature and child mental problems. In the third trimester, weekly mean temperature increase (33rd week; OR=1.11)

showed the significantly highest effects on child anxiety problems. On the other hand, an increased weekly average high temperature showed the highest effect on child oppositional defiant problems in the third trimester (34th week; OR=1.07). In addition, increased mean temperature in the second trimester (15th week) had the highest effect on child depression. We observed an association between prenatal ambient temperature change and the risk of mental problems in children at age four, suggesting the potential impact of climate change on neurodevelopmental outcomes. Further research is warranted to elucidate the mechanisms underlying the link between ambient temperature and fetus neurodevelopment. Prenatal ambient temperature change may be associated with mental health in children after birth.

#### **P025: Incremental health risk of an increase in Air Quality Index for women of reproductive age in India**

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Air quality has been identified as the leading environmental health risk. Health burden attributable to air pollution in India is one of the highest globally. Existing studies on exposure to air pollution and its health burden in India are mostly limited to fine particulate matter (PM<sub>2.5</sub>). The incremental health risk in a multi-pollutant scenario is not explored in India. In this work, we addressed this knowledge gap. Air Quality Index (AQI) is a scale used to describe the cumulative impact of multi-pollutant exposure. We first developed an AQI database for India at a high spatial (1-km x 1-km) scale for 13 years (2005-2017) by analysing satellite-derived surface PM<sub>2.5</sub>, NO<sub>2</sub> and O<sub>3</sub> concentrations. We then merged the data with health data collected in the National Family Health Survey (NHFS) of 2015-2016 and used logistic regression model to assess the cumulative impact of long-term exposure (2007-2016) to AQI on anaemia prevalence among women of reproductive age (WRA, 15-49 years). We found that country-averaged AQI has increased by 22% from 121.93 in 2005 to 148.84 in 2017, with the highest rise observed over the Indo-Gangetic Plain and the western arid regions. In 2005, 40% of the Indian population was exposed to NO<sub>2</sub> levels exceeding the World Health Organization (WHO)-air quality guideline (AQG), while the proportion increased to 59% in 2017. Corresponding changes in the proportion of population exposed to levels exceeding the WHO-AQGs for PM<sub>2.5</sub> and O<sub>3</sub> were 99% and 69% in 2005 to 99% and 93% in 2017, respectively. We found that for a unit change, 10-unit change and 50-unit change in AQI, the odds ratios (ORs) for anaemic prevalence among WRA were 1.0032(1.003-1.0035), 1.032(1.03-1.034) and 1.172(1.16-1.18), respectively. Our study reveals a significant association between AQI and anaemia prevalence among WRA in India, emphasizing the urgent need for targeted interventions and linking of environmental and health policies.

#### **P026: The acute health effect of PM2.5 on daily cardiovascular disease mortality: a time series study in India**

by *Taruna Singh | Sagnik Dey | Ambuj Roy | Centre for Atmospheric Sciences, Indian Institute of Technology Delhi | Department of Cardiology, All India Institute of Medical Sciences Delhi*

Numerous epidemiological studies have examined the acute health effects of exposure to PM<sub>2.5</sub> on cardiovascular mortality in developed countries. However, due to data limitations, there have been few related studies in developing countries with high levels of PM<sub>2.5</sub> exposure. In recent years, the population of India has experienced a substantial burden of cardiovascular disease, especially among those exposed to high levels of PM<sub>2.5</sub>. Here, we aim to study the association between short-term PM<sub>2.5</sub> exposure and daily cardiovascular disease mortality among the population of India. The analysis involves health data from the National Heart Failure Registry and PM<sub>2.5</sub> exposure data from Katoch et al. (2023). A satellite-based dataset (1 km resolution) is used



for PM<sub>2.5</sub> exposure because ground-based measurements are inadequate and do not cover all the districts of India. The data is calibrated against the existing ground-based measurements. Preliminary results showed that 74.4% of patients had de novo heart failure and 25.6% had re-admissions. Population showed 72% ischemic heart disease, the predominant etiology for heart failure, followed by cardiomyopathy with 18% of the population. Hypertension and diabetes were the most frequent co-morbid conditions in the population (48.9% and 42.3%, respectively). Other conditions reported in the population were chronic kidney disease (8.5%), stroke (3%), and chronic obstructive pulmonary disease (6.9%). Further analysis will be done to study the effect of an increase in PM<sub>2.5</sub> pollution on the number of hospital admissions due to heart failure.

**P027: Investigating sanitary conditions of a water treatment plant supply system in Johor Bahru: a path to better quality**

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Rapid urbanisation and industrialization have intensified water pollution, affecting socio-economic growth and public health. This study focuses on assessing the bacteriological and physicochemical drinking water quality of a water treatment plant (WTP) supply system in Johor Bahru, Malaysia. A descriptive case study approach was used to collect and analyse 43 water samples from four areas—Skudai River, its tributaries, a water treatment facility, and a distribution network—on July 10th and 11th, 2023. In collaboration with local agencies, these samples were tested for biological and physicochemical parameters using established methods, and data analysis was conducted using Microsoft Excel and SPSS version 29. The bacteriological analysis revealed that 69.8% of the samples were contaminated with total coliforms (TC), with 83.3% of the samples tested positive for *E. coli*. Meanwhile, 7 of 13 (53.8%) physicochemical parameters, exceeded the recommended acceptable limits with pH (11.6%), COD (39.5%), BOD (18.6%), ammonia (51.2%), nitrate (4.7%), iron (67.4%) and aluminium (46.5%) in all four areas. The highest ammonia concentration was 26.89 mg/L, far exceeding national standards. High contamination levels mainly due to industrial effluents, agricultural runoff, and residential sources. Turbidity levels, however, conformed to standards across all areas, with the highest recorded turbidity being 203 NTU. Residual chlorine levels were within the safe range, indicating compliance with drinking water quality standards. The study identifies critical drinking water quality issues in the examined regions, stressing the need for immediate corrective actions to protect public health. It advocates for collaborative and ongoing research to deeply understand water quality variations and create adaptable management strategies. This research significantly contributes by thoroughly examining both bacteriological and physicochemical parameters, offering key insights into the challenges of water pollution in rapidly urbanising areas.

**P028: Differential Heat Exposure among the Indian subpopulation at different climate zone over India**

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The soaring extreme heat events impact society differentially. A good number of studies from high-income countries found the actual disparities were consistent across cities, and most of the inequalities in heat exposure were based on income and race. Due to the unavailability of systematic heat exposure data and a framework to merge it with

health data, it is difficult to attribute the exposure at the population level and to make scientific evidence of the health impacts of heat stress in LMICs like India. This work tried to find heat exposure disparities among rural-urban clusters in India based on the climate classification using the developed ambient heat exposure database at a large spatial and temporal resolution using routinely available meteorological variables, specifically for India. The framework can address current exposure assessment limitations for analysing health risks associated with environmental stressors. This study is useful for identifying the discomfort level due to ambient heat exposure in the vulnerable population and further heat-related health impact assessment in those vulnerable subpopulations over India. Our study provides the first national-scale analysis of Heat exposure on disparity among Indian sub-populations using national-scale survey data from 2015 to 2021. The preliminary results show that the arid climate zone will experience more heat exposure (70%) during summer days (16th March to 15th July). The corresponding numbers in the semiarid, humid subtropical, tropical wet and tropical wet and dry zones were 75, 54, 57, and 60%, respectively. We found larger disparities contributed from central and southern states. We further estimate factors for the regional disparity, especially special urban and rural regions. Such information can help city leaders use better measures of heat disparities and protect populations most at risk from heat exposure. This understanding is vital for long-term infrastructure planning and development in risk reduction.

**P029: Interactive effects of ozone and temperature on mortality in Japan**

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Extensive epidemiological analysis has shown a significant increase in mortality risks associated with both ozone and temperature. The simultaneous exposure to ozone and temperatures may also lead to exacerbation of adverse health effects due to interaction. However, regional inconsistencies persist in understanding the potential interactive effects of ozone and temperature on acute mortality. In this study, we explored the interaction effects between ozone and temperature on daily mortality using a comprehensive nationwide dataset covering all 47 prefectures in Japan (2009 – 2019). The analysis was based on prefecture-specific daily weather conditions, ozone concentration levels (ppb), and daily mortality counts. Meteorological data were provided by the Japan Meteorological Agency, and daily mortality data were provided by the Ministry of Health, Labor, and Welfare of Japan. Hourly ozone data were obtained from the National Institute for Environmental Studies, and a daily maximum 8-hour moving average ozone was derived. A time-series quasi-Poisson regression model was applied to illustrate the mortality risks. We fitted a non-parametric bivariate response-surface model incorporated with the tensor product to explore the interactive effect of temperature and ozone on mortality while adjusting for the day of the week and time trends. The three-dimensional surface plots were generated with controlled extrapolation to improve clarity and avoid unnecessary visual artifacts by preventing misleading visualizations that extend beyond the observed data range. Our findings demonstrate the intertwined influence of temperature and ozone on mortality in Japan, highlighting geographical variations in the associated risks. Therefore, integrating both ozone and temperature factors into public health prevention plans, given the anticipated increase in future temperatures, and

developing region-specific adaptation strategies and local awareness initiatives for risk prevention is imperative.

### **P030: Effectiveness of national climate strategies in mitigating infectious diseases in OECD countries**

by *Caillin Dunsford* | *University of Sydney*

This report sought to analyse how current national climate strategies are impacting infectious disease mitigation efforts, and benchmark Vietnam's efforts against other OECD South-East Asia (SEA) countries. By comparing national climate change strategies and data from IHME and the Climate Watch, Vietnam was found to be doing relatively well in terms of addressing infectious diseases through climate change mitigation efforts, both individually and in comparison to other OECD SEA countries. Further analysis found that Vietnam has the highest prevalence of respiratory diseases and TB in comparison to other OECD countries but is ranked comparatively well when looking at overall infectious disease DALY's and incidence rates. However, this report recommends that Vietnam include infectious disease mitigation efforts in all current and future national plans, focus infectious disease interventions on the infectious diseases that have the highest burden in the country such as tuberculosis, increase health expenditure per capita to above 5% by reducing spending on pharmaceuticals, and implement these changes in the next 3 years in order for efforts to be reflected in Vietnams 2027 NDC.

### **P031: An evidence-based association between extreme temperatures and mental disorder: A time-series study of Taiwan**

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Extreme temperature events have been linked to adverse health outcomes, including mental disorders (MD). This study aimed to investigate the association between extreme temperatures and the burden of age-sex-specific overall MD in Taiwan using 11 years (2010-2020) data. We conducted a retrospective study using daily outpatient visits of overall MD from the Taiwan National Health Insurances database. A distributed lag non-linear model was employed to assess age (19-44, 45-64, and 65 years and above), sex-specific outpatient visits associated with extreme cold (5<sup>th</sup> percentile) and hot (99<sup>th</sup> percentile) temperatures considering a cumulative lag of 7 days. Random-effects meta-analysis was used to investigate the pooled relative risks (RR) and 95% confidence intervals (CI). We found that extreme cold temperatures in Taiwan had a predominant effect on MD, particularly in the population aged 45-64 years, with higher risks observed in female at lag of 7 days (RR: 1.13; 95% CI: 1.08-1.19). Extreme hot also increased the risks of MD in all populations studied, with the highest increment of 4% observed in female aged 45-64 years (RR: 1.04; 95% CI: 1.02-1.05). Our result

highlight that females population tend to be more vulnerable to both extreme cold and hot temperatures compared to males population. Our data reveals varied risks linked to extreme temperatures and their detrimental impacts on MD in Taiwan. It is important for public health practitioners to prepare adaptation strategies to account for such differences for it to have a meaningful impact. The study provides valuable insights into the association between extreme temperature and MD. By investigating the burden of MD associated with extreme temperatures over an 11-year period, this nationwide study contributes to improve the understanding of how climate change may impact mental health outcomes.

### **P032: Heat index trends in Greater Klang valley, Malaysia: A short-term investigation**

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Rapid urbanization is being driven by population growth and upward pattern of economic activity in urban areas. The global warming trend in Malaysia using a 50-year (1951-2001) temperature data set observed that the annual mean temperature climbed from 0.99 to 3.44°C/100 years, which is harmful to people's health. This study aims to determine the level of heat index in Greater Klang Valley (GKV) during the study period which took daily data on temperature (°C) and relative humidity (%) into account. These data collected between 1st June 2022 and 31st March 2023. The heat index was calculated using MS Excel and the spatial interpolation was mapped by ArcGIS. Inverse distance weighted (IDW) method was used to identify the distribution level of heat index spatially. Four stations namely in Nilai, Cheras, Petaling Jaya and Shah Alam hit above caution level with heat index of 33.36°C, 34.39°C, 35.27°C and 32.14°C respectively. These values were observed at the same date (19th October 2022) except for Shah Alam. Across the study duration, Batu Muda and Shah Alam were highlighted by IDW maps as locations with heat index over 26.5°C, almost reaching the caution threshold. These results demonstrated that a small number of urban areas deserved to be monitored for having surpassed the cautionary limit. This deserves to be addressed promptly, considering that it directly affects all sectors namely in terms of human health, human-being and economics.

### **P033: The association between environmental factors, weather and light, and traffic accidents in Taiwan**

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Traffic accidents was the most overlooked leading cause of death. Environmental factors such as weather influenced by climate change and visibility affected by air pollution, may play crucial roles in traffic accidents. The present study is to examine whether there are differences in injury severity and road user categories in traffic accidents under different weather and light conditions. We obtained the 2020 Road Traffic Accident Investigation Report and established the database focusing on the first parties involved. Excluding passengers, drunk drivers, and unlicensed drivers. Chi-square analysis was used to examine differences of injury severity, road user categories in different weather and light conditions in Taiwan. As to weather, the highest injury rate was in strong wind, while fog-or-smoke led to the second-highest

injury rate and the highest fatality rate. Among road user types, it was revealed that only under fog-or-smoke showed the significantly higher proportion of car and pedestrian when compared to sunny day. During dawn and dusk, accidents have significantly higher fatality and injury rates than natural light, and the proportions of injuries for cars, bicycles, and pedestrians were significantly higher. In nighttime or limited spaces, non-illumination exhibited significantly higher accident fatality and injury rates than illuminated, and the proportion of car accidents in non-illumination was significantly higher. Regardless of any weather and light conditions, motorcycle accidents consistently resulted in the highest fatality and injury rates. Traffic accidents in strong winds, fog-or-smoke, and during slanting sunlight, are more likely to cause injuries and death. The increased injuries in different road user types under specific weather or light conditions. This study clarifies the differences in the distribution of injuries during weather and light conditions in Taiwan. We should further explore the environmental changes caused by climate change or worsening air pollution.

### **P034: Health and climate-heat preparedness through heat-health warning systems**

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Driven by the increasing negative impacts related to global warming and heat wave events, a heat-health warning metric (HHWS) has been introduced to reduce the risk of heat-related death events. HHWS is designed to activate warning signals when projected temperatures and meteorological factors exceed threshold values capable of affecting health. Heat wave early warning systems in most developing countries including Malaysia are more focused on meteorological factors than from a health perspective. This study aims to develop a HHWS for State of Kelantan, Malaysia. An ecological study was conducted and the relationship between temperature and death was analysed with the Generalized Linear Model and the Distributed Lag Non-Linear Model. The HHWS is formed using the cumulative effect (relative risk) of high temperature (90th–99th percentile) on death (all causes) and lag for temperature (average and maximum). This warning system provides three levels of heat-related death risk based on temperature percentiles and duration after heat exposure. The HHWS is divided into three risk levels: low, medium and high. Results showed an increase of the heat-related death risk after the 3rd day to the 4th day duration using the average temperature metric. While the maximum temperature metric shows that the highest risk at a shorter exposure time i.e. on the 1st day and the risk decreases after that. These findings could assist the relevant government agencies in formulating targeted interventions and policies, increasing community awareness and developing a more effective HHWS on the verge of 1.5°C–2.0°C global warming. A similar study throughout Malaysia, variation in heat metrics usage and projection data when at 1.5°C–2.0°C global warming in the formation of SAH-K should be conducted to ensure the country's preparedness in facing the threat of extreme heat in the future.

### **P035: Temperature's impact on insomnia-related emergency department visits in Seoul, South Korea**

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Insomnia induces notable distress, obstructs daytime functionality, and reduces overall quality of life. This sleep disorder is a growing health concern globally, influenced by various factors, including ambient temperature. This study aims to explore the short-term association between ambient temperature and emergency department (ED) visits for insomnia in Seoul, South Korea. Using the National Emergency Department Information System (NEDIS) database from 2008 to 2017, we identified 7,855 patients who visited ED for insomnia [International Classification of Disease, 10th revision code F51.0 and G47.0] in Seoul, South Korea. We employed a time-stratified case crossover design using a conditional logistic regression model, and utilized a distributed lag non-linear model to explore possible non-linear and delayed effects of ambient temperature on ED visits for insomnia. We also calculated the odds ratio (OR) for the temperature with maximum ED visits for insomnia (MaxIT) compared to the temperature with minimum ED visits for insomnia (MinIT). In the subgroup analysis, the modification effects of sex, age (18–34, 35–49, 50–64, and ≥65 years), comorbidity (without/with comorbidities) and season were also examined. A significant association was found between ambient temperature and ED visits for insomnia. Total insomnia increased significantly at high temperature (MaxIT: 29.3°C, OR: 2.09) compared to MinIT (-8.9°C). Furthermore, subgroup analyses results revealed that the risk of ED visits for insomnia was significantly associated with high temperature in the group of female patients (MaxIT: 29.3°C, OR: 2.66), patients aged 35–49 (MaxIT: 25.6°C, OR: 4.84), patients without comorbidities (MaxIT: 29.4°C, OR: 2.21), fall (MaxIT: 25.6°C, OR: 2.38) and winter (MaxIT: 8.1°C, OR: 1.90). We found the impact of ambient temperature on ED visits for insomnia, suggesting a need for tailored interventions. Understanding these associations contributes to effective management and prevention strategies for insomnia-related ED visits.

### **P036: Effect of diurnal and nocturnal temperature range on mortality from cardiovascular disease**

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Recent studies show that short-term temperature variations impact human health, with effects varying based on the direction of the temperature change. However, research on the directional impact of temperature changes on mortality between neighboring days is limited. Cardiovascular diseases, associated with climate change, are the leading cause of death worldwide. Therefore, we aim to investigate the impact of diurnal temperature range (DTR), representing the temperature increase from night to day, and nocturnal temperature range (NTR), representing the temperature decrease from day to night, on mortality from CVD in Seoul, South Korea. Using the mortality data provided by the Korea National Statistical Office from 2008–2020, we identified a total of 73,918 individuals who died from CVD [International Classification of Disease, 10th revision code I10–I15, I20–I24, I50 and I60–64]. We defined DTR as the difference between the maximum and minimum temperatures on the present day, and NTR as the difference between the minimum temperature on the present day and the maximum

temperature on the previous day. We performed a quasi-poisson regression analysis using generalized additive model to assess the short-term effect of DTR and NTR on mortality from CVD. We found a significant positive association between per 1 SD (2.87°C) increase in DTR and an elevated risk of mortality from CVD at lag 1 (percentage change in relative risk [RR]:1.11%, 95% confidence interval [CI]: 0.10-2.13), lag 2 (RR=0.93%, 95% CI: 0.07-1.81), lag 0-2 (RR=1.72%,95% CI: 0.45-3.00), lag0-3 (RR=1.62%, 95% CI: 0.40-2.85), and lag 0-4 (RR=1.29%, 95% CI: 0.09-2.51). However, the association between NTR and mortality from CVD was not significance. Our findings contribute to an enhanced understanding of the impact of short-term temperature variations on health and the development public health policies for mortality from CVD.

**P037: A study protocol for assessing vulnerability and adaptation to urban heat island in the Klang Valley**

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Urban Heat Islands (UHIs) present tremendous challenges to urban people, exacerbates vulnerabilities and affecting their health, livelihoods, and overall well-being. This study was aimed at assessing vulnerability mapping of the urban area due to climate change using a recommended framework based on three dimensions at the household level: exposure (E) to UHI, sensitivity (S) due to demographic and socioeconomic factors, and adaptive capacity (AC) relating to available assets and adaptive behaviour to deal with climate change impacts. A pre-tested questionnaire and face-to-face interviews were carried out with 462 randomly selected households in the Klang Valley region (Kuala Lumpur, Petaling District, Hulu Langat District, and Klang District) between December 2023 till February 2024. The primary data gathered were utilised to calculate the vulnerability index using the exposure (E), sensitivity (S), and adaptive capacity (AC) indices. We expected that the differences in exposure, socioeconomic and sociodemographic attributes, and accessible resources across various districts may have led to varied levels of vulnerability within these areas. This study will highlights the necessity for tailored and proactive adaptation strategies at the community level, which should be facilitated by government resources and participation. It is recommended that an adequate community-based adaptation be implemented to effectively meet the needs of the most vulnerable people in the exposed area. Enhancing the resilience of urban households necessitates a collective effort involving all stakeholders, with a particular emphasis on close collaboration between local government bodies and the community. This collaboration should involves fostering an inclusive decision-making process that takes into account the voices of marginalized groups and ensures that interventions are tailored to address the specific vulnerabilities and challenges faced by different groups in the population.

**P038: Impact of climate change on vector-borne diseases in the Asian region**

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Climate change has emerged as a critical factor influencing the distribution, prevalence, and dynamics of vector-borne diseases (VBDs) worldwide. It is increasingly recognized as a significant driver of VBDs across the Asian region, presenting complex challenges to public health and disease control efforts. This review aimed to determine the relationship between climate change and VBDs, focusing on the implications for public health, disease ecology, and mitigation strategies. It also aims to determine current knowledge on the impacts of climate change on VBD transmission dynamics in Asia. Rising global temperatures, altered precipitation patterns, and extreme weather events are reshaping the habitats and behaviour of vectors such as mosquitoes, ticks, and sandflies, thereby amplifying the transmission of diseases such as malaria, dengue fever, Zika virus, Lyme disease, and Japanese encephalitis. Changes in climate also impact vector-host interactions, pathogen development, and human susceptibility to infection, exacerbating the burden of VBDs on vulnerable populations. Socio-economic factors and human activities interact with climatic variables to exacerbate VBD transmission. While some regions may experience shifts in disease patterns due to climate change, others face the re-emergence or introduction of new VBDs. While climate change presents formidable challenges, it also offers opportunities for innovative adaptation and mitigation measures. Effective adaptation and mitigation strategies are essential to address these challenges, requiring interdisciplinary approaches that integrate climate science, epidemiology, and public health interventions. Strengthened surveillance systems, enhanced vector control measures, and capacity-building initiatives are imperative to mitigate the impact of climate change on VBDs in Asia and safeguard human health in the face of an evolving climate landscape. Hence, interdisciplinary collaborations across sectors including public health, environmental science, and policy are essential to address the multifaceted impacts of climate change on VBDs in the Asian region.

**P039: Spatio-Temporal Dynamics of Dengue Incidence and Meteorological Variables in Malacca State, Malaysia.**

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Dengue fever remains a significant global health challenge, with its incidence influenced by various factors, including meteorological conditions. This study aims to unravel the complex relationships between dengue incidence and meteorological variables, focusing on the Malacca State, which has seen fluctuating dengue cases over the years. The research employs a multi-faceted analytical approach, using the Johansen Cointegration Test to examine long-term relationships among dengue cases, temperature, and rainfall in year 2020-2022. The study further applies the Vector Error Correction Model (VECM) to validate these relationships and assess short-term adjustments. To capture the evolving dynamics over time, a time series clustering approach using Dynamic Time Warping (DTW) with k-Nearest Neighbors (k-NN) was utilized. The study also incorporates t-Distributed Stochastic Neighbor Embedding (t-SNE) and Uniform Manifold Approximation and Projection (UMAP) for data visualization, alongside Local Indicators of Spatial Association (LISA) analysis for spatial pattern identification. The Johansen Cointegration Test revealed a long-term equilibrium relationship among the variables, supported by VECM findings. The model diagnostics indicated a Root Mean Square Error (RMSE) of 26.81, denoting satisfactory model fit. Time series clustering exposed significant volatility in the interplay of these variables, particularly during the year 2020. Visualization techniques revealed complex, overlapping clustering patterns, while LISA analysis in 2020 highlighted localized high case and temperature clusters and significant spatial associations between cases and rainfall. The study demonstrates a significant, intricate nexus between dengue incidence and meteorological variables, characterized by both temporal and spatial heterogeneity. This research contributes to a deeper understanding of the spatiotemporal dynamics

of dengue fever, highlighting the importance of considering both meteorological factors and their spatial patterns. These insights pave the way for the development of more effective predictive models and targeted intervention strategies in dengue-prone areas.

**P040: Cold spells and renal disease mortality in Japan during 1979-2019: vulnerable populations and temporal changes**

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Quantifying the short-term associations between cold spells and renal disease mortality in vulnerable populations can be crucial for public health policymaking. This study examined the associations between short-term exposure to cold spells and renal disease mortality and its temporal variations. We obtained daily mortality data for all renal diseases (ICD-10 N00-N39), acute renal failure (ICD-10 N17), and chronic renal diseases (ICD-10 N18) from the Ministry of Health, Welfare, and Labor, Japan. The analysis focused on Japan's four coldest months spanning 1979-2019. We defined four types of cold spells based on duration (2 or 4 days) and intensity (2.5<sup>th</sup> or 5<sup>th</sup> percentile of prefecture-specific mean temperature). A two-stage time-stratified case-crossover analysis was conducted. Prefecture-specific estimates were derived in the first stage and the national-level estimate was estimated in the second stage. Subgroup analyses by sex and age (0-64, 65-84, and >85) and temporal analyses across four sub-periods were conducted. Statistical significance for temporal changes was assessed through pairwise comparisons of risk estimates between the first (1979-1988) and the last sub-period (2009-2019). A total of 367,663 deaths were included for analysis. Cold spells days, defined as those below the 5<sup>th</sup> percentile temperature lasting at least 2 days, increased the risk of all renal mortality (relative risks (RR) 1.14 [95% confidence interval (CI) 1.09-1.18]), acute renal failure (RR 1.23 [95% CI 1.07-1.41]), and chronic renal disease (RR 1.07 [95% CI 1.01-1.14]) compared to days without cold spells. Subgroup analyses revealed susceptibility to cold spells in all sub-groups except individuals aged 0-64. Significantly increased risk was observed in the recent sub-period for females with chronic renal disease. Cold spells elevate the risk of renal disease mortality despite a warming climate. The findings underscore the need for personalized interventions to prevent winter-related renal deaths.

**P041: Study on method for predicting heavy metal concentration based on pm2.5 concentration using machine learning**

by Ji-Yun Jung | Cheol-Min Lee | In-Seok Choi | Jong-Won Kim | Tae-Woo Koo | Ju-Young Noh | Min-Woo Oh | Seokyeong University | Seokyeong University | Korea Conformity Laboratories | Busan Technopark

Industrial complexes are one of the artificial sources of fine dust, emitting particulate matter with unique physicochemical characteristics depending on manufacturing process and raw materials used. The concentration of heavy metals emitted from industrial complexes is significantly higher than that in the general atmospheric environment. In particular, when heavy metals deposit on PM<sub>2.5</sub>, their adverse effects on the human body are exacerbated. As part of efforts to reduce air pollutants within industrial complexes, this study proposes a method

using machine learning to predict heavy metal concentration based on PM<sub>2.5</sub> concentration. Utilizing data collected from five measurement points, including concentration of PM<sub>2.5</sub> and heavy metals, along with meteorological information (wind direction, wind, speed, precipitation, temperature, relative humidity), this study proposes a method to predict the concentration of 17 types of heavy metals. The approach employs machine learning techniques such as Multiple Linear Regression (MLR), Random Forest Regression (RFR), and Gradient Boosting, as well as deep learning techniques like Artificial Neural Network (ANN). Splitting the data into 70% for training and 30% for validation, models were trained based on the training data. Subsequently, the predictive performance of each model was assessed the final R<sup>2</sup>, RMSE, and MAE values. The combination with the best predictive accuracy was then selected. The results indicate that, in order of performances, RFR, Gradient Boosting, ANN, and MLR exhibited strong predictive capabilities. Based on this, it was determined that a model combining RFR and Gradient Boosting is suitable for predicting heavy metal concentration. If the proposed heavy metal prediction model in this study is employed, it would allow the real-time estimation of heavy metal concentration that may currently go undetected due to limitations in measurement and analysis technologies. Additionally, with the availability of data corresponding to input variables, it offers the advantage of assessing heavy metal concentration in various regions.

**P042: Exposure to multiple heavy metals is associated with hypertension: A cross-sectional study in China**

by Ruoyu Gou | Ningxia Medical University

Heavy metals may play an important role in hypertension. The aim of this study was to investigate the relationship between hypertension and exposure to manganese (Mn), lead (Pb), copper (Cu), zinc (Zn), cadmium (Cd) and antimony (Sb). A cross-sectional study of 3,446 subjects was conducted. Logistic regression was used to estimate the relationship between each metal exposure and risk of hypertension. The potential heterogeneity of groups according to sex, age and smoking status was investigated, and metal mixtures and interactions were assessed by Bayesian kernel machine regression (BKMR). The logistic regression analysis identified Cu ([OR]=7.796, 95% [CI]: 3.395-17.903, P <0.001) and Cd (OR=1.894, 95% CI: 1.385-2.592, P <0.001) as risk factors for hypertension. The BKMR analysis indicated that all heavy metals had a complex, nonlinear exposure-response relationship with the risk of hypertension in participants aged 60-99; the stratified analysis of all Cu levels also showed a complex nonlinear relationship. The stratified analysis revealed a significant correlation between the plasma levels of heavy metals and risk of hypertension aged 30-59, nonsmokers, and women. We did not observe any interaction between the hypertensive status of study participants and exposure to the metals, but the logistic regression model revealed possible interactions; we provide explanations for these results. Plasma Cu and Cd levels were positively correlated with risk of hypertension when the metal levels were assessed individually or in combination and may be risk factors for hypertension. Future cohort studies with larger sample sizes and longer follow-up periods are necessary to confirm these associations.

**P044: Carbon disulfide exposure, Genetic susceptibility, and Lung function decline: A gene-environment interaction study in Chinese urban adults**

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2g sample. *Remannia glutinosa* was performed ultrasonic extraction on a 1g sample, followed by liquid-liquid extraction. Both samples were purified with florisil cartridges, reconstituted with methanol, and analyzed by GC-MS. Method validation was performed with low, medium, and high-concentration samples (n=5) over three days, evaluating limit of detection, accuracy, precision, and linearity. Accuracy ranged between 95.2 – 103.6% in edible oils and 94.5-106.9% in *Remannia glutinosa*. Precision ranged between 3.5 – 9.5% in edible oils and 1.6-5.3% in *Remannia glutinosa*. The limit of detection was 0.02 µg/kg (edible oils) and 0.06 µg/kg (*Remannia glutinosa*), with the coefficient of determination ( $r^2$ ) for the calibration curve exceeding  $r^2 > 0.99$ . Modified benzo(a)pyrene testing methods in this study proved suitable for sample analysis. However, matrix matched calibration is required to reflect the matrix effect. Pre-treated calibration showed a 2-3 times higher slope compared to the standard substance-diluted calibration, indicating quantification results in concentrations 2-3 times higher due to matrix effects.

**P049: Method validation and application of analyzing urinary metabolites of volatile organic compounds and pyrethroid insecticide**

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Exposure to volatile organic compounds (VOCs) and pyrethroid insecticides can cause irritation of the skin and respiratory mucous membranes and sensory abnormalities. Both substances are included in household chemical products, so the level of exposure may vary depending on individual usage. This study established a simultaneous analysis method for 14 metabolites of VOCs and 3 metabolites of pyrethroid insecticides for analyzing biomarkers of pregnancy and childbirth diseases in urine samples of pregnant women and infants. Additionally, previously collected human samples were analyzed to confirm the applicability of the method. For the validation of the analysis method, the detection limit, accuracy and precision were calculated using the results of repeated analysis of the three concentration levels 5 times for 3 days. Analysis was performed on urine samples collected from 10 families (n=60) consisting of mothers and children. Urine samples were quantitatively analyzed using UHPLC-MS/MS after hydrolysis by enzymes and syringe filtration. The accuracy and precision were 88.61-109.73% and 1.96-8.51%. The  $r^2$  of the calibration curve was over 0.999, showing excellent linearity. Most substances showed a detection rate of over 90%. Among the substances, DHBMA was detected at the highest geometric mean (GM) concentration of 172.34 ng/mL, followed by 3-MHA+4-MHA (137.69 ng/mL), and ATCA (127.68 ng/mL), PGA (106.19 ng/mL). ATCA levels were relatively higher in children, while AMCC levels were relatively higher in adults ( $p < 0.05$ ). This study established a simultaneous analysis method of 17 metabolites of VOCs and pyrethroid insecticides in urine for biomarker analysis of pregnancy and childbirth diseases, and analyzed urine samples to confirm the applicability of the method.

**P050: Effects of meat type and sodium chloride on 3-monochloropropanediol esters contents: implications for health risk in brined meats**

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3-Monochloropropanediol (3-MCPD) esters (3-MCPDEs) are processing contaminants derived from glycerides under high-temperature treatment. 3-MCPDEs are hydrolyzed during digestion to free 3-MCPD, which was classified as group 2A carcinogen by the International Agency for Research on Cancer (IARC). The aim of this study was to determine the effect of various meat and sodium chloride (NaCl) additions on the 3-MCPDE content. The meat samples including pork butt, chuck eye steak, salmon steak, and chicken thigh steak were brined in 0, 3, 5, or 10% NaCl solution (1:3, w/v) for 2 hours and then heated at 210°C to safe minimum internal temperatures. 3-MCPDE contents, acid value (AV), peroxide value (POV), and *p*-anisidine value (*p*-AnV) of the extracted oils from meats were determined. The contents of 3-MCPDEs increased with increasing NaCl concentrations in all kinds of meats. Salmon steak immersed in 10% NaCl solution generated significantly higher 3-MCPDEs than other groups. Salmon and chicken showed relatively higher values of AV, POV, and *p*-AnV, probably due to its highly unsaturated fatty acids. The 3-MCPDE contents of the four types of meats showed strong positive correlations with AV, POV, and *p*-AnV, with *r*-values all greater than 0.7. The results indicate that NaCl acts as a precursor and lipid oxidation promoter, leading to an increase in the content of 3-MCPDEs during the heating process of brined meat, particularly in meat with higher levels of unsaturation in fats. The exposures to 3-MCPDEs, calculated based on the daily meat intake in Taiwan, did not exceed the tolerable daily intake (TDI) for each of the four types of meats, posing a low health risk.

**P051: Correlation between cigarette smoking and alcohol drinking habits and LINE-1 DNA methylation**

by Chih-Ching Yeh | Chiao-Chen Wang | Taipei Medical University | Taipei Medical University

Cigarette smoking and alcohol drinking are significant public health concerns due to their association with various cancers. The epigenetic theory, a hypothesis in carcinogenesis, prompts further exploration into the impact of these habits on epigenetic factors, specifically DNA methylation. This study aimed to investigate the association between LINE-1 DNA methylation, a global DNA methylation biomarker, and the consumption of cigarettes and alcohol. A total of 2469 adult subjects from the Taiwan Biobank were included. LINE-1 methylation levels were measured using the Illumina Infinium Methylation EPIC Bead Chip and represented as a percentage. The mean percentage of LINE-1 among subjects with different smoking and drinking statuses was compared by Student's *t*-test or ANOVA. LINE-1 methylation level was also categorized into two or four groups based on median or quantile. Logistic regression was used to estimate odds ratio (OR) and 95% confidence interval (CI) to assess the association of smoking and drinking status with categorical LINE-1 methylation levels. LINE-1 methylation levels in smokers (74.00±1.08%) were significantly higher than in non-smokers (73.77%±1.06%) ( $P < 0.001$ ). Similarly, alcohol drinkers have a higher LINE-1 methylation level than non-drinkers (74.05% vs. 73.80%,  $P < 0.001$ ). Compared to non-users of cigarettes or alcohol, both cigarette smokers and alcohol drinkers had a 1.38-times higher risk of LINE-1 hypermethylation levels. The risks were more pronounced in the highest quantile, with an OR of 1.61 (95% CI=1.25-2.08,  $P=0.0002$ ) for cigarette smoking and an OR of 1.99 (95% CI=1.36-2.90,  $P=0.0004$ ) for alcohol drinking. The findings suggest that cigarette smoking and alcohol drinking contributed to increased LINE-1 methylation levels. Further studies are necessary to investigate the role of LINE-1 hypermethylation in cancer development.

### P052: Phthalate exposure assessment in paint manufacturing environments through airborne and surface analysis

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Phthalates, known for their disruptive effects on the endocrine system, are extensively used in industrial and household products. Despite restrictions imposed in several countries, managing occupational exposure to these chemicals remains insufficient, potentially risking the health of workers. This study aimed to examine the presence of four commonly used phthalates—bis(2-Ethylhexyl) phthalate (DEHP), Dimethyl phthalate (DMP), Diethyl phthalate (DEP), Dibutyl phthalate (DBP)—in a paint manufacturing setting. We collected airborne and surface wipe samples from various areas, encompassing manufacturing sites and office/lounge spaces. Air samples were gathered using Tenax TA OVS samplers to capture both gaseous and particle-bound phthalates, while surface wipe samples were collected using gauze soaked in 70% IPA within a 100 cm<sup>2</sup> defined area. Analysis was conducted using GC-MS. Results showed detection rates of DMP (92.3%), DEP (100%), DBP (69.2%), and DEHP (100%) in air samples. Median concentrations (in ug/m<sup>3</sup>) during mixing processes were: DMP 2.41 (<LOD-16.3), DEP 3.43 (1.42-4.58), DBP 1.28 (<LOD-1.78), and DEHP 10.68 (8.72-18.57). Phthalates were also present in office/lounge areas, with concentrations of DMP 1.94, DEP 6.98, DBP 2.17, and DEHP 7.02. Surface samples (in ng/cm<sup>2</sup>) indicated notable exposure levels, particularly during the mixing process: DMP 17.6, DBP 0.59, and DEHP 205.27 (6.93-2114). DEHP was also detected in the office/lounge area at 24.89 (9.2-91.0). These findings suggest that workers in paint manufacturing are potentially exposed to phthalates through inhalation and dermal contact during their work shifts and breaks. To further understand their overall exposure and potential health implications, a biomonitoring study among these workers is underway.

### P053: Indoor exposure to fine particle and household characteristics in patients with idiopathic pulmonary fibrosis

by Seokmin Ji | Sun-Young Kim | Kyumin Kyu | Miyoung Shin | Soyoung Han | Seung-Hyun Cho | Hee-Young Yoon | Jin Woo Song | Korea University, Korea | National Cancer Center, Korea | Korea University, Korea | National Cancer Center, Korea | Yonsei University, Korea | Soonchunhyang University, Korea | Asan Medical Center, Korea

The adverse health effects of fine particle  $\leq 2.5$  micrometer in diameter (PM<sub>2.5</sub>) found in previous epidemiological studies may be greater in susceptible populations such as patients with chronic lung diseases who spend more time indoors. Indoor PM<sub>2.5</sub> concentrations are affected by household characteristics. However, there were limited attempts that investigated the association between household characteristics and indoor PM<sub>2.5</sub> in elderly patients. This study aims to examine household characteristics that affect indoor PM<sub>2.5</sub> concentrations in patients with idiopathic pulmonary fibrosis (IPF). We carried out a monitoring campaign of indoor PM<sub>2.5</sub> at homes of 169 patients with IPF for five days in each of four seasons from September 2021 through August 2023. We measured PM<sub>2.5</sub> concentrations using MicroPEMs (RTI, USA) and interviewed each patient to obtain household characteristics including demographics, home environments, and lifestyles. Using the household characteristics chosen based on Kruskal-wallis test of each characteristic and mean PM<sub>2.5</sub> concentration in each visit, we applied stepwise regression to finalize the list of household characteristics associated with indoor PM<sub>2.5</sub> concentrations. The household characteristics selected in the final model include use of humidifier and air purifier, and housing condition. PM<sub>2.5</sub> concentrations were 0.91 (95% CI=0.62, 1.19) and

0.56 (0.20-0.98)  $\mu\text{g}/\text{m}^3$  higher for the patients who used humidifiers always and frequently, respectively, compared to those who never used. PM<sub>2.5</sub> concentrations were lower for the patients who used air purifiers always (0.38 [95% CI=-0.51, -0.24])  $\mu\text{g}/\text{m}^3$ , compared to never-users. In addition, PM<sub>2.5</sub> concentrations were higher for the patients living in housing buildings constructed 10-20 years (0.24 [0.06, 0.41]) and  $\geq 20$  years before (0.25 [0.09-0.41]), compared to those  $\leq 1$  year. Our findings suggest that improving the housing conditions and using air purifiers can reduce exposure to indoor particulate matter in patients with chronic lung diseases.

### P054: Assessing the risk of diarrheal mortality associated with floods in Bangkok, Thailand

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Floods are one of the major global natural disasters. It is uncertain whether floods contribute to an increased risk of diarrheal mortality due to the poor hygiene and sanitation condition, and disrupted health-care access. Located on the low-lying areas of Chao Phraya River basin, Bangkok is subjected to high risks of fluvial floods. In 2011, a catastrophic flood occurred in Thailand affecting multiple provinces, including Bangkok. This study aims to examine the association between flood and diarrheal mortality in Bangkok, Thailand. The severity of the flood was examined by considering several levels of simulated inundation. We conducted a time-stratified case-crossover study to analyze data spanning from 2011 to 2014. Daily inundation depth was calculated using a land surface model and global river model driven by bias-corrected climate reanalysis. Floods were defined (binary and categorical levels) using cut-off values at various inundation levels: 0.1m, 0.5m, 1.0m, 2.0m and 3.0m. Conditional quasi-Poisson regression with distributed lag non-linear model was used to examine the exposure-response association, with 60-days lags, and adjusted for days-of week in each four months in each year, and temperature with a cross-basis function over 21-days lags. We also conducted sensitivity analyses with different strata lengths (two-and one-month), and 30-days lags. There were a total of 352 cases of diarrheal mortality. Overall, we did not observe statistically significant increment in diarrheal mortality risks. Higher risks were observed at shorter lags, except for binary flood at inundation  $\geq 2.0\text{m}$ , which showed higher risks at extended lags. Sensitivity analyses with different strata did not suggest any difference in the pattern. The results remained unchanged after examining lags of 30 days. The results suggest potentially increased risks of diarrheal mortality associated with flood. There was no extended lagged effect observed, whereby higher risks were at shorter lags.



### P055: Association Between Per- and Polyfluoroalkyl Substances and Dyslipidemia: Data Analysis of The Korean National Environmental Health Survey (2018–2020)

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Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are widely used in South Korea in food packaging, coatings for cookware, and outdoor products. PFAS can enter the body through various exposure routes, leading to high levels observed in the general population of South Korea. Despite its potential role as an endocrine disruptor, there is a lack of research on the association between elevated levels of PFAS and dyslipidemia in the general population. This study aims to analyze the correlation between serum PFAS levels and dyslipidemia in South Korean adults. This study utilized cross-sectional data from 2,968 adults without missing values who participated in the 4th Korean National Environmental Health Survey (KoNEHS) conducted from 2018 to 2020. PFAS included in the study were perfluorooctane sulfonate (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexanoic acid (PFHxS), perfluorononanoic acid (PFNA), and perfluorodecanoic acid (PFDeA). General linear regression analysis, robust Poisson regression analysis were conducted to examine the association between PFAS and dyslipidemia. All five PFAS were detected in over 99.8% of the study participants, with geometric mean concentrations as follows: PFOA = 6.44 µg/L, PFOS = 15.06 µg/L, PFHxS = 4.18 µg/L, PFNA = 2.07 µg/L, and PFDeA = 0.91 µg/L. PFOA, PFHxS, PFNA, and PFDeA showed positive associations with total cholesterol (TC) and low-density lipoprotein cholesterol (LDL<sub>c</sub>). Stratified analysis by gender, the risk of dyslipidemia associated PFAS was statistically higher in females compared to males. The study results demonstrate a significant association between PFAS and dyslipidemia in South Korean adults. Given that only PFOA, PFOS, and PFHxS are currently regulated in Korea, there is a need to expand regulations for PFAS in the future. We utilized data representing Korean adults to assess the Korean adults serum PFAS levels and association between PFAS and dyslipidemia.

### P056: Evaluating arsenic and lead concentrations in commercial beverages in Taiwan: a health risk assessment for the general adult population

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Heavy metals naturally exist in the environment, potentially reaching the food chain through air, water, and soil. This study examines the concentrations of arsenic As and lead Pb in commercial beverages in Taiwan. This study collected 20 types of commercial beverages in Taiwan, and the concentrations of As and Pb were analyzed using ICP-MS/MS. The study utilized data collected from the TNFCD in 2023, 19~65 years old, N=3499, ingestion rate=830.05±767.28g/day. The results showed the mean concentrations of As and Pb in beverage samples were 1.706 and 7.032ng/g, respectively. Fermented fruit and vegetable juice showed the highest concentrations of both As:5.067ng/g and Pb:54.908ng/g concentrations. The average estimated daily intake of As and Pb were 2.136E-05 and 8.804E-05mg/kg-BW/day, respectively. The results indicated that carcinogenic risk values of As exceeded 10<sup>-4</sup> for the 5.50%

of the general Taiwanese adult population. Therefore, it is necessary to regularly monitor the heavy metals in beverages and ensure the dietary safety of the general population in Taiwan.

### P057: The interactive effects of arsenic and inorganic elements on DNA damage

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According to the literatures, exposure to inorganic arsenic is associated with various chronic diseases and cancers in humans. The Taiwan arsenic research team found that some metabolism-related genes were proven to be moderating factors for carcinogenesis. However, the effects of arsenic and selected inorganic multi-elements on the DNA damage in humans have not been thoroughly investigated. The DNA damage biomarkers, including 8-hydroxy-2'-deoxyguanosine (8-OHdG) and malondialdehyde (MDA), were determined by LC-MS-MS and thio-barbituric acid reactive substance assays, respectively. Using the Yunlin cohort, the study obtained a total of 6996 specimens for 8-OHdG, and a total of 5013 specimens for MDA. Urinary arsenic and inorganic multi-elements were assayed by ICP-MS. Multiple linear regression was used to construct the associations. After adjusting for confounding factors, a dose-response relationship was found between arsenic exposure and the levels of 8-OHdG and MDA. Zinc and cadmium were found to be significantly interacted with arsenic on DNA damage. The participants with low zinc and high arsenic exposures were at the highest risk of DNA damage as shown by the elevated levels of 7.728ng/mg in 8-OHdG ( $p < 0.0001$ ) and 0.262 µmol/g in MDA ( $p < 0.0001$ ) as opposed to ones with high zinc and low arsenic. Zinc plays as an antagonistic role while cadmium plays as a synergistic role in the arsenic carcinogenesis DNA damage. This study has elucidated further on the effects of arsenic and inorganic multi-elements on DNA damage. The antagonistic role of zinc on the association between arsenic exposure and DNA damage is important for future practices of preventive medicine. The studies on biological mechanisms of the association between inorganic multi-elements and DNA damage related health effects are vital for future academic developments.

### P058: Association of serum per- and polyfluoroalkyl substances with non-alcoholic fatty liver disease in the US and Korean adults

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While numerous studies have reported an association between per- and polyfluoroalkyl substances (PFAS) and liver damage, research examining the association between PFAS and non-alcoholic fatty liver disease (NAFLD) is limited and has predominantly focused on Western populations. However, it has been reported that the association between PFAS and NAFLD can be modified by race, and specifically, Asians are

more susceptible to non-obese NAFLD than other races. Therefore, our study aimed to investigate the association between PFAS exposures and NAFLD in two general populations (the US and Korea). We analyzed 1,196 adults from the National Health and Nutrition Examination Survey (NHANES) spanning from 2015 to 2018, as well as 2,641 adults from the Korean National Environmental Health Survey (KoNEHS) spanning from 2018 to 2020. We collected information on five serum PFAS concentrations, namely PFDeA, PFHxS, PFNA, PFOA, and PFOS. To assess NAFLD, we employed three NAFLD indices: CAP/Stiffness for the US population and HSI for the Korean population. Our analysis methods encompassed multiple linear regression, robust Poisson regression, and Bayesian kernel machine regression (BKMR) to evaluate the association between individual and combined serum PFAS and the prevalence of NAFLD. We observed that increased serum levels of PFDeA, PFHxS, PFNA, and PFOS were associated with a greater prevalence of NAFLD among non-obese individuals in Korea. Furthermore, BKMR analyses revealed positive overall effects on Non-obese NAFLD prevalence with increasing serum PFAS concentrations in Koreans, with PFHxS contributing the most. Conversely, no significant association between individual and combined serum PFAS levels and NAFLD was observed in the US population. The findings of our study suggest that elevated serum PFAS concentrations are associated with an increased risk of NAFLD in Koreans, particularly among non-obese individuals. Further longitudinal studies are warranted to explore the association between NAFLD and PFAS in Asians.

**P059: Sharing experience: Pre and post covid-19 pandemic control measure of pertussis outbreak in Beaufort district**

by Suzana binti Awg Piut | Neilson Richard Seling | Siti Norhasnizah Maad | Nik Aisha Nikita Ahmad Nizar | Affirol Daud | Pejabat Kesihatan Kawasan Beaufort | Pejabat Kesihatan Kawasan Beaufort | Pejabat Kesihatan Kawasan Beaufort | Pejabat Kesihatan Kawasan Beaufort

Pertussis, is a highly contagious respiratory disease caused by the bacterium *Bordetella Pertussis*. Pertussis remains a significant public health concern globally, impacting individuals across age groups and posing risks to infants and young children. Factors contributing to this resurgence include waning immunity, changes in circulating bacterial strains, and the complex interplay of vaccination coverage rates (Clark et al., 2018). In this study we are comparing two episodes of Pertussis outbreak in Beaufort district that reported during pre-Covid-19 pandemics and three episodes post Covid-19 pandemic. Observational study and analysis of every pertussis outbreak that had been reported in Beaufort in year 2019 until 2023. We are comparing pre and post covid pandemic about the sampling method, the rate of transmission among healthcare worker and effective Active Case Detection (ACD) method been used. Pre pandemically, sampling method using Nasopharyngeal aspirates (NPA) was more difficult to perform in view of painful and causing uncomfortable experience to patient and close contact. Nasopharyngeal swab (NPS) had been used post-pandemically for Pertussis sampling method. Pre-pandemic, ACD among 1047 children ages from 0-17 years old and 0.4 % positivity rates and 2<sup>nd</sup> episodes involving 118 contacts based on personalise care (PC) area and 2.5 % positivity rate. The 1st outbreak in 2023, involving 40 close contact and 2.5 % positivity rate. 40% of the close contacts are healthcare worker and only 1 positive contact. Decision of ACD method is dynamically decided by Associate Medical and Health Officer (AMOH) or Epidemiology Officer in-charge during outbreak intervention. Through observation, health care worker attitude towards wearing PPE while managing all infective cases have shown a tremendous change that help reducing transmission of the disease. Availability of sampling method that are well accepted and readiness helps in managing the outbreak more effectively.

**P060: Association between job adaptation according to education level and dementia in middle-aged and older workers**

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Various factors that middle-aged and older workers receive from work can be an important cause of dementia. The purpose of this study was to examine the effects of job adaptation and job satisfaction according to the educational level of middle-aged and older workers on the Mini-Mental State Examination (MMSE), and to identify the cognitive management group considering individual characteristics. This study was conducted using 2008-2016 Korean Longitudinal Study on Health and Aging (KLoSA) data. The study subjects were 3,114 adults aged 45 years or older. Regression analysis was performed to observe the association between job adaptation and job satisfaction according to education level and MMSE. In addition, a subgroup analysis was performed considering gender. Among middle-aged and older workers, there was a mismatch in job adaptation according to education level, and lower the education level, lower MMSE score was predicted. However, in the same job adaptation, higher level of education predicted higher MMSE score. In the case of female gender, the association between job adaptation according to education level and MMSE was higher than that of male. In order to prevent cognitive decline of middle-aged and older workers, it is necessary to prepare an occupational health policy that can manage job adaptation according to educational level and identify cognitive management groups in consideration of individual characteristics.

**P061: Association between weather and emergency ambulance dispatches for cardiovascular disease: a nationwide case-crossover study, Japan**

by Saori Kashima | Center for the Planetary Health and Innovation Science, The IDEC Institute, Hiroshima University

Cardiovascular diseases are the leading cause of morbidity and mortality. Meteorological factors might be one of the important triggers for the onset of this deadly disease. However, the differences in temperature effects by background meteorological conditions have not been understood yet. This study aims to evaluate the temperature effects on cardiovascular disease in Japan and show the regional characteristics of those associations. Ambulance call data of cardiovascular disease (ICD:10: I00-I52 and I170-199) between 2015 and 2019 in Japan were obtained from the Fire and Disaster Management Agency. A time-stratified case-crossover design was adapted and the prefecture-specific adjusted odds ratios (ORs) by humidity were calculated by using conditional logistic models. Then, pooled adjusted ORs in each geographical region and the entire Japan were calculated. The risks of cardiovascular disease increased with decreasing the temperature (1°C). This association was observed shortly after decreasing the temperature (pooled adjusted OR of the entire Japan in Lag0: 1.014 (95% CI: 1.013-1.015)) and Lag1: 1.013(1.014-1.105). Although these associations were particularly observed during the cold season, these associations were also observed during the summer season. In the regional-based pooled analysis, slightly higher impacts were observed in the South-West area [e.g. 1.032 (1.030-1.034) in the Chugoku region] than Kanto region [1.026 (1.022-1.030)]. Meanwhile, during extremely hot days (above 90% tile), significant associations with increased temperature (1°C) were not observed across the regions. Shortly after the temperature decrease, increasing risks of cardiovascular disease were observed. Geographical differences in the impacts of temperature might be attributed to the background meteorological conditions. This study showed the temperature effects on cardiovascular disease by using nationwide real-world data and described the differences in temperature impacts across geographic

regions and seasons. The warning system needs to be tailored based on background meteorological conditions.

**P062: Exposure profiles of toxic heavy metals and trace elements in children from South Korea, Bangladesh, Indonesia, and Thailand**

by JaeHyun Kim | Sohyeon Choi | Aram Lee | Yongjun Jeon | Kraichat Tantrakarnapa | Ramadhan Tosepu | Md. Khaled Hossain | Joem Jung | Areum Jo | Kyungho Choi | Jeongim Park | Department of Environmental Health Sciences, Soonchunhyang University, Asan, Republic of Korea | Department of Environmental Health Sciences, Soonchunhyang University, Asan, Republic of Korea | Department of Environmental Health Sciences, Soonchunhyang University, Asan, Republic of Korea | Department of Social and Environmental Medicine, Faculty of Tropical Medicine, Mahidol University, Ratchathewi 10400, Thailand | Department of Environmental Health, Faculty of Public Health, University of Halu Oleo, Kendari 93232, Indonesia | Department of Biochemistry and Molecular Biology University of Rajshahi, Rajshahi-6205, Bangladesh | School of Public Health, Seoul National University, Seoul, Republic of Korea | School of Public Health, Seoul National University, Seoul, Republic of Korea | School of Public Health, Seoul National University, Seoul, Republic of Korea | Department of Environmental Health Sciences, Soonchunhyang University, Asan, Republic of Korea

Children, known for their heightened susceptibility to metal exposure compared to adults, necessitate a thorough understanding of metal concentrations, particularly in Asian populations where data remains insufficient. This study aimed to explore toxic heavy metals and trace elements among Asian children from four countries: South Korea (n=89), Bangladesh (n=100), Indonesia (n=100), and Thailand (n=116). Urine samples were collected from children aged 5-13, with preliminary measurements of height, weight, and blood pressure. Field blanks, consisting of distilled water, were taken prior to collection and analyzed alongside the samples. Subsequently, ICP-MS analysis assessed the concentrations of 6 toxic heavy metals (As, Cd, Cr, Hg, Ni, and Pb) and 12 trace elements (Co, Cu, Mn, Mo, Zn, I, In, Se, Sr, Sb, Ba, and Tl). All elements had 100% detection rate except for Cr (99.3%), Hg (99.3%), and In (66.8%). Median concentrations (in ppb) were recorded as follows: As: 57.4, Cd: 0.27, Cr: 0.50, Hg: 0.39, Ni: 3.55, Pb: 2.16, Co: 1.63, Cu: 16.4, Mn: 1.41, Mo: 99.9, Zn: 459, I: 320, In: 0.004, Se: 35.0, Sr: 155, Sb: 0.17, and Tl: 0.21. The study identified significant concentration differences among the countries. Korean children, for instance, exhibited higher levels of toxic heavy metals such as As, Cr, and Pb compared to their counterparts ( $p < 0.05$ ). Conversely, Indonesian children demonstrated elevated concentrations of Cd, Hg, Ni, and trace elements Co, Mo, and Tl ( $p < 0.05$ ). Thailand generally showed lower trace element concentrations. In short, this study analyzed toxic heavy metals and trace elements, revealing distinct differences among Asian countries. A detailed analysis of factors influencing concentration levels in children across different countries will be crucial for developing effective exposure management strategies in the future.

**P063: Adverse effects of prenatal phthalate exposure on neurodevelopmental genomics**

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Exposure to phthalates during fetal development has been associated with adverse effects on children's neurological development, impacting IQ and the prevalence of attention-deficit/hyperactivity disorder (ADHD). Given the substantial heritability of IQ and ADHD, both genetic and environmental factors are significant contributors to their development. Our hypothesis posited that prenatal phthalate exposure might disrupt the genetic influence on neurodevelopment. To investigate

this, we utilized the Polygenic Risk Score (PRS) method, estimating individual IQ and ADHD genetic scores, and examined variations in the effects of PRS on IQ or ADHD across different levels of prenatal phthalate exposure. In our analysis of 137 mother-infant pairs from the Taiwan Maternal and Infant Cohort Study, phthalate metabolites were measured in mothers' urine during the third trimester as exposure indicators. Additionally, we included the measurement of children's IQ and Child Behavior Checklist Attention Problems (CBCL AP) as indicators for IQ and ADHD. Using IQ Genome-Wide Association Studies (GWAS), educational attainment GWAS, and ADHD GWAS results, we computed children's IQ PRS, Educational Attainment PRS (EDU PRS), and ADHD PRS through PRS-CS methods. Multiple linear regression and logistic regression were employed to examine the interaction between prenatal phthalate exposure and PRS, with a stratified analysis for PRS and IQ under varying phthalate exposures. The results revealed a significant interaction effect ( $p = 0.001$ ) between IQ PRS and maternal urine MBzP concentration. In the low MBzP group, a stronger correlation between IQ PRS and IQ residuals was observed. Similarly, in the analysis of EDU PRS, MMP exhibited a significant interaction effect ( $p = 0.013$ ). For ADHD, both MMP and MEP showed a slight interaction with ADHD PRS ( $p = 0.06$ ). These findings suggest that prenatal phthalate exposure may impact children's neurological development, with CBCL AP serving as an indicator for attention problems in the context of ADHD.

**P064: Skin Sensitization potential prediction of Zinc oxide and Aluminium oxide metal-oxide nanoparticles through LLNA:BrdU-FCM alternative test method**

by Gyeong Lee | Daegu Catholic University

As the use of cosmetics, medicines, and household products containing metal-oxide nanoparticles increases, concerns about the safety of metal-oxide nanoparticles have increased. In particular, research on the allergic contact skin sensitization effect of nanometal powders contained in cosmetics that come in direct contact with the skin, such as sunscreen, is insufficient. Therefore, skin sensitization was evaluated for zinc oxide and aluminum oxide, which are metal-oxide nanoparticles widely used in sunscreens and color cosmetics. As animal testing is prohibited for safety testing of cosmetic raw materials, the LLNA:BrdU-FCM (Local Lymph Node Assay: 5-bromo-2-deoxyuridine Flow Cytometry Method) animal alternative test method, registered as an OECD test guideline in 2018, was applied when evaluating skin sensitization. In the vehicle selection experiment, DMF (N,N-dimethylformamide) was selected as an excipient, and the main test concentration was set through a two-step pre-screening tests. As a result of the main test of zinc oxide, the SI (Stimulation Index) values of the test substance group were 1.6, 2.1, and 2.0 in the 10%, 25%, and 50% test substance groups, respectively. As a result of the main test of aluminum oxide, the SI (Stimulation Index) values of the test substance group were 1.0, 1.0, and 1.6 in the 5%, 10%, and 25% test substance groups, respectively. Therefore, as a result of the skin sensitization evaluation of metal-oxide nanoparticles zinc oxide and aluminum oxide, both substances were evaluated as non-sensitizing substances with SI 2.7 or less. In conclusion, it was very appropriate to apply the LLNA:BrdU-FCM animal alternative test method by directly applying it to the skin to evaluate skin sensitization to zinc oxide and aluminum oxide, which are metal oxide nanoparticles, and the skin sensitization evaluation results, metal-oxide nanoparticles zinc oxide and aluminum oxide were evaluated as non-sensitive substances.

**P065: Mediation effect of oxidative stress on the associations between cadmium and kidney damage in the metal-contaminated areas in Korea**

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The adverse effects of cadmium on oxidative stress and kidney are well known. Also, oxidative stress, plays a role in kidney damage by modifications to membranous lipids, protein, and DNA. We investigated the mediation effect of oxidative stress on the association between cadmium and kidney damage to the population living near the metal-contaminated smelter areas. A total of 243 urine samples were collected from residents living near metal smelters in Korea, from August 2021 to February 2022. Urinary cadmium was analyzed using an inductively coupled plasma-mass spectrometer. As biomarkers of oxidative stress, 8-hydroxy-2'-deoxyguanosine (8-OHdG) was analyzed using Enzyme-linked immunosorbent assay, and malondialdehyde (MDA) was analyzed using high-performance liquid chromatography. Beta-2-microglobulin ( $\beta_2$ -MG) and N-acetyl- $\beta$ -D-glucosaminidase (NAG), early indicators of renal tubular damage, were analyzed using a chemistry autoanalyzer. Mediation analysis was conducted to investigate the mediation effect of oxidative stress associations between cadmium exposure and kidney damage. All variables were natural log-transformed, and covariates such as age, sex, cigarette smoking, and job history were adjusted for. In the mediation analysis, the proportion of the mediation effect by 8-OHdG was found to be 66.3% for  $\beta_2$ -MG and 44.2% for NAG, respectively ( $p < 0.001$ ). Additionally, an indirect effect of cadmium on NAG mediated by MDA was observed significantly (21.3%,  $p < 0.001$ ). The significant mediated effects of 8-OHdG on  $\beta_2$ -MG and NAG, and MDA on NAG were observed. These findings highlight the importance of oxidative stress in the pathway linking cadmium exposure to kidney damage, suggesting potential targets for intervention and prevention of cadmium-induced renal toxicity. We found that 8-OHdG and MDA partially mediate the associations between cadmium exposure and kidney damage.

**P066: Utilizing Random Forest for the estimation of spatiotemporal distribution of fungal spore concentrations: a case study in Tainan city, Taiwan**

*by Pei-Yi Wong | Huey-Jen Su | Chih-Da Wu | National Cheng Kung University | National Cheng Kung University | National Cheng Kung University*

Fungal spores penetrate the lower respiratory tract and increase asthma exacerbation. Previous studies used Hirst-type volumetric spore traps with limited sampler to investigate variations of fungal spore concentration. However, the regional differences of fungal concentrations induce the uncertainty of exposure assessment in a large spatial scale for health risk evaluation. This study aims to develop a random forest machine learning model with geographic variables to estimate ambient fungal spore concentrations in Tainan city, Taiwan. This study sited 50 sampling locations in Tainan city with Burkard portable samplers for slides to collect fungal spores. The impacted air samples on the slides were stained using glycerin jelly. A total fungal spore concentration was counted and calculated regarding air volume. Variables included meteorological parameters, air pollutants, land use variables, and satellite image derived vegetation data. Random forest machine learning algorithm was then trained by all variables and used to predict fungal spores. Estimation maps were generated covering Tainan city. The important variables for fungal spore included meteorological parameters (solar radiation), air pollutants ( $O_3$ ,  $PM_{10}$ ) and vegetation index. The developed random forest model achieved a high prediction accuracy with a  $R^2 = 0.90$ . Similar results were obtained in validation tests. The estimation maps showed a higher fungal spore concentration in greenery areas and lower in downtown areas in Tainan city. The use of random forest

model captured outdoor fungal spore concentrations with great prediction capabilities. The distribution of estimated fungal spore denoted a high correlation between the distribution of vegetation. Important variables for outdoor fungal spore included meteorological parameters, air pollutants, and vegetation. The spatial and temporal distribution of outdoor fungal spore concentrations was depicted with a high prediction accuracy model. The estimations could be used to assess the health risk in epidemiological studies.

**P067: Using solid waste management indicators to explore the implementation status of energy saving and carbon reduction in different cities in Taiwan**

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Waste management plays a pivotal role in carbon reduction amid the global focus on climate change. This study aims to utilize pertinent waste management indicators to assess the waste management practices of cities across Taiwan with varying levels of development, both pre- and post-initiatives promoting energy saving and carbon reduction. We conducted three indicators including municipal solid waste (MSW) disposal fee policy, number of employees working in waste management, and MSW budget as a share of municipal expenditures to evaluate the waste management for energy saving and carbon reduction. We collected the data on waste management in six first-tier and three second-tier cities in Taiwan, and compared the indicators of these cities in the five years before and after they started promoting climate change action. Regarding to MSW disposal fee policy, five of the nine cities had implemented this policy, but it remained unchanged after climate change action. Before the climate change actions, the average number of employees was 73.2% and 47.2% of the average demand in first-tier and second-tier cities. After actions, it increased to 85.4% and 70.3%, separately. In terms of the MSW budget, the average budget of first-tier and second-tier cities were 3.37% and 7.5%, separately, less than the standard value before the climate change actions. After promoting actions, the average budget of first-tier and second-tier cities slightly improved to 3.26% and 6.85%, separately, less than the standard value. The popularity of waste removal charging systems still needs to be improved in cities in Taiwan. In the case of insufficient waste management personnel and budget expenditures for waste management need to be increased. From the perspective of climate change, such solid waste management indicators can be used as reference information for waste management in Taiwan cities in climate change actions.

**P068: The effect of Covid-19 preventive policy and epidemic status on carcinogenic metal exposure levels around Taiwan's special industrial parks**

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During the COVID-19 pandemic, economic activities have undergone significant changes due to the pandemic itself or preventive policies. This study primarily investigated whether the concentrations of carcinogenic metals around special industrial parks in Taiwan have experienced any changes because of lockdown policy and epidemic status. This study selected five air monitoring stations closest to Taiwan's five special industrial parks, collecting daily concentrations of four carcinogenic metals including As, Cr(VI), Ni, and Pb from 2019 to 2022.



We investigated the extent of heavy metal contamination in the soil of children's urban parks and residential playgrounds in Gyeonggi Province, South Korea. From April to June 2023, soil samples were collected from a total of 50 sites in Gyeonggi Province according to the Environmental Health and Safety Management Standards Act of South Korea. While all areas met the criteria of Level 1 soil contamination concern, concentrations of Cd and As exceeded those of background levels in Gyeonggi Province. The single-item index assessment of heavy metals indicated notably elevated levels of Cd and As, with the average Single Pollution Index (PI) being high for these elements. The calculated Ei indicated strong ecological hazard levels for Cd and moderate levels for Hg, while other elements showed low ecological hazard levels. The Pollution Load Index (PLI), reflecting the extent of soil quality degradation due to heavy metal accumulation, indicated soil quality degradation at seven points. Although the heavy metal content in the soil of urban parks and residential areas in Gyeonggi Province fell within the soil contamination concern criteria Level 1 at all sites, the nature of outdoor play spaces exposes them to contamination risks. Therefore, continuous assessment of contamination status and characterization is necessary to ensure the health and safety of children.

#### **P072: Assessment of heavy metal content in indoor paints and finishing materials in daycare facilities in the southern region of Gyeonggi province**

by Jisoo Kim | Gyeonggi-do Institute of Health and Environment

Through an investigation into the levels of heavy metal lead contamination within childcare facilities, concerns regarding environmental hazards have been heightened, emphasizing the importance of children's health and safety. This study aimed to examine lead levels within childcare facilities based on the 2021 environmental inspection results provided by the Ministry of Environment. Utilizing X-ray fluorescence (XRF), lead levels were measured at 37 childcare facilities across 12 cities and counties in Gyeonggi Province, South Korea. Results indicated that 24% of samples were selected for detailed examination, with 68% showing unsatisfactory outcomes, particularly with elevated concentrations found in paper and paint, predominantly within the yellow color spectrum. Furthermore, a Pearson correlation coefficient of 0.1828 between lead levels analyzed by XRF and inductively coupled plasma optical emission spectroscopy (ICP-OES) revealed a weak positive correlation. These findings underscore ongoing concerns regarding lead contamination within childcare facilities, highlighting the urgent need for facility improvements. Additionally, given the potential risks posed by lead contamination to children's health and safety, prompt action is imperative. Consequently, the necessity for policy interventions and support to foster healthy and safe childcare environments becomes increasingly evident.

#### **P073: Per- and poly-fluoroalkyl substances concentration in serum and related factors in Korean adults: findings from Korean National Environmental Health survey**

by Eun Ji Ko | Dabee Han | Yong Min Cho | Kyung Hua Choi | Young-Seoub Hong | Institute of Environmental Health, Seokyeong University | Institute of Environmental Health, Seokyeong University | Institute of Environmental Health, Seokyeong University | Department of Preventive Medicine, Dankook University College of Medicine | Department of Preventive Medicine, School of Medicine, Dong-A University

Per- and poly-fluoroalkyl substances (PFAS) are exposed to the general population and associated with various health outcomes. Through the national biomonitoring program (Korean National Environmental Health Survey, KoNEHS), we investigated the national reference values and related factors of PFAS exposures of Korean adults. The 4<sup>th</sup> cycle of KoNEHS recruited 2,993 adults aged 20 over from 2018 to 2020. Blood samples were collected from adults who agreed to participate in the survey and stored in serum separator tubes. Protein precipitation

was applied of preprocessing of serum samples, and high-performance liquid chromatography-triple tandem mass detector was applied to simultaneous analysis of five PFAS (perfluorooctanoic acid-PFOA, perfluorooctane sulfonic acid-PFOS, perfluorohexane sulfonic acid-PFHxA, perfluorodecanoic acid-PFDA, perfluorononanoic acid-PFNA). Various factors such as lifestyles, social economic statuses (SES), diet, drinking water sources and others were investigated via questionnaires. Geometric means of serum PFOA and PFOS were 6.429 and 15.068 µg/L, respectively (PFHxS 4.170 µg/L, PFDA 0.907 µg/L, and PFNA 2.062 µg/L). Males, coastal residents, past smokers and heavy drinkers showed higher concentrations of PFAS. As age increases and SES decreases, PFAS concentrations increased. Subjects who use local-based sources for drinking water had higher PFAS concentration significantly. Serum concentrations of PFAS of Korean adults were higher than other national reference values e.g. US National Health and Nutrition Examination Survey (NHANES). Various factors such as individual and environmental factors may be involved in the exposure of PFAS. This study suggests that local-based water supply may be a risk factor of PFAS exposure to the general population, as well as individual and SES characteristics which already reported.

#### **P074: Machine learning-based analysis of hazardous factors and conjunctivitis prediction**

by Yuyoung Song | Wonsuck YOON | Allergy Immunology Center, College of Medicine, Korea University | Allergy Immunology Center, College of Medicine, Korea University

In this study, we investigate the feasibility of applying machine learning to air quality analysis by separately collecting images of airborne bacteria cultured in the air and air quality data (CO<sub>2</sub> concentration, TVOC, PM<sub>2.5</sub>, temperature, humidity, mold, and bacterial levels). The goal of this research is to examine the viability of utilizing machine learning approaches, as opposed to complex air quality analysis methods, to facilitate the analysis of disease and environmental data. We conducted a large-scale survey, comprehensively utilizing obtained strain information and analysis result data. Utilizing YOLO technology on images of airborne bacteria captured in the air and artificially cultured images, we accurately matched bacterial images and strain information, distinguishing bacterial strains. Subsequently, our research extended to the analysis of diseases potentially caused by bacterial strains, focusing on conjunctivitis. For this analysis, SVM and Random Forest algorithms were employed, leading to the prediction of conjunctivitis occurrence. Through this methodology, distinct patterns related to conjunctivitis were derived, and efforts were made to enhance predictive capabilities for conjunctivitis onset. Machine learning analysis applied to 5000 cultured bacterial images demonstrated an analysis accuracy of over 90% in identifying bacterial strain information. The conjunctivitis prediction data, trained on environmental variables, showed a correlation ranging from 0.4 to 0.5. The results of the conjunctivitis model were categorized into three classes: attack, incidence, and prevalence, with correlations of 0.490, 0.419, and 0.418, respectively. These outcomes suggest the feasibility of predicting diseases based on environmental information through machine learning. In conclusion, our study demonstrates the potential of machine learning in analyzing air quality and predicting conjunctivitis occurrences. The results showcase high accuracy in identifying bacterial strains and highlight correlations between environmental variables and conjunctivitis. The developed models offer valuable insights into disease prediction based on environmental factors, emphasizing the promising role of machine learning in this context.

#### **P075: Employing ai-deep learning techniques for forecasting allergic asthma health impacts linked to indoor air quality**

by Wonsuck Yoon | Yuyoung Song | Insoon Kang | Jinkyu Lee | Allergy Immunology Center, College of Medicine, Korea University | Allergy

*Immunology Center, College of Medicine, Korea University | Allergy Immunology Center, College of Medicine, Korea University | Allergy Immunology Center, College of Medicine, Korea University*

This study aims to explore the relationship between indoor air quality, sourced from a variety of locations, and human health outcomes. By leveraging multiple machine learning approaches to analyze the data, we seek to assess the potential for predicting health outcomes, specifically focusing on asthma, based on air quality metrics. We collected air quality data from various locations and employed machine learning techniques, including Random Forest, SVM, and LightGBM, to develop predictive models for asthma incidence, exacerbation, and prevalence. The Random Forest model with random\_seed=2023 demonstrated superior performance, with correlations of 0.483 for exacerbation, 0.483 for incidence, and 0.380 for prevalence. Variables with importances above 0.1 were highlighted, with TVOC and mold levels showing significant impacts. CO<sub>2</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub> also exhibited importance exceeding 0.1, while HCHO demonstrated variable effects. Our research underscores the potential of developing an AI-based predictive model for asthma outcomes using indoor air quality data. Harnessing these findings to create health impact programs could pave the way for innovative strategies to enhance public health and well-being.

**P076: Evaluating lead exposure in preschool children through biomarkers, applying the IEUBK model and a health risk model**

by Chi-Sian Kao | Ying-Lin Wang | Chuen-Bin Jiang | Yi-Hua Chen | Hsing-Cheng Hsi | Ling-Chu Chien | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan | Department of Pediatric Gastroenterology, Hepatology and Nutrition, MacKay Children's Hospital, Taipei, Taiwan | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan | Graduate Institute of Environmental Engineering, National Taiwan University, Taipei, Taiwan | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan

Our study aimed to investigate the extent to which preschoolers in northern Taiwan were exposed to lead (Pb) through microenvironmental and dietary food. We collected hair and fingernail samples from 359 preschoolers between August 2019 and July 2021 to measure their internal exposure to Pb. Additionally, we analyzed the Pb content in 111 dietary foods and 85 household dust samples to estimate the children's blood Pb levels (PbPb) using the IEUBK model and to assess the non-carcinogenic risk utilizing a health risk model. The geometric mean ± geometric standard deviation Pb concentrations in children's hair and fingernails were 1.28±2.63 and 0.81±2.04 µg/g, respectively. The PbPb concentrations in children aged 0 to 3 years and 4 to 6 years were 2.59±0.5 and 2.70±0.54 µg/dL, respectively. It was found that the non-carcinogenic risk through dietary and dust sources among children aged less than 1 year was 2.8 times higher than that among children aged 5 to 6 years. Furthermore, the analysis revealed that the contribution of non-carcinogenic risk of Pb exposure through dust ingestion was inversely correlated with children's age. Among children aged 4 to 6 years, the non-carcinogenic risk assessment model via dietary and dust sources and the PbPb model showed similar outcomes.

**P077: Assessment of the potential risks and benefits of dietary mercury and selenium, and their implications for hair mercury and the growth performance of preschool children**

by Chi-Sian Kao | Ying-Lin Wang | Chuen-Bin Jiang | Ying-Chih Chuang | Yi-Hua Chen | Hsing-Cheng Hsi | Ling-Chu Chien | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan | School of Public Health, College of Public Health, Taipei Medical University, Taipei, Taiwan | Department of Pediatric

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This study aims to assess the risks and benefits of dietary mercury (Hg) and selenium (Se) on preschool children's hair Hg concentration and growth performance. To conduct a thorough dietary risk-benefit assessment, 108 food samples were analyzed for Hg and Se levels. Furthermore, our study analyzed hair Hg levels and growth performance among 359 preschool children. The mean mercury concentration in children's hair was 1.11 ± 1.12 µg/g, with 32% of the children exceeding the recommended Hg value of 1 µg/g set by the US Environmental Protection Agency. Eggs and related products had the highest Se:Hg molar ratio and selenium health benefit value (HBV<sub>Se</sub>), indicating a substantial net source of Se. This contributed to 84% of the recommended daily selenium intake for preschool children after considering the antagonistic interaction of Hg. Fish displayed the highest Hg concentrations and a positive HBV<sub>Se</sub> value, which suggests that consuming fish provides protection against potential adverse health effects associated with Hg exposure. Fruits, however, had a negative HBV<sub>Se</sub> value, implying an insufficient Se intake following Hg sequestration. Despite the exposure to high levels of Hg (hair Hg >1µg/g), children showed better height and weight development performance, considering the protective effects of Se against Hg exposure.

**P078: Integrated Risk Assessment of heavy metals (Pb, Hg, Cd) for Koreans**

by DaeHwan Kim | Daegu Catholic University

The exposure level of heavy metals may have determined in environmental media like soil, air, and water, as a result of human activities such as incineration, vehicle emissions, and thermal power plants. Heavy metals existing in the environment are exposed through various exposure routes (oral, inhalation, and dermal). Heavy metals can cause health effects and accumulate in the human body through various exposure routes. This study collected toxicity reference values, exposure scenarios, and exposure factors for three types of heavy metals for all ages through a literature review. We collected exposure algorithms applicable to each exposure scenario. Heavy metals dose were calculated by applying the exposure factors to the appropriate exposure algorithm according to each exposure route (inhalation, dermal, ingestion). In the risk assessment, the applicable toxicity reference value for each exposure route was applied to the exposure amount to calculate the hazard index (HI) and cancer risk (CR) for each exposure route and check the contribution rate. The contribution rates of Pb, and Hg were highest in oral route, range from 86.93-90.53%, to 87.64-97.35% respectively. The contribution rate of Cd was 98.26-99.50% when smoking was not considered in the oral route of exposure and 56.58-98.96% when smoking was considered. The integrated risk assessment revealed that among Koreans of all ages, oral exposure to three types of heavy metals had the highest contribution rate. Additionally, it is imperative to manage unintentional dust ingestion exposure in children and infants. This study aims to assess the risk of heavy metal exposure and evaluate its contribution to the entire population. It also aims to suggest reduction measures and guidelines based on major exposure routes.

**P079: Phylogenetic linkage and virulence profiles of environmental vibrio cholerae from Northern Cameroon reveal potential disease risk**

by Deborah Yebon Kang | National University of Singapore (NUS), Singapore Centre for Environmental Life Sciences Engineering (SCELS)

*Vibrio cholerae* is a causative agent of cholera, an acute diarrheal disease that has led to several pandemics and regional outbreaks. Aquatic environments remain underexplored in cholera research, despite their role as an ecological niche of *V. cholerae*, influencing the genetic diversity and evolution of the bacteria. Studying *V. cholerae* and related species in water sources can help us understand evolution and the emergence of new pathogenic strains. Here, we explored the genetic characteristics and phylogenetic relationships of 19 *V. cholerae* and one *V. paracholerae* from different water sources in cholera-endemic Cameroon. Water samples were collected in 2018 and 2021, from Maroua and Bibemi, regions known for recurring cholera outbreaks. Samples were filtered, incubated in alkaline peptone water, and cultured on TCBS agar. Suspected colonies were further cultured on brain heart infusion agar and then made into stab culture for transport to Singapore. Strains were re-isolated in Singapore using TCBS and TSB. DNA was extracted and tested for *V. cholerae* and *V. paracholerae* using *viuB* PCR. Positive samples were sequenced using Illumina HiSeqX, with subsequent bioinformatic analysis. Phylogenetic analysis shows the global presence of *V. paracholerae*, often misidentified as *V. cholerae* due to high genetic similarity. The phylogenetic similarity of Cameroon *V. cholerae* to Kenyan strains suggests cross-continental circulation in Africa. Notably, the Cam23 strain, closely related to Argentinian clinical strains, harbours a nearly intact TCP (toxin-coregulated pilus) cluster along with accessory toxin genes. *tcpA*, a major subunit of TCP serving as a receptor of cholera toxin, was found to be highly conserved among the Cameroon strains. *tcpA* positive non-toxicogenic strains have potential to evolve into toxigenic strains, posing risks of regional and global transmissions. These findings highlight the important need for environmental surveillance of *V. cholerae*, especially as climate change expands *V. cholerae*'s habitats.

**P081: Association between chronic ambient heavy metal contamination exposure and mental health in Korean adult asthma patients and the general population**

by Yejin Ha | Juyeon Huang | Hyun-Jin Kim | Byungmi Kim | National Cancer Center Korea | National Cancer Center Korea | National Cancer Center Korea | National Cancer Center Korea

Given the insufficient evidence available to confirm the effect of exposure to airborne metals on mental disorders, particularly among asthmatics, We aimed to investigate the effect of exposure to airborne metals on mental health problems and the effect modification across asthmatics. Nationally representative data were used and a total of 47,796 adults were included in the analyses. We assessed the association between mental health factors such as perceived stress, depressive symptoms, and suicidal ideation and individuals' annual average exposure to airborne metals, including plumbum (Pb), cadmium (Cd), chromium (Cr), copper (Cu), manganese (Mn), and Ferrum (Fe) over fourteen years period using multiple logistic regression. The association was compared using the propensity score matching (PSM) method. The odds ratio (OR) and 95% confidence interval (CI) for mental health outcomes were calculated for an interquartile range (IQR) increase in the concentration of each airborne metals. Exposure to airborne metals was significantly associated with increased odds of adverse mental health in asthmatics. Significant associations between all ambient heavy metal contaminants and suicidal ideation were found in both asthmatic patients and the general population. After PSM, all ambient heavy metal contaminants, except for Cu exposure, showed significant associations with suicidal ideation in both asthma patients and the general population. All heavy metal exposures in asthmatics were significantly associated with suicidal ideation after adjusting for depressive symptom, whereas no association was found in the general population. Exposure to Pb (OR, 1.99; 95% CI: 1.41-2.81) and Fe (OR, 1.72; 95% CI: 1.26-2.34) showed particularly strong associations with suicidal ideation in asthmatics. This study suggests that exposure to airborne metals significantly increased mental health problems, especially among individuals

with asthma. Additional research on clinical stages is needed to better explain these associations.

**P082: A study on aggregate risk assessment for multi-route exposure of hazardous chemicals by chemical accident**

by Ji-Yun Jung | Si-Hyun Park | Ji-Eun Moon | Hee-Seok Kim | Yong-Sung Jo | Cheol-Min Lee | Sung-Won Yoon | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University

Chemical accidents persistently occur, often leading to harm through human exposure. Previous health nutrition surveys on chemical accidents have identified various exposure routes for humans. However, existing studies, including health risk assessments, have predominantly focused on individual routes, and comprehensive risk assessments covering multiple routes are limited. This study employs an aggregate risk assessment method that considers exposure through multiple routes and incorporates the behavioral characteristics of harmful chemicals in different environmental media. A chemical accident scenario involving the release of an entire 500L batch of toluene over 1hr was designed. This scenario was based on information from a real chemical accident in Siheung-si, Gyeonggi-do, occurring on September 27th, 2019. A multimedia environmental fate model was utilized to calculate toluene concentrations in environmental media over time. Exposure victims were categorized into four age groups. Exposure dose and hazard quotient were calculated for each exposure route. The total hazard index was then determined, and a hazard map was compiled. Upon calculating the mean daily exposure dose by route, values for inhalation, oral, and transdermal exposure were highest in the 0-9 age group. However, risk assessment for each exposure route showed that the hazard quotient did not exceed 1 for any route, indicating no possibility of health effects through any single route. Similarly, in the aggregate risk assessment covering multiple exposure routes, the total hazard index did not exceed 1, signifying an absence of overall health effects. This study conducted a health risk assessment of a chemical accident for multiple exposure routes by combining results from a multimedia environmental fate model based on a real chemical accident with an aggregate risk assessment for residents in the surrounding area. In situations requiring a health effects survey in regions affected by chemical accidents, this method could serve as a preliminary assessment before conducting a detailed survey.

**P083: A study of acute health risk assessment for toluene leakage chemical accidents**

by Nuri Han | seokyeong university

Chemical accidents means all situations that occur because chemical substances flow out or are leaked to humans or the environment. Toluene, a common chemical in manufacturing, can cause skin irritation and central nervous system anesthesia upon short-term acute exposure. This study aims to assess the acute health risks to local residents from short-term high-concentration toluene exposure, focusing on three major toluene chemical accidents (2014-2023). Toluene concentrations were calculated using the multimedia environmental dynamics model developed by Lee et al.(2019). Hourly meteorological data from actual accident locations were inputted into the model. All toluene leaks were assumed to occur entirely outdoors within 10-minute after the accidents, with concentrations below 8.36 $\mu\text{g}/\text{m}^3$  in the air marking the end of the accident impact(NIER, 2011). The calculated concentrations were compared to the 10-minute values of AEGL-1, 2, and 3, with a ratio(the concentration 10-minute after the initial leakage divided by AEGL-1 or 2 or 3 (10min)) exceeding 1 indicating acute health effects due to toluene exposure. In Case-1(2019), where 500L of toluene leaked, the 10-minute concentration after the initial leakage was 68.8 $\text{mg}/\text{m}^3$ , dissipating in 32minutes. In Case-2(2015), where 1ton leaked, the



concentration was 85.4mg/m<sup>3</sup>, dissipating in 27minutes. Case-3(2020) leaked 450kg, the concentration was 166mg/m<sup>3</sup>, dissipating in 80minutes. All cases showed a ratio did not exceed 1, indicating no health risk effects from acute toluene exposure. This study assess the acute health risks from toluene accidents, there were no acute health effects on local residents. The assumption of complete outdoor leakage may lead to overestimating modeled concentrations. The dissipation points varied by the amount of leakage, emphasizing the need to consider factors like accident scale, weather conditions, and accident progress in assessing chemical accidents. This study provides valuable insights into toluene exposure-related health risks in chemical accidents, enhancing understanding of chemical safety risk assessment and management strategies.

#### **P084: Comparison of acute health risk assessment: focusing on the nitric acid chemical accident case**

by Ji-Eun Moon | Si-Hyun Park | Ji-Yun Jung | Nu-Ri Han | Yong-Sung Jo | Cheol-Min Lee | Sung-Won Yoon | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University

This study selected nitric acid accident cases and evaluated their acute health risk based on various acute health reference values recommended by international organizations and committees. Cases for evaluation were selected based on single-substance accidents involving nitric acid with leakage quantities ranging from 1 to 2 tons. S1 was selected as an accident case in which nitric acid leaked from Gumi-si, Gyeongsangbuk-do (1.2 tons), S2 as Anseong-si, Gyeonggi-do (2 tons), and S3 as Jinju-si, Gyeongsangnam-do (1.2 tons). The concentration of nitric acid in the air was modeled using a multimedia environmental dynamic model, with a grid of 100m×100m over a total range of 15km×15km. The concentration of hazardous substances for each case was divided by the respective reference values to evaluate acute health risk and compare them. The results of acute risk assessment showed that S1 exceeded ERPG-2, AEGL-1, and PAC-1 values, while S2 exceeded ERPG-2, AEGL-2, and PAC-2 values. S3 exceeded ERPG-3, AEGL-3, and PAC-3 values. In terms of the maximum number of grids exceeding each reference level, the most significant differences were observed as follows: for Level 1, S1 exceeded AEGL-1 and PAC-1 (771 grids), ERPG-1 (210 grids); for Level 2, S2 exceeded ERPG-2 (76 grids), AEGL-2, and PAC-2 (9 grids); for Level 3, S3 exceeded ERPG-3 (20 grids), AEGL-3, and PAC-3 (6 grids). This suggests that Level 1 values for AEGL and PAC, and Level 2 and 3 values for ERPG, were the most conservative evaluations for nitric acid, indicating the need for further research on other substances. This study compared and analyzed the health impact results for various reference values through three nitric acid leakage cases as part of the development of techniques for assessing the health risk of hazardous pollutants due to chemical accidents.

#### **P085: Personal Exposure Assessment of PM2.5 by Microenvironment Using Real-Time Portable Monitors**

by Hyeok Jang | Shin-Young Park | Cheol-Min Lee | Seokyeong university | Seokyeong university | Seokyeong university

Exposure to air pollutants is determined by both the concentration in microenvironments where individuals spend their time and the duration of residence in each location(Guak and Lee, 2022). However, past exposure assessments have been insufficient in evaluating individual exposure levels due to a focus on environmental media through specific exposure sources(Steinle et al., 2013). This study aimed to measure PM2.5 concentrations and personal exposure levels among 21 participants, and to calculate the contribution of particulate matter exposure to individuals based on their time activity patterns. From January 1 to 31, 2024, 21 participants residing in metropolitan area were monitored using a real-time portable monitor to measure PM2.5 concentrations at 1-minute intervals. GPS data were utilized to determine the occupancy time in different microenvironments, and participants occupancy spaces

were divided into five categories as outdoor, residential indoor, offices, transportation, and other indoor areas. The occupancy contribution of different microenvironments was calculated by PM2.5 concentration and occupancy time of each microenvironments. The measured results showed that the PM2.5 mean (SD) exposure concentration for all participants was 24.93 (38.48) µg/m<sup>3</sup>. Personal PM2.5 exposure concentrations for the participants varied widely, ranging from 8.61 (8.93) to 79.21 (64.42) µg/m<sup>3</sup>. The highest occupancy contribution measured at residential indoor, this microenvironment contributed 69.16% for the daily exposure, due to the large amount of time spent there (67.51%). This study, by assessing personal PM2.5 concentrations and microenvironmental occupancy contribution among 21 participants, highlights the necessity for personal exposure assessment and provides foundational data for future efforts aimed at reducing individuals' exposure to particulate matter.

#### **P086: Quicksilver, the forgotten heavy metal: a review of mercury studies in Malaysia**

by Nachia Banu Abdul Rahim | Khamisah Awang Lokman | Nabibah Ali | Rudi Nasib | Nelson Lean Boon Leong | Muhammad Muddassir Abdul Rahim | Universiti Malaysia Sabah | Universiti Malaysia Sabah | Universiti Malaysia Sabah | Universiti Malaysia Sabah | Universiti Malaysia Sabah

Mercury, a pervasive environmental contaminant, exists in various forms in the atmosphere, water bodies, and soil. Its diverse sources, including industrial processes and natural occurrences, contribute to widespread pollution. Understanding mercury's multifaceted effects is paramount due to its detrimental impacts on ecosystems and human health. This scoping review aims to assess the current landscape of research on mercury in the environment and human population in Malaysia over the past decade, shedding light on crucial areas for further investigation and mitigation efforts. Following PRISMA guidelines, we conducted a scoping review to explore the dynamics of mercury research in Malaysia. Using SCOPUS, we searched for articles published between 2013 and 2022, concentrating on mercury's effects on health and the environment. After screening and data extraction, we included 24 relevant articles meeting our predetermined criteria. The synthesized findings from these articles were analysed to address the effect of mercury on humans and the environment. Among the 24 reviewed articles, 19 examined mercury in the environment, covering air, water, food, animals, and plants. Water quality studies showed mixed results, with some samples exceeding mercury limits, while food studies, including seafood, generally showed no health risks from mercury. Studies on animals and plants indicated varying mercury concentrations. Only five studies focused on mercury in humans, mainly through biomonitoring and consumer product exposure. Most research was conducted in Peninsular Malaysia, highlighting a need for more studies in East Malaysia, where seafood consumption is high. Although this review highlights the studies on mercury in Malaysia's environment and human population over the past decade, its coverage was limited. Urgent action is needed to broaden the research scope, mainly focusing on human samples and prioritizing investigations in East Malaysia to address gaps in understanding mercury pollution and health risks.

#### **P087: HEALTHCARE WASTE MANAGEMENT PRACTICES AND ASSOCIATED FACTORS IN HOSPITAL OF CHAMPASAK PROVINCE, LAOS.**

by VONGSENA Thippachanh | Saori KASHIMA | Environmental Health Sciences Laboratory, Graduate School of Advanced Science and Engineering, Hiroshima University. | 2 Center for the Planetary Health and Innovation Science, The IDEC Institute, Hiroshima University.

In Laos, alongside population growth and economic development, hazardous waste management, especially in rural hospitals, remains under-examined. The situation regarding healthcare waste management

(HCWM) is not yet fully understood. A mixed-methods design analyzed HCWM in 10 hospitals, using surveys and interviews with 300 workers to identify influencing factors. Healthcare waste management (HCWM) practices reveals varied compliance and capabilities across different regions. While 75% of hospitals adhere to national HCWM regulations, 25% have faced penalties for non-compliance. Training is widespread with 80% of healthcare workers educated in HCWM, yet only 40% of facilities conduct refresher courses annually. Access to modern treatment facilities is limited, with only 50% having advanced technologies and 60% reporting insufficient containers and protective gear. Despite 90% of hospitals having clear HCWM policies, only 70% enforce them effectively. Geographical and cultural challenges further complicate adherence, impacting both urban and rural healthcare settings. The study underscores substantial disparities in HCWM practices, mainly due to resource distribution and training levels. These inconsistencies pose serious public health and environmental risks. Improving training, regulatory frameworks, and resource allocation is imperative. Enhanced training can significantly boost compliance and safety practices among healthcare workers. This study reveals major inconsistencies in healthcare waste management across ten hospitals in Champasak Province due to resource limits, uneven policy enforcement, and training deficiencies, posing significant health and environmental risks. It advocates for collaborative enhancements in HCWM through better regulatory support, infrastructure, and training, aligning with international standards for improved safety and advocating for ongoing adaptation and excellence in waste management practices. This study contributes significantly to the environmental health management dialogue, especially in developing areas like Champasak. It offers a foundational framework for enhancing HCWM, leading to better health outcomes and sustainability.

#### **P088: Acute health risk assessment due to chemical accident of actual leakage of sulfuric acid in Guro-gu, Seoul**

by Jeong-In, Jeon | Ji-Yun, Jung | Si-Hyun, Park | Sung-Won, Yoon | Cheol-Min, Lee | Seokyeong university | Seokyeong university | Seokyeong university | Seokyeong university | Seokyeong university

Chemical accidents can affect the environment and human damage by spreading around the origin of the accident, not limited to the accident point. In this study, an acute health risk assessment was conducted using the concentration of hazardous chemicals caused by chemical accidents and floating population data, focusing on actual accident cases, to confirm the damage to the population group at the time of the chemical accident. For actual accident cases, we selected an incident where 1ton of sulfuric acid was fully released from a factory in Namyangju in 2014, and assumed a scenario where 1ton of sulfuric acid was fully released for 30minutes in Guro-gu, Seoul on April 5, 2019. Using a multi-media model, and the calculated concentration was compared with the AEGL(Acute Exposure Guideline Level)-1, 2, 3 values based on one-hour exposure. If these concentrations exceeded the AEGL values, it was deemed that there could be potential health impacts due to acute exposure to the released sulfuric acid. Using population data within a 100m by 100m grid in Guro-gu, Seoul at the time of the chemical accident, we estimated the population at risk of potential health impacts resulting from the chemical accident. The evaluation results indicated that the AEGL-1 value was exceeded for up to 5 hours after the accident, while AEGL-2 and AEGL-3 values were not exceeded during the assessment period. The estimated population at risk within grids exceeding the AEGL-1 value was approximately 365.23 individuals. It is considered an overestimation since the study assumed that residents were exposed fully outdoors throughout the assessment period. Additionally, the utilization of general population data during non-emergency situations implies a limitation in considering the chemical accident scenario. It is considered that these results could be utilized in devising measures

for post-incident management of victims who stayed in nearby areas for a specific period after the chemical accident.

#### **P089: Development of Adverse Outcome Pathway (AOP) utilizing Molecular Network Analysis from Methylparaben exposure**

by SeokGyu Yun | EunMin Cho | Jun Lee | YoungRok Seo | seokyeong university | seokyeong university | Dongguk University | Dongguk University

With the continuous increase of hazardous chemicals, there has also been an increase in approaches for assessing their toxic effects. However, despite the wealth of study reports, there is still not enough toxicology studies to fully understand the effects of chemical risks. As demand for toxicity assessments continue to rise, adverse outcome pathways (AOPs) have emerged as a new framework to predict apical toxic outcome using molecular level effects. This study aims to find evidence of AOP by performing systemic reviews using key factors and genetic factors expressed from molecular network analysis following exposure to methylparaben.

Utilizing the Gene Expression Omnibus (GEO) dataset GSE122022 and Pathway Studio software (Version 12.5.0.2), we have been able to identify key genetic factors. Subsequently, a systematic literature review was conducted using the identified genetic factors as keywords. Molecular network analysis has revealed VEGFA, TP53, STAT1, MIR21, and SOX9 as major genetic factors. We reviewed a total of 123 papers from the systematic literature review based on the genetic factors. As a result, major Key Events (KEs) associated with methylparaben exposure were confirmed, including increased expression of ITGB2, ROS, IL-8, among others. From the result, we have developed AOP from the integration of molecular network analysis and systematic literature review, providing evidence for key events for AOP. However, evidence for Key Event Relationships (KERs) still remain.

#### **P090: Health risk assessment and evaluation of trace metals bound-pm2.5 in urban area Kuala Lumpur**

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Traffic emissions are one of the main causes of air pollutant emissions, especially in urban areas and they may pose a health impact. The study aims to determine the concentration of selected trace metals bound-  $PM_{2.5}$  and their health risks to humans in urban area of Kuala Lumpur. Samples collected using the high-volume sampler, during the Southwest (SW) and Intermonsoon (IM). Human Health Risk Assessment, Multiple-Path Dosimetry Model and the Respiratory Flow Rate were used for health risk analysis, determination of deposition of  $PM_{2.5}$ , and lung exposure assessment. The SW monsoon exhibits a higher concentration of  $PM_{2.5}$ , while sodium, calcium, zinc and lead have the

highest concentrations during IM monsoon. Non-carcinogenic risks are not significant to all age groups. Infant have the highest Hazard Index value for chronic exposure while the risk of carcinogenic was highest in the adult group i.e. definite risk, with the highest exposure on chromium for both risks. The lung exposure assessment showed that the 60-year-old group of men had the highest amount of PM<sub>2.5</sub>-bound trace metal inhalation. The head region had the highest fraction of PM<sub>2.5</sub> deposition where the lobar area is highest in the left lower and lowest in the right middle lobe. The 21-year group has the highest deposited mass of PM<sub>2.5</sub> in the tracheobronchial region. In conclusion, exposure to trace metals bound- PM<sub>2.5</sub> in the study area has the potential to have health effects on the surrounding community.

### **P091: The relationship between phthalates and obesity: A cross-sectional study**

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The prevalence of overweight/obesity among adults has been steadily increasing, and over 80% of people have excessive body fat percentage. Recent studies have indicated that phthalates may contribute to obesity. Therefore, this study explore the association between urine phthalate exposure and obesity. The cross-sectional study used data from 1799 participants in Taiwan Biobank. We analyzed 10 phthalates, including mono-2-ethylhexyl phthalate (MEHP), mono-2-ethyl-5-oxohexyl phthalate (MEOHP), mono-2-ethyl-5-hydroxyhexyl phthalate (MEHHP), mono-2-ethyl-5-carboxypentyl phthalate (MECPP), mono-[(2-carboxy methyl)hexyl] phthalate (MCMHP), mono-benzyl phthalate (MBzP), mono-n-butyl-phthalate (MnBP), mono-iso-butyl phthalate (MiBP), mono-ethyl phthalate (MEP), and mono-methyl phthalate (MMP). Body mass index (BMI) was calculated by body height and weight. A whole-body fat mass predictive formula was used to estimate the fat mass in all individuals of Taiwan Biobank. Due to the skewed distribution of metabolites, log<sub>10</sub> transformation was performed, and metabolites were categorized into quartiles. The linear regression was conducted to evaluate the relationship between phthalate metabolites and fat mass/BMI separately, adjusting for age, gender, education level, smoking, alcohol consumption, and regular physical activity. MEHP exhibited a significantly negative correlation with fat mass ( $\beta = -902.086; p = 0.017$ ) and BMI ( $\beta = -0.658; p = 0.0013$ ). MEOHP showed a significant negative correlation with fat mass ( $\beta = -2667.899; p = 0.0182$ ) and BMI ( $\beta = -1.331; p = 0.0295$ ), while MEHHP showed a significant positive correlation with fat mass ( $\beta = 1757.442; p = 0.0464$ ) and BMI ( $\beta = 1.158; p = 0.014$ ). When categorized into quartiles of phthalate metabolites, levels of MEHP exposure per quartile were significantly associated with lower fat mass ( $\beta = -358.04816; p \text{ trend} = 0.0088$ ) and BMI ( $\beta = -0.21024; p \text{ trend} = 0.0047$ ). Additionally, MEHHP exposure was significantly positively correlated with BMI ( $\beta = 0.21452; p \text{ trend} = 0.0049$ ). This study found that different phthalates have varying effects on obesity. Future researchers could recruit more participants and utilize longitudinal data to validate the results.

### **P092: Mitigation Risk to Human Health: A Program for Recycling Pesticides Containers in support of Environmental Conservation**

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The utilization of pesticides poses significant risks to both living organisms and the environment primarily due to unsustainable agricultural practices. Introducing innovative methods for recycling pesticide containers offers a smarter approach to sustainable farming which

minimizing the environmental contamination that contributing to a healthier ecosystem and safer farming practices. DOA is responsible for overseeing pesticide compound management in the country. In 2002, DOA initiated the Recycling and Disposal Pesticide Container Program aimed at encouraging proper disposal of the pesticides container to mitigate environmental and human health risks. The program encompasses various methodologies, including assessment, planning, stakeholder engagement, education, infrastructure development, monitoring, evaluation, and continuous improvement. Tabulated data from 2004 to 2023 indicates that 1,910.1 tons of empty pesticide containers underwent a triple rinsing process before being voluntarily collected for recycling. This process enables the containers to be recycled as non-scheduled waste in accordance with the Environmental Quality Act of 1974. The program has received support from diverse stakeholders, including non-governmental organizations, farmers' associations, pesticide manufacturers' associations, and State Agriculture Office include Sabah and Sarawak territory.

### **P093: Role of gut microbiota in the association between metal fume particulate matter exposure and oxidative damage**

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Previous studies showed long-term exposure to welding metal fume particles increases oxidative stress and causes health effects. However, the relationship between oxidative damage caused by welding fumes and gut microbiota remains limited in research. This study explores the association between metal fume particulate exposure, oxidative damage, and gut microbiota composition. This cross-sectional study was conducted in 2022 and comprised 55 welders and 24 administrative staff in a shipyard in northern Taiwan. Personal breathing zone PM<sub>2.5</sub> samples were collected on the Monday shift. The urine and stool samples were collected on Tuesday morning pre-shift. Metals were analyzed by inductively coupled plasma mass spectrometry. Biomarkers for oxidative damage 8-hydroxy-2-deoxyguanosine (8-OHdG) and N7-methylguanine (N7-MeG) were detected by liquid chromatography-tandem mass spectrometry. Gut microbiota was analyzed by full-length 16S rDNA sequencing. All statistics were conducted in SPSS version 22.0 (IBM Corporation) and R version 4.2.1. The concentration of PM<sub>2.5</sub>, as well as Al, V, Cr, Mn, Fe, Ni, Cu, Zn, As, and Pb in the PM<sub>2.5</sub>, oxidative damage biomarkers 8-OHdG and N7-MeG were higher in welders than those of administrative staff. In the multivariate linear regression analyses, after adjustment for all confounders, Al, V, Cr, Mn, Fe, Ni, Cu, Zn, Cd, As, Se, and Pb in urine were significant positive association with 8-OHdG and N7-MeG. The gut microbiota analysis showed, at the family level, Cr, Mn, and Fe were associated with a significant increase in *Sutterellaceae*; As caused a significant decrease in *Prevotellaceae*. N7-MeG had a significant positive association with *Fusobacteriaceae*. The results demonstrated that heavy metals in welding fumes increase oxidative damage and cause gut microbiota composition differences in the human body. Significantly, N7-MeG increases the relative abundance of some pathogenic gut microbiota. This study found that exposure to metal fume was associated with oxidative damage and gut microbiota dysbiosis. Further appropriate control measures for welding workers are needed.

### **P094: Characterizing urinary metabolites of plasticizers among male workers in an automobile parts manufacturing plant**

by Sohyeon Bang | Sohyeon Choi | Aram Lee | YongJun Jeon | JaeHyun Kim | Jeongim Park | Department of Environmental Health Sciences, Soonchunhyang University | Department of Environmental Health Sciences, Soonchunhyang University

Phthalates and alternative plasticizers are known as endocrine-disrupting chemicals. Automobile interiors, sealants and exterior molding utilize high phthalates due to their high-temperature resilience and effectiveness in enhancing product durability. This study aimed to characterize the urinary metabolite concentrations of plasticizers among different task groups. A total of 174 male workers, with an age range between 28 and 55 (average 40.6), were recruited from an automotive parts manufacturing factory that extensively use PVC and paint. Utilizing a systematic questionnaire, demographic and occupational exposure data were gathered. The workers were categorized into four task groups: injection molding (n=98), painting (n=13), assembling (n=30), and office work (n=33). Post-shift urinary samples were collected at the end of the workweek. Analysis via LC-MS/MS was conducted to detect urinary metabolites from 16 plasticizers (including DMP, DEHTP, DBP, etc.). Among the 33 targeted metabolites, 19 were detected in at least 60% of the samples. Concentration levels varies between 0.1 and 38.8 ng/mL for different metabolites. The highest levels were detected for DnBP (MnBP 38.8), followed by DEHTP (5cx-MEHTP 7.9), DBP (MiBP 7.0), and DEHP (5cx-MEPP 5.1). Notably, MnBP levels were highest across all four occupations: painting 57.1, injection molding 43.5, assembly 28.7, and office work 18.0. Comparison of plasticizer concentrations among the four groups revealed that workers engaged in injection molding had significantly higher urinary levels of MMP, MEP, MiBP, MEHP, 5oxo-MEHP, 2cx-MMHP, 5cx-MEPP, 5oxo-MEHTP, OH-MINCH, cx-MMeHP, cx-MiDP, and OH-MEHA ( $p < 0.05$ ). This underscores that injection molding workers had the highest concentration of plasticizer metabolites in their urine. Moreover, our findings suggest that even office workers were exposed to phthalates. Future analysis aims to delve deeper into the occupational exposure and potential health effects among these workers.

#### **P095: To explore the heat injury news events by short- and long-term trends of heat indexes in Taiwan**

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With the impact of climate change, in addition to actual temperature increases, heat injury events reported in the news were also becoming more frequent in global. In order to understand the situation in Taiwan, the purpose of this study was to explore the heat injury news events by short- and long-term trends of heat index in Taiwan. We focused on the heat injury news in summer period (6/21~9/23) of 2022 and 2023. We collected temperature-related data from eight weather stations of the Central Weather Bureau in Taiwan for ten years, and further applied the Heat Index and Wet Bulb Globe Temperature (WBGT) to judge the degree of heat injury depending on the criteria suggested by US National Weather Service and Japanese Society of Biometeorology. In the summer period, there were eight heat injury news in 2023 and all of the events occurred at dangerous levels of both the Heat Index and WBGT. However, it only showed the daily maximum values at dangerous levels for Heat Index, and there was only one heat injury news in the summer period of 2022. For the long-term trend analysis, the Theil-Sen estimation indicated that the long-term temperature and heat index were significantly increasing in the northern, central and southern metropolitan areas in Taiwan in recent ten years. In the Taipei area, there were similar increasing trends in both urban and suburban areas, and there was no significant increase only in mountainous area. Short-term trends reflect the correlation with heat injury news, and long-term trends indicate that heat injury conditions should be paid more attention in the nearly future in Taiwan. It is recommended to use the Heat Index and the WBGT

as criteria to determine the potential heat injury risk for high-intensity labor or other outdoor activities.

#### **P096: Relationship between emergency room visits (ERVs) and ambient temperature among different occupational groups in Taiwan**

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This is a population-based study to explore the association between ambient average temperature and risk of emergency room visits (ERVs) from all-causes, circulatory and respiratory diseases among different occupational groups in Taiwan. Daily area-age-sex specific emergency room visits (ERVs) by occupational groups were obtained from the Taiwan's Ministry of Health and Welfare from 2009 to 2018. Distributed lag-nonlinear model (DLNM) was used to estimate the exposure-response relationship between daily average temperature and ERVs from all-causes, circulatory and respiratory diseases for different occupational groups. Random-effects meta-analysis was used to pool the overall cumulative relative risk (RR) and 95% confidence interval (CI). The exposure-response curves indicated increased risks of ERVs with rising temperatures for all-cause and respiratory diseases. In contrast, circulatory diseases showed an inverted J-shaped curve, with significant risks observed during cold temperatures. The results also showed that females were more susceptible to cold effects on circulatory diseases compared to males. Furthermore, a higher risk of ERVs from all three diseases were seen among younger age-groups (20-64 years) than elderly ( $\geq 65$  years). Notably, highest risk of ERVs from all-causes and respiratory diseases were seen among male outdoor (union members) and indoor workers, respectively. Conversely, female

farmers (RR: 4.06; 95% CI: 1.03-15.9) demonstrated the highest risks of cardiovascular ERVs during cold conditions. Our findings highlighted the complexity of temperature-related health risks within different occupational contexts. The population-level insights into vulnerable occupational groups could provide valuable comprehension for policymakers and healthcare practitioners. By examining the association between ambient average temperature and ERVs among different occupational groups, this study sheds light on the occupational health implications of temperature-related health risks. This is particularly important for developing targeted interventions and workplace policies to protect workers' health in varying environmental conditions.

#### **P097: The association between smoking behavior and occupational secondhand smoke exposure on the mental health of workers in the COVID-19 era**

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of Health Administration, College of Health and Welfare, Dankook University

The unprecedented shutdown due to the COVID-19 pandemic has not only affected the workers' environment but also influenced on their health behaviors. The objective of this study is to identify the association between the smoking behavior, secondhand smoke(SHS) exposure of Korean workers and their mental health in the COVID-19 era. This study is a cross-sectional study analyzing data from the Korea National Health and Nutrition Examination Survey(2016-2022). The study subjects were workers(n=21,706) classified into gray, white, pink, and blue collar. The years 2016-2019 were defined as the pre-pandemic period, 2020-2021 as the during-pandemic period, and 2022 as the post-pandemic period. The association between smoking behavior, SHS and mental health among workers was tested through multiple logistic regression analysis using SAS version 9.4. In all periods, the group with the highest smoking rates and the most exposed to SHS was the blue collar( $p < .05$ ). In pre and post-COVID-19 pandemic period, smokers had a higher perceived stress risk compared to non-smokers among all group of workers( $p < .05$ ). In pre-pandemic period, SHS exposure group in the white collar, pink collar, and the blue collar had higher perceived stress risk compared to the non-exposure group( $p < .05$ ). However, during the pandemic period, there was no association between SHS exposure and perceived stress in all groups( $p > .05$ ). In post-pandemic period, the exposure group to SHS in white collar had a 1.661(95%CI:0.201-2.179) times higher perceived stress level compared to the non-exposure group. Workers have experienced differences in smoking behavior and extents of SHS exposure during the COVID-19 era. Our study suggests establishing promotional strategies and creating a smoke-free culture within each workplaces. This study is of great significance in exploring the impact of smoking behavior and the extent of SHS exposure in workplace on the mental health of workers, categorized into pre, during, and post-COVID-19 pandemic periods.

#### **P098: Workplace violence and occupational outcomes among clinical nurses in Taiwan**

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Workplace violence poses a global challenge affecting nurses' physical and emotional well-being. This study aimed to investigate the prevalence of workplace violence and the risk factors for workplace violence experienced by nurses in Taiwan to identify the effects of workplace violence on adverse occupational outcomes. A cross-sectional study was conducted in 2017 using a structured questionnaire. Sampling included 55 representative hospitals in Taiwan, with 1,753 full-time female nurses participating. Data on demographics, work factors, workplace violence exposure, workplace justice, and intention to leave were collected and analyzed. In the past 12 months, 44.9% nurses experienced verbal violence, followed by physical violence (15.1%), verbal harassment (11.3%), and physical harassment (7.7%). Patients and their families were the main perpetrators (41.6%). Perceived workplace justice was negatively correlated with verbal abuse from patients/families( $b = -1.82$ ) or supervisors/colleagues ( $b = -4.00$ ) and physical harassment from supervisors/colleagues ( $b = -4.35$ ). High intention to leave was associated with exposure to verbal abuse (OR=1.75-1.86). Workplace violence from supervisors and colleagues significantly reduced perceived workplace justice and increased intention to leave. Workplace violence is a significant concern in Taiwanese hospitals, affecting nurses' perceived workplace justice and intention to leave. Efforts to address workplace violence and promote a safe work environment are essential for ensuring nurses' health and retention in the profession.

#### **P100: Occupational inequalities in intention to quit smoking plan in Korea**

by Sunhee Park | Jeoung A Kwon | Byungmi Kim | Yejin Ha | YoonJoo Choi | National Cancer Center | National Cancer Center | National Cancer Center | National Cancer Center | National Cancer Center

The governments focus on the tobacco control policy for the better health behavior and health status, however, it has been still high smoking prevalence in Korea. Inequalities in health behavior are expected to appear depending on occupational level. This study investigated quit smoking plan within one month as an indicator of health behavior, we expect it has an inequality by socioeconomic status according to the occupational level. We included nationally representative data from the Korean National Health and Nutrition Examination Survey VII-VIII (2016–2021). 4,617 subjects analyzed who had answer with “Do you have a plan to quit smoking in 1 month?” As socioeconomic status, we investigated education, income and occupation level. We divided the occupation level as three levels. We measured health inequality using two indices; the Slope Index of Inequality (SII) for absolute inequalities and the Relative Index of Inequality (RII) for relative inequalities. The covariates were age, sex, number of cohabitant, education level, income level and occupation level. The annual prevalence of quit smoking plan rate showed decreasing trend. As a result of examining the inequality according to socioeconomic level in quit smoking plan within one month, there was no significant difference in education and income level. However, significant differences appeared at the occupational level (aOR=1.33; 1.03-1.71; SII=0.24; 0.009-0.039; RII=1.16, 1.03-1.31). Other variables were significantly related were the number of cohabitation people and age. There were inequalities in intention to quit smoking plan depending on occupational level. Targeted interventions to reduce the inequality in quit smoking plan of occupational level must be needed to address the developed health behavior. This study provides direction for smoking cessation policies and monitoring national smoking cessation programs by explaining the inequality by the occupational level in health behavior such as quit smoking plan.

#### **P101: Association Between Dietary Intake And Inflammatory Factors Among Welding Workers In Shipyards**

by Ting-You Chang | Ching-Huang Lai | National Defense Medical Center | National Defense Medical Center

IL-6 is often used as a biomarker of inflammation prediction. Metal exposure has been shown to increase inflammatory factor (IL-6) concentrations, contributing to inflammation and long-term chronic diseases such as diabetes and cardiovascular disease. The type of dietary intake was also shown to be related to inflammation, and the relationship between diet and inflammation was known through the dietary inflammatory index (DII) and dietary patterns. Due to the differences in dietary habits and FFQ design, DII and dietary patterns may be different in the Chinese diet culture, and the past literature has rarely discussed metal-exposed objects, so the motivation for this study was triggered. To investigate the association between metal exposure, dietary patterns, and DII on inflammatory factors (IL-6) in shipyard welding workers, and to further explore the relationship between dietary patterns and DII, whether the concentration of inflammatory factor (IL-6) can be modified and the impact of inflammatory response on physical health is further explored. This is a cross-sectional study, samples from 242 male employees aged 20 or above at a shipyard in northern Taiwan. Iron and zinc were the significant compositions of welding rods in metal fumes. They were selected and divided into high-iron-zinc group and low-iron-zinc group by median. The 26 food parameters of the food frequency questionnaire (FFQ) were converted into DII scores, and the dietary data were divided into seafood group, poultry group, and vegetable group through factor analysis. This study showed a positive association between metal exposure and inflammatory factor (IL-6)

( $\beta = 0.318$ , 95%CI= 0.09~0.546,  $P = 0.006$ ), but not with dietary inflammatory index (DII). The seafood group had the highest dietary inflammation index, and the vegetable group had a significantly lower dietary inflammation index than the seafood and the poultry groups. There was a positive association between DII and inflammatory factor (IL-6) ( $\beta = 0.141$ , 95%CI= 0.007~0.275,  $P = 0.04$ ).

### P102: Effect of employment status trajectory on Catastrophic Health Expenditure

by Jeong Min Yang | Ji Eun Hwang | Department of Public Health in Dankook university | Department of Health Administration in Dankook univeristy

This study was to longitudinally analyze the effect of employment status trajectory (EST) on Catastrophic Health Expenditure (CHE). After excluding missing values, the data of 6,686 participants were analyzed using the chi-square test and Group-based trajectory model (GBTM) from 9-12<sup>th</sup> National Survey of Tax and Benefit (NaSTaB) and chi-square test, log-rank test, and generalized estimating equation from 12-14<sup>th</sup> NaSTaB. Among the group under 50 years of age included 2,524 participants, no significant was found between EST and CHE. However, for the group aged 50 and above, compared to the “Sustained standard WC” group, the “Unemployment” group had a 1.51 times higher odds of experiencing CHE at the 20% threshold (Odds Ratio [OR]:1.51, p-value:<.0001), 1.73 times higher odds at the 30% threshold (OR:1.73, p-value:<.0001), and 1.84 times higher odds at the 40% threshold (OR:1.84, p-value:0.000). Additionally, the “Changed WC to unemployment” group had 1.56 times higher odds of experiencing CHE at the 20% threshold (OR:1.56, p-value:0.006), 1.49 times higher odds at the 30% threshold (OR:1.69, p-value:0.011), and 1.94 times higher odds at the 40% threshold (OR:1.94, p-value:0.015) compared to the “Sustained standard WC” group. For individuals aged 50 and above, selective medical cost support policies aimed at groups with changing employment statuses and sustained unemployment are required to reduce CHE. Furthermore, for groups with frequent employment changes, applying more comprehensive support criteria to the current criteria for CHE support could decrease CHE for vulnerable individuals.

### P103: Association of prenatal exposure to bisphenol-A and parabens with neurobehavioral development in children

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This study aimed to determine whether prenatal exposure to bisphenol-A (BPA) and parabens was associated with neurobehavioral development in children with aged 3-5 years in Taiwan Maternal Infant Cohort study (TMICs). A longitudinal cohort study was conducted and 331 pairs of pregnant women and their children were enrolled during 2012-2015 and 2017-2020. Each child or his/her parents filled out a structured questionnaire on sociodemographic characteristics, lifestyle, and dietary habits. Neurobehavioral development was evaluated by pediatric psychologist using Wechsler Intelligence Scale for Children (WISC-IV). Urinary BPA/parabens levels were determined by using liquid chromatography tandem-mass spectrometry (LC-MS/MS). A

multivariable regression model was applied to evaluate the association between prenatal exposure to BPA/parabens and neurobehavioral development. The detection rates of BPA, methyl paraben (MP), ethyl paraben (EP), propyl paraben (PP), and butyl paraben (BP) were 60%, 96.4%, 68.9%, 86.8%, and 69.3% respectively. The geometric mean concentration (geometric standard deviation) was 0.75 (4.50) mg/g cre., 26.7 (8.66) mg/g cre., 0.82 (21.49) mg/g cre., 4.41 (17.97) mg/g cre., and 1.00 (21.32) mg/g cre. for BPA, MP, EP, PP, and BP. Girls had higher Verbal Comprehension Index (VCI: 111.4 vs. 106.1, p value=0.04) and Processing Speed Index (PSI: 102.5 vs. 97.8, p value<0.01) than boys. Spearman's correlation showed the significant correlations between prenatal BPA and BP concentrations and Full-Scale and Visual Spatial Index (p value<0.05). After the adjustment for other covariates, prenatal BP exposure was significantly associated with Full-Scale ( $\beta = -3.35$ , p value<0.05) and Verbal Comprehension Index ( $\beta = -3.86$ , p value<0.05) among 3-year-old girls. There was a significant correlation between prenatal BPA exposure and fluid reasoning in girls aged 4-5 ( $\beta = -5.29$ , p value<0.05). The present study indicated that prenatal exposure to BPA/parabens were negatively associated with childhood verbal comprehension and fluid reasoning, especially in girls.

### P104: Exposure levels of per-and polyfluoroalkyl substances (PFASs) in the serum of pregnant women during pregnancy and childbirth

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Per-polyfluoroalkyl substances (PFASs) are substances that the hydrogen attached to the carbon chain is replaced with a fluorine atom and have strong chemical stability. PFASs are useful in various industries and consumer goods. Because of long half-life, they tend to accumulate in the body and environmental toxicological interest has increased. Exposure to PFASs during pregnancy is highly likely to cause pre-eclampsia, high blood pressure, and various cancers. So it can affect the fetus, increasing the rate of deformed child. This study tried to determine the exposure levels of PFASs in the serum of Korean pregnant women during pregnancy and cord plasma. A total of 33 PFASs substances were selected as target analytes. Serum samples were collected from 60 pregnant women from the “DearMom cohort” collected in Korea in 2023 and stored at -70°C until analysis. Serum samples were prepared by automated solid phase extraction. Quantitative analysis was performed by UPLC-MS/MS. A total of 11 substances showed a detection rate of over 70%. In maternal serum, high concentrations of 6:2diPAP, PFOA, L-PFOS, L-PFHxS, and PFNA were detected in that order and in the fetal cord blood, high concentrations of 6:2diPAP, L-PFOS, PFOA, L-PFHxS, and PFNA were detected in that order. The transplacental transfer (TPT) ratio exhibited a U-shaped pattern, similar to previous reports for singleton pregnancy. Various PFASs were detected in maternal serum and fetal cord blood, so it is believed that maternal exposure to PFASs is highly likely to affect fetal development. Therefore, additional research is needed on the association between exposure levels to PFASs in maternal serum and fetal cord blood during pregnancy and health outcomes.

### P105: Assessment of arsenic and lead concentrations in vegetables and fruits in northern Taiwan: implications for children's health risk

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According to the Taiwan National Food Consumption Database, children's daily dietary intakes of vegetables and fruits rank in the top 6. Arsenic As and lead Pb are two of the WHO's 10 chemicals of major public health concern. We assessed the health risk assessment for 3-6-year-old  $N_{\text{Vegetables}}^*$ : 843; fruits  $N_{\text{Fruits}}^*$ : 620 and 6-12-year-old  $N_{\text{Vegetables}}^*$ : 1689;  $N_{\text{Fruits}}^*$ : 978 children. The result showed the median concentrations of As 2.183 ng/g and Pb 1.945 ng/g in vegetables were significantly higher than those in fruits As: 0.829; Pb: 0.821 ng/g. We evaluated Cancer Risks CRs through Monte Carlo simulation. The CRs  $>10^{-4}$  of As in vegetables and fruits for 3-6-year-old children were 3.83% and 0.09%, respectively. And the CRs of As in vegetables and fruits for 6-12-year-old children were 1.78% and 0.01%, respectively. All CRs of Pb in the samples for children were within acceptable levels. It should be noted that As in vegetables and fruits pose potential health hazards to children in Northern Taiwan.

### P106: Dietary exposure to environmental phenols in Korean children and adolescents: data analysis of the Korean National Environmental Health survey 2018–2020

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Environmental phenols may pose health risks to children and adolescents, including allergies, developmental disorders, and reproductive problems. Dietary intake, a primary exposure source, reveals these chemicals in food due to containers and processing. This study aims to identify dietary patterns linked to environmental phenol exposure in Korean children and adolescents. In the Korean National Environmental Health Survey (2018–2020), we analyzed 710 children and 768 adolescents as separate study subjects. Dietary patterns were determined through principal component analysis (PCA) (eigenvalues  $\geq 1.00$ ), considering food items with factor loadings  $\geq 0.25$ . The associations between dietary patterns and urinary concentrations of environmental phenol metabolites were assessed using adjusted linear regression models to estimate coefficients ( $\beta$ s) and 95% confidence intervals (CIs). We identified four dietary patterns in children and adolescents, explaining 49.8% and 50.1% of the overall food consumption variation, respectively. PC1 represented a traditional Korean diet with high factor loadings of grains, fruit, and fish, while other patterns exhibited distinct characteristics. In children, a low-seafood diet was significantly associated with increased MP [ $\beta$  (95% CI) = -0.08 (-0.15, -0.01)] and EP [ $\beta$  (95% CI) = -0.11 (-0.21, -0.005)]. There was a significant negative association between BPS [ $\beta$  (95% CI) = -0.06 (-0.11, -0.01)] and a diet with more grilled meat and fish and less seafood and shellfish. In adolescents, there was a significant positive association between the low-seafood diet pattern and TCS [ $\beta$  (95% CI) = 0.05 (0.005, 0.09)]. A diet low in canned or

packaged food was significantly positively associated with EP [ $\beta$  (95% CI) = 0.07 (0.01, 0.13)], but significantly negatively associated with MP [ $\beta$  (95% CI) = -0.06 (-0.12, -0.003)]. These findings imply that specific dietary patterns may be related to environmental phenols in children and adolescents. Enhancing our knowledge of chemical exposure through dietary sources is crucial for improving food safety.

### P107: Association between hepatitis c infection and risk of cognitive impairment

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Hepatitis C virus (HCV) infections pose a significant challenge in Taiwan. Early interventions have the potential to alter the risk of cognitive impairment. To explore whether HCV infections is associated with the risk of cognitive impairment. This cohort study obtained 9,079 individuals over 60 years old from the Taiwan Biobank database. We used the Mini-Mental State Examination score (MMSE) to evaluate cognitive impairment. Cox proportional hazards regression models were utilized to assess the risk of cognitive impairment associated with HCV infection. Adjusted linear mixed regression model was used to determine the changes of mean MMSE domains scores during follow-up. Additionally, the impact of APOE  $\epsilon 4$  polymorphism on the association between HCV and the risk of cognitive impairment was investigated. All statistical analyses were conducted using SAS version 9.4 software and R. After adjustment for age, sex, educational level, and hypertension, we observed a significantly increased risk of cognitive impairment associated with HCV infections (HR=1.81, 95% CI=1.13-2.88,  $P=0.0134$ ). In addition, individuals carrying the APOE  $\epsilon 4$  alleles had a higher risk of cognitive impairment compared to those without APOE  $\epsilon 4$  allele (HR=1.64, 95% CI=1.25-2.15,  $P=0.0003$ ). However, the interaction between HCV infection and APOE  $\epsilon 4$  polymorphism on the risk of cognitive impairment was not discovered in this study. This cohort study found a significantly increased risk of cognitive impairment among individuals above 60 years with HCV infection. We suggest that older adults with chronic HCV infection should undergo routine assessment of cognitive function.

### P108: Exploring the association between prenatal urban green space exposure and attention development in 2-year-old children

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Green spaces were found to have a positive effect on parental mental health and children's development. Exposure to green spaces during pregnancy may exert positive effects in mitigating children's behavioral problems, potentially by enhancing birth outcomes, fostering positive mood in children, and promoting increased physical activity. Limited understanding exists regarding the relationship between urban green space exposure during pregnancy and the attention development of 2-year-old children. The study thus aimed at examining the association between prenatal urban green space exposure and attention development

in toddlers. Participants were selected from an ongoing cohort study: Longitudinal Examination across Prenatal and Postpartum Health in Taiwan (LEAPP-HIT). This study evaluated parental physical and mental health and development of the children from early pregnancy to postpartum years. We analyzed the data between November 2019 and December 2023. Attention development of 2-year-old children was measured by the Child Behavior Checklist For Ages 1<sub>1/2</sub>-5. A raw score was used, with higher score indicating more attention problems. Urban green space was assessed using the 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. A total of 359 participants were included in the analysis. Prenatal NDVI exposure showed a significant protective effect on toddlers' development from within 1000m to 2000m. Specifically, NDVI within 1500m buffer during the entire pregnancy-whether mean, maximum, or minimum- all exhibited a significant protective effect on the attention development of the 2-year-old children. After adjustment for other covariates, prenatal NDVI within a 1500m buffer was associated with the attention development of the toddlers ( $\beta = -1.41$   $p < 0.05$ ). Having more prenatal green space exposure near the residence was associated with lower risks of 2-year-old children's attention problems. Exposure to green spaces during pregnancy may present an opportunity for early prevention of children's attention problems.

#### **P109: Emerging flame retardants and children's health: the Hokkaido Study**

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Organophosphate esters are a class of chemicals predominantly used as additives in flame retardants and plasticizers. In Japan, the use of PBDE diminished in the early 1990s for voluntary controls, and phosphate flame retardants (PFRs) are now the most frequently used organic flame retardants. Consequently, people are likely to be exposed to PFRs ubiquitously, as many PFRs are found in indoor environments such as indoor air and house dust, as well as urine. In this symposium, recent findings about PFR exposure and children's health in Japan will be presented. We have collected house dust as well as children's morning void urine to measure PFRs and their metabolites, respectively. Asthma and allergies were determined by ISAAC questionnaires. Helper T2 biomarkers, peripheral blood eosinophil counts, fraction of FeNO, and IgE levels were measured. For oxidative stress biomarkers, 4-hydroxynonenal (HNE), hexanoyl-lysine (HEL) and 8-hydroxy-2'-deoxyguanosine (8-OHdG) were measured. Correlation between house dust and urinary PFRs were assessed. Associations between PFR levels and children's health outcomes were also examined. Levels of TBOEP in house dust are extremely high in Japan, whereas other PFR levels are comparable with those in other countries. Levels of PFRs in dust and their metabolite in urine, respectively, showed significant correlations. We found an association between TDCIPP in dust and children's eczema, as well as TCIPP and TBOEP metabolites in children's urine and any allergic symptoms. TDCIPP,  $\Sigma$ TPHP, and  $\Sigma$ TBOEP were significantly associated with increased odds of FeNO ( $\geq 35$  ppb).  $\Sigma$ TPHP was significantly associated with high eosinophil counts ( $\geq 300/\mu\text{L}$ ). Significant positive association between PFRs exposure and urinary 8-OHdG, HNE, and HEL levels were also found. The study results suggest that exposure to PFRs may increase asthma and allergies symptoms, T2 inflammation,

and oxidative stress. Future studies in finding effective ways to reduce the PFRs exposure are warranted.

#### **P110: Study on application of the risk assessment method based on personal oriented location for exposure to chemical by chemical accident**

by Si-Hyun Park | Ji-Yun Jung | Ji-Eun Moon | Yong-Sung Jo | Cheol-Min Lee | Hee-Seok Kim | Sung-Won Yoon | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University | Seokyeong University

This study developed personal oriented exposure and risk assessment methods for hazardous chemicals caused by chemical accidents and presented case studies applying these methods. The methods were developed to distinguish indoor and outdoor acute or chronic exposure and evaluate health risks based on the concentrations of hazardous chemicals in the atmosphere in personal oriented locations. In the hypothetical chemical accident scenario, ammonia, which is the most commonly occurring chemical accident substance in Korea, was selected as the target substance. According to the created hypothetical chemical accident scenario, a multimedia environmental dynamics model was used to calculate the concentration of hazardous chemicals over time. Personal oriented location data was collected by simultaneously collecting the GPS-based method and writing the time location table method. Acute and chronic exposure and risk were calculated according to the developed personal oriented location-based acute and chronic exposure and risk assessment method. As a result of the acute and chronic risk assessment, no health effects occurred after the hypothetical ammonia leakage accident as the risk index did not exceed 1 in all cases. Although the cases showed similar activity patterns, the acute and chronic exposure concentrations and risks showed significant differences between cases. In a comparison of cases 1-3, based on the calculated chronic risk in case 1, the risk was approximately 215-fold higher in case 2 and around 0.18-fold higher in case 3. In the comparison of cases 5-7, it was expected that case 6, which was the lowest out of the assessment range, would have the highest risk; case 5, which was the highest out of the assessment range, would have the lowest risk. However, the chronic risk appeared high in the order of case 7, case 5, and case. These results suggest that personal oriented location-based assessments are necessary for exposure and risk assessment of chemicals caused by chemical accidents.

#### **P111: Risk factors of thyroid cancer in Taiwan: A national population-based study from the Taiwan Biobank**

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Thyroid cancer rates have been on the rise globally, including in Taiwan. Numerous studies have explored potential risk factors, though results remain controversial. In Taiwan, earlier investigations relied on the National Health Insurance database, which lacked crucial environmental factors. Our study utilizes the Taiwan Biobank, which provides comprehensive risk factors, aiming to identify the risk factors associated with thyroid cancer in Taiwan. Established in 2012, the Taiwan Biobank serves as a cohort database, encompassing over 200,000 participants aged 20 and above. Our study focused on 121,809 participants without any cancers except thyroid cancer at their baseline recruitment. Comprehensive risk factors, including socioeconomic, environmental, and health factors from structured questionnaires and laboratory results from blood and urine examinations, were collected. Employing a cross-sectional study design, we utilized logistic regression to estimate



the odds ratios (OR) associated with various risk factors. There were 148 cases of thyroid cancer identified in the study. Significant risk factors for thyroid cancer included female (OR=2.65, 95% CI=1.74-4.02), aging (OR=1.02, 95% CI=1.01-1.04), and family history of thyroid cancer (OR=16.16, 95% CI=8.16-32.00). Interestingly, hepatitis B virus (HBV) infection also increased the risk of thyroid cancer (OR=2.13, 95% CI=1.30-3.49). Within the female subgroup, an increased risk of thyroid cancer was also observed in women with endometriosis (OR=1.87, 95% CI=1.19-2.92). In addition to well-established risk factors, our research suggested HBV infection and endometriosis as potential risk for thyroid cancer. Further investigations in longitudinal studies identifying larger numbers of thyroid cancer patients are critical to validate our findings.

### **P113: Air pollution and acute kidney injury with comorbid disease: a time-stratified case-crossover study in South Korea**

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Ambient air pollution has been suggested as one of the potential risk factor of acute kidney injury (AKI). Although AKI is a common secondary event in ill patients, evidence on the association between air pollution and AKI accompanied by specific comorbid diseases is limited. Thus, this study aimed to investigate the comorbid disease-specific risk of incident AKI associated with air pollution (fine particulate matter  $\leq 2.5\mu\text{m}$  [ $\text{PM}_{2.5}$ ] and ozone [ $\text{O}_3$ ]). This study used the using the Korea National Health Information Database within the period 2015–2021. The incident AKI was defined as an emergency department (ED) visit due

to AKI. Air pollution concentration was predicted at  $1\text{km}^2$  spatial resolution from machine learning-based ensemble model. The time-stratified case-crossover design was performed for  $\text{PM}_{2.5}$  and  $\text{O}_3$  individually, using a conditional logistic regression model and stratified analysis was conducted by 11 comorbid diseases of AKI to estimate the comorbidity-specific association between air pollution and AKI. Total of 160,390 ED visits due to AKI were observed during 2015–2021 in South Korea. Short-term exposure to  $\text{PM}_{2.5}$  and  $\text{O}_3$  was associated with ED visits due to AKI with ORs of 1.008 (95% CI: 0.999, 1.017) and 1.019 (95% CI: 1.005, 1.033) for an interquartile range increase in lag 0–1day  $\text{PM}_{2.5}$  and  $\text{O}_3$  respectively. The odds of incident AKI associated with air pollution was evident when it occurred in conjunction with ischemic heart disease, cerebrovascular disease, gastrointestinal bleeding, and pneumonia. Increased exposure to air pollution was associated with increased odds of incident AKI and the odds was different by comorbid diseases of AKI. Our findings provide epidemiological evidence on plausible mechanism between air pollution and AKI and suggest personalized strategy for prevention of AKI.

### **P114: Long-term exposure to ambient air pollutants mixture and incidence of lung cancer: A nationwide retrospective cohort study in South Korea**

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Air pollution is increasingly recognized as a risk factor for lung cancer, yet epidemiological studies show varied results regarding its impact. This heterogeneity may arise from the complexity of air pollution, which is a mixture of various pollutants. Therefore, we examined the long-term effect of both individual and combined exposures to air pollutants on lung cancer incidence and assessed sex as effect modifiers in a large Korean population. We conducted a retrospective cohort study using the claims database of the Korea Health Insurance Service. We selected the health examination participants in 2011–2012, those who had no cancer history prior to 2011 and were aged 40–69. Annual mean concentration of four air pollutants ( $\text{PM}_{10}$ ,  $\text{PM}_{2.5}$ ,  $\text{CO}$ ,  $\text{NO}_2$ ,  $\text{SO}_2$ ) were estimated at the district level using the Integrated Multi-Scale Air Quality System for Korea, and individual exposures were determined by linking these to participant's residential addresses. Lung cancer cases, identified using the ICD-10 codes C33–34 from January 2011 to December 2021, totaled 3,282 incidents over a median follow-up of 11.0 years. We employed a time-varying Cox proportional hazards model to assess the associations between air pollution and lung cancer, and Quantile-based g-Computation to evaluate the combined effects of air pollutants. When stratified by sex, a  $10\text{-ug}/\text{m}^3$  increase  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  was positively associated with lung cancer for women (HR=1.23, 95% CI = 1.03–1.46 for  $\text{PM}_{10}$ ; HR=1.32, 95% CI = 1.03–1.68 for  $\text{PM}_{2.5}$ ) and a  $10\text{-ug}/\text{m}^3$  increase  $\text{NO}_2$  and  $\text{SO}_2$  was negatively associated with lung cancer for men (0.88, 0.82–0.95 for  $\text{NO}_2$ ; 0.24, 0.11–0.50 for  $\text{SO}_2$ ), adjusting for

potential confounders. In quantile g-computations, simultaneous quartile increase in four air pollutants was significantly associated with lung cancer in both men and women. Our results provide understanding the multifactorial environmental risk factors in lung cancer etiology, highlighting the importance of considering both gender-specific associations and combined exposures to air pollutants.

**P115: Impact of social relationship on mental health in the elderly: A nationwide cross-sectional study from Korea Community Health Survey**

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Recently, social isolation (SI) or social disconnection (SD) has emerged as a serious public health issue. Especially, the elderly population has less social activity and face difficulty in using the social infrastructure for various reasons, which is reported to have a negative impact on mental health. This study aims to identify the connections between social relationship and mental health in the elderly population in South Korea. The database of Korea Community Health Survey was used to analyze 85,861 adults aged 65 years and older from 2015 to 2017. For outcome variables, gloom and Patient Health Questionnaire (PHQ-9) responses were used. Social relationship was defined using three indicators: social contact (3 variables), social activity (4 variables), and perception of neighborhood (7 variables). The associations between social relationship and depressive symptom were analyzed using a multivariate logistic regression analysis. In multivariate analysis, social relationships, and gloom [social contact: aOR: 0.423(0.353,0.507); social activity: aOR: 0.823(0.757,0.896); perception of neighborhood: aOR: 0.609(0.479,0.774)] and depressive symptom (PHQ-9 score  $\geq 10$ ) [social contact: aOR: 0.412(0.340,0.500); social activity: aOR: 0.510(0.460,0.564); perception of neighborhood: aOR: 0.527(0.397,0.701)] had a statistically significant association. The results showed that working status, higher income, sleep hours ( $\geq 7$  hours), and drinking alcohol were less likely to be associated with gloom and depressive symptom. In subgroup analysis, social contact was strongly linked to lower depressive symptom in all income segments and was more significant than other outcome variables in the lowest income segment. This study suggested that mental health in the elderly is associated with social relationship indicators, such as social contact, social activity, and perception of neighborhood. Considering the impact of social relationship on mental health, a social context-based approach should be considered.

**P116: Association between dietary patterns and the risk of cardiovascular disease via gut microbiome**

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Gut microbiota are essential in human metabolism, and the diet strongly affects gut microbiota diversity. The association between meat diet (MD), vegetable diet (VD), and seafood diet (SD) and the risk of

cardiovascular disease via gut microbiome are not well known. This study explored the association between dietary patterns and the risk of cardiovascular disease via gut microbiome. A cross-sectional study comprised 79 males in northern Taiwan in October 2021. All participants were omnivores. This study collected data including the Food Frequency Questionnaire, stool sample, blood sample, and urine collection. Participants were divided into three patterns: meat diet (MD), vegetable diet (VD), and seafood diet (SD), using factor analysis according to the Food Frequency Questionnaire. Gut microbiota analyzed alpha and beta diversity by 16s rRNA under the Pacbio Sequel Iie system. The outcome indicator of the Framingham Risk Score (%) risk was calculated. The three dietary patterns were significantly different in the distribution of age, triglycerides, SBP, DBP, Framingham Risk Score, and current smoking. The meat dietary pattern was significantly higher than the vegetable pattern. Gut microbiota compositions differed primarily between the three dietary patterns. In the multiple linear regression, adjusting confounders of age, current smoking habit, and triglycerides, Longibaculum (genus), *p* Longibaculum\_muris (species), Oscillibacter (genus), Oscillibacter\_valericigenes (species), Lawsonbacter(genus), and Lawsonbacter\_asaccharolyticus (species) was negatively associated with Framingham Risk Score (All  $p < 0.05$ ). Different dietary patterns were associated with Framingham Risk Score and gut microbiota composition. Longibaculum, Oscillibacter, and Lawsonbacter were associated with lower Framingham Risk Score. This study explored the association between dietary patterns and the risk of cardiovascular disease via gut microbiome.

**P117: Physical activity levels among adults in an administrative city in Malaysia: a cross-sectional study**

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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. Understanding physical activity patterns among adults is essential for designing effective public health interventions. The study aims to determine the prevalence of PA levels among respondents and the correlates. A total of 301 adults participated in the survey. A cross-sectional survey involving adults aged 18 to 69 years old using a questionnaire with personal factors and the long-version International PA Questionnaire (IPAQ-LF) to measure PA levels. IBM SPSS software was used to analyse the data. Ethical approval from University Putra Malaysia Ethics Committee was obtained. The findings revealed 31 individuals (9.2%) exhibited low PA levels, while 66 (19.6%) engaged in moderate PA. Majority of respondents (n=204, 89.6%) demonstrated high levels of PA. Stratified analysis by gender indicated that 125 females (62.8%) and 79 males (77.5%) exhibited high PA levels, with a statistically significant difference observed between genders ( $p$ -value=0.04). Moreover, a considerable proportion of respondents with tertiary education (n=151, 67.7%) reported engaging in high PA levels. In terms of BMI, the majority of respondents with high PA fell within the normal BMI range (n=86, 29.2%). Surprisingly, respondents with high PA belonged to the B40 income category, with 79 individuals (44.6%). The study underscores a notable prevalence of high PA levels among adults in the urban landscape of Malaysia, with distinct associations observed with gender, educational level, BMI category, and income levels. The findings indicate potential interventions to promote physical activity, especially among demographics with lower engagement, which can improve public health outcomes and reduce non-communicable disease burdens in urban areas. Further longitudinal research is needed to explore PA determinants and develop evidence-based strategies for promoting active lifestyles and well-being.

### P118: Smoking knowledge, attitudes, and practices in Korea over time: the Korean National Cancer Prevention Awareness and Practice survey

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This study investigated how knowledge and attitude influence the smoking cessation behavior of individuals who have either quit smoking or are still smoking, using the extended knowledge, attitude, and practice (KAP) model. This study used data from the Korean National Cancer Prevention Awareness and Practice Survey, conducted between 2014 and 2023, involving 12,400 participants. After excluding responses lacking KAP questions and individuals who had never smoked, 4,794 participants were included. To evaluate the associations between knowledge (smoking-related cancer), attitude (smoking cessation for cancer prevention), and practice (decision to stop smoking), we applied multiple logistic regression and mediation analyses to evaluate the direct and indirect effects. Multiple logistic regression analysis was used to analyze the relationships among knowledge, attitude, and practice. A decline in ORs was noted in 2023 compared to that in 2021. The attitude towards stopping smoking for cancer prevention directly affected to practice about decision to stop smoking (Direct effect: 0.23 in 2014, -0.10 in 2016, 0.50 in 2018, 0.42 in 2021, 0.40 in 2023). Additionally, existing knowledge about smoking indirectly influenced practices regarding the decision to stop smoking through attitudes towards smoking (Indirect effect: 0.12 in 2018, 0.10 in 2021, 0.09 in 2023). However, knowledge does not directly affect practice. Thus, the attitude towards smoking cessation for cancer prevention served as the primary mediator between knowledge and practices. The participants' decisions to stop smoking were influenced by their attitudes. Therefore, interventions regarding smoking cessation policies should consider attitudes that integrate Korean knowledge and practices. In addition, the relationship between knowledge, attitude, and practice gradually weakened, highlighting the need to strengthen this relationship through a new smoking cessation policy. This study provides direction for smoking cessation policies and monitoring national smoking cessation programs by explaining the role of attitudes in the relationship between knowledge and practice using nationwide population-based surveys.

### P119: The relationship between sun exposure and depression among type 2 Diabetes Mellitus (T2DM) patients in Johor, Malaysia

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In recent years, mental health problems among T2DM patients have become a major public health problem worldwide. Past studies have shown the relationship between sun exposure and depression. However, relevant studies examining sun exposure and depression among T2DM patients are limited. This study aimed to examine the relationship between sun exposure and depression among T2DM patients in Johor, Malaysia. This was a cross-sectional study involving

330 T2DM patients in Johor, a southern state in Peninsular Malaysia. Information on their sun exposure was collected through a validated questionnaire. Depressive symptoms were assessed using the Patient Health Questionnaire (PHQ-9). The prevalence of depression among T2DM patients was 35.5%. The data analysis showed that factors with a significant association with depression among T2DM patients were older age (>60 years old) (adjusted OR 2.07, 95% CI 1.23–3.48), deficiency of serum vitamin D levels (adjusted OR 4.64, 95% CI: 2.09–11.38), insufficiency of serum vitamin D levels (adjusted OR 1.82, 95% CI: 1.07–3.10), sun exposure during the weekend, less than 30 minutes (adjusted OR 1.76, 95% CI: 1.25–2.93), and sun exposure during work, less than 30 minutes (adjusted OR 2.82, 95% CI: 1.90–3.81). Older age, sun exposure less than 30 minutes during weekend and work, and deficiency and insufficiency of vitamin D levels are the factors associated with depression among T2DM patients. The depression among the T2DM patients in this study was associated with older age, low serum vitamin D levels and minimal sun exposure. It is important that the T2DM patients, especially the elderly, have enough daily sun exposure and vitamin D levels to prevent the occurrence of depression.

### P120: Effect of artificial lights on Aedes eggs in strata residential in Selangor, Malaysia: a field cluster randomized control trial

by Dr. Lina Farhana binti Ramli | Dr. Subainizam bin Saliluddin | Dr. Mohd Rafee bin Baharudin | Dr. Zailiza binti Suli | Dr. Lau Sai Ming | Jebebu District Health Office, Negeri Sembilan State Health Department | Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia | Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia | Hulu Langat District Health Office, Selangor State Health Department | Vector Borne Disease Control Unit, Selangor State Health Department

Dengue fever remains the deadliest infectious disease in tropical and subtropical regions. Even though numerous vector control measures have been taken, dengue incidence has continued to rise in the country due to rapid urbanization, population growth, and vertical housing development. Few studies have examined the association between light intensity and *Aedes* in Malaysia. Therefore, this study assesses how artificial light interventions may affect *Aedes* population density in strata residential buildings in Selangor, Malaysia. The study was a two-armed, single-blinded, parallel, stratified cluster-randomized trial conducted in epidemiology week 41 until 52 in 2022. Nine blocks of intervention sites were applied with artificial light in addition to the usual standard operating procedure for dengue control. The *Aedes* density was measured using paddle ovitraps placed at the study sites weekly. Every *Aedes spp.* egg was identified and counted under a stereo microscope at 2.5x. The ovitrap index (OI) and egg density index (EDI) were calculated. In both intervention and control groups, positive ovitraps were the highest at 1-month post-intervention follow-up compared to the baseline and immediate post-intervention periods. Among intervention sites, the total *Aedes* eggs were lowest during baseline (24.2%), whereas among control sites, they were lowest during immediate post-intervention (25.2%). There was no significant difference in OI between intervention and control sites ( $\beta = -3.156$ , 95% CI: -10.151, 3.839,  $p = 0.368$ ). Meanwhile, there was a statistically significant difference in EDI between intervention and control sites ( $\beta = 12.607$ , 95% CI: 3.295, 21.918;  $p = 0.009$ ). Artificial light can serve as an approach to vector control for mitigating the transmission of *Aedes*-borne illnesses. The high capture of the *Aedes* population with artificial light can be used in dengue preventive management with the invention of the larvicidal light trap. This method may complement existing insecticide approaches or human behavioural prevention programs in vector control in the future.

### **P121: Knowledge, attitude and practice towards dengue fever among low-socioeconomic group in Hulu Langat district, Selangor**

by Dr. Lina Farhana binti Ramli | Associate Profesor Dr. Hayati Binti Kabir @ Shahar | Dr. Nor Faiza binti Mohd. Tobit | Jelebu District Health Office, Negeri Sembilan State Health Department | Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia | Faculty of Medicine and Defence Health, National Defence University of Malaysia

Dengue is a preventable infectious disease and become a significant threat to public health worldwide. Dengue remains endemic in Selangor state, consistently exhibiting the highest incidence of dengue cases every year in Malaysia. Therefore, this study aims to determine the level of knowledge, attitude and prevention practice towards Dengue among the low-socioeconomic group in Hulu Langat, Selangor. An analytical cross-sectional study was conducted in 2020 among adults above 18 years old who receive a financial assistance scheme from the Department of Social Welfare Malaysia. About 407 respondents were selected by proportionate stratified random sampling method, and data collection was done by phone call interviews in Malay language or English. The majority of the respondents had good knowledge (67.3%) and positive attitude (53.5%) towards Dengue. However, 94.3% of them had poor practice levels in preventing the infection. There was an association between knowledge and ethnicity ( $p < 0.001$ ), with education level ( $p = 0.017$ ), previous history of Dengue outbreak in the neighborhood ( $p = 0.009$ ), past involvement in health education or health promotion activity ( $p = 0.011$ ), and informative level of the respondent based on the source of information regarding Dengue ( $p = 0.021$ ). Age, ethnicity, education level, previous history of Dengue infection, previous history of Dengue outbreak, previous involvement in health education or health promotion activity, and informative level of the respondents were found to have associations with attitude level towards Dengue. Only education level ( $p = 0.012$ ) and income status ( $p = 0.017$ ) were found associated with prevention practice. There was a significant association between knowledge and attitude ( $\chi^2 = 9.977$ ,  $df = 1$ ,  $p = 0.002$ ). However, no association was found between attitude and practice as well as knowledge and practice level in this study. The related findings may guide relevant authorities and stakeholders in developing comprehensive dengue prevention programs tailored to the low-socioeconomic group. Effective strategies should incorporate culturally with relevant social language for maximum impact.

### **P122: Transition of early childhood infections to chronic diseases in adolescence in Korea: a nationwide study**

by Jonghmin Oh | Jiyoung Lee | Yoorim Bang | Jibyen lee | Eunhee Ha | Department of Environmental Medicine, College of Medicine, Ewha Womans University, Seoul, Republic of Korea; Institute of Ewha-SCL for Environmental Health (IESEH), College of Medicine, Ewha Womans University, Seoul, Republic of Korea; Department of Human Systems Medicine, College of Medicine, Seoul National University, Seoul, Republic of Korea; Integrated Major in Innovative Medical Science, Seoul National University Graduate School, Republic of Korea. | Inflammation-Cancer Microenvironment Research Center, College of Medicine, Ewha Womans University, Seoul, Republic of Korea | Institute for Development and Human Security, Ewha Womans University, Seoul, Republic of Korea | Department of Pediatrics, College of Medicine, Ewha Womans University, Seoul, Republic of Korea | Department of Environmental Medicine, College of Medicine, Ewha Womans University, Seoul, Republic of Korea; Institute of Ewha-SCL for Environmental Health (IESEH), College of Medicine, Ewha Womans University, Seoul, Republic of Korea

Infectious diseases in early childhood rank in the top five burden of disease in children in Korea as well as overseas. In particular, there is a rise in the incidence of infectious diseases in children under 5 years of

age due to the increased flow of people and goods by overseas travel. There are re-emerging diseases such as measles, or new infections such as COVID-19. These frequent infections in early life can act as a risk factor for chronic diseases. Therefore, we aimed to study the transition of early childhood infections to chronic diseases in adolescence in Korean children. We used the National Health Insurance Service–National Sample Cohort (NHIS-NSC) data from 2002 to 2019. We identified the top ten infectious diseases in children from age <6 years from year 2002 to 2006. The transition of these infectious diseases into chronic diseases in adolescence age 13 to 18 years will be evaluated by multivariate Cox proportional hazard regression. A total of 128580 children under six years of age were included in this study from year 2002 to 2006. In our study, around 48% were girls and the mean age of participants was 4.1 years. The highest prevalence was of acute bronchitis 13% and the lowest prevalence was of pneumonia due to other infection 0.01%. The incidence rate for acute bronchitis was 15%, highest in year 2006, while acute pharyngitis 5% and upper respiratory tract infections 9.2% were highest in the year 2002, respectively. Our study contributes towards reducing medical costs and improving the future health of children by suggesting preventive policies that can reduce chronic diseases in adolescence and disability-adjusted life years. The study will help derive chronic disease prevention policies by supplementing public health promotion, public health awareness, and health policy strategies and programs.

### **P123: Evaluation of polytetrafluoroethylene nanoparticles toxicity through 90-day repeated oral administration to Sprague Dawley rats**

by Jisun Lee | Graduate School Department of Toxicology Daegu Catholic University

Microplastics (MPs) have been recently recognized as posing a risk to human health. Nanoplastics (NPs) could cause more health risk than MPs since NPs can be readily absorbed by cells. Polytetrafluoroethylene (PTFE) is mainly used for manufacturing nonstick cookware and medical devices. Since toxicity of PTFE-NPs has been rarely studied, the present study investigated whether subchronic (90 days) exposure to PTFE-NPs by gastric intubation caused overall toxicities to S.D. rats. Average size 260 nm PTFE-NPs were administered to six-week-old SD rats at 0, 250, 500 and 1,000 mg/kg/day (10 males and 10 females/group). Toxicity of PTFE-NPs administration has been comprehensively evaluated through examining clinical signs, functional observation battery, urinalysis, ophthalmology, hematology, clinical chemistry, electrolyte analysis, thyroid hormone tests, blood coagulation tests, necropsy findings, and histopathology. The high-dose male group demonstrated significantly lower body weight than the vehicle control after initiating administration. In addition, a trend of dose-response decrease in body weight gain was observed without statistical significance. Blood level of aspartate aminotransferase in males tended to dose responsively increase in the PTFE-NPs administration groups compared to the control group with statistical significance in the high-dose group, suggesting a liver toxicity through PTFE-NPs administration. In addition, although no statistical significance was shown in the testis, a dose-responsive increase in weight was observed in the PTFE-NPs administration groups. Following the present results, the No Observed Adverse Effect Level for SD rats administered with PTFE-NPs for 90 days was determined to be 1,000 mg/kg/day, the highest dose. Overall the present study demonstrated certain abnormal changes in male for weight gain, blood chemical tests related with liver or kidney functions, and weight of epididymis. However no histopathological alteration was observed with all organs examined.

### **P124: Acute pneumonia in mice induced by Korean airborne bacteria**

by Chanhee Chong | Yongsung Park | Soonhyun Kwon | Wonsuck YOON | Allergy Immunology Center, College of Medicine, Korea

University | Allergy Immunology Center, College of Medicine, Korea University | Allergy Immunology Center, College of Medicine, Korea University | Allergy Immunology Center, College of Medicine, Korea University

Indoor air quality is critical to respiratory health, and airborne bacteria in particular pose a serious risk. While airborne chemical pollutants have been extensively studied, the extent to which airborne bacteria are toxic to the lungs is less well understood. This study investigates the potential health risks of suspended bacteria in the air to respiratory health. Airborne bacteria from 2,591 Korean outdoor air samples were studied using animal models. Pulmonary responses in C57BL/6 mice were assessed through intratracheal instillation, bronchoalveolar lavage fluid (BALF) analysis, and histological examination of lung tissue. Pulmonary responses in C57BL/6 mice were studied after single intratracheal instillation of five dominant airborne bacterial strains (*Bacillus infantis*, *Kocuria palustris*, *Microbacterium testaceum*, *Micrococcus yunnanensis*, and *Moraxella osloensis*). All bacteria instillation groups exhibited significant increases in relative lung weights, total inflammatory cell numbers, and inflammatory cytokines compared to control groups. Histological analysis revealed acute inflammation in the alveolar regions in all bacteria instillation groups, except for *M. yunnanensis*, which displayed eosinophilic cell infiltration. Intratracheal instillation of airborne bacteria can induce acute lung inflammation in mice, with varying responses observed depending on the bacterial strains. These findings emphasize the importance of identifying and monitoring specific airborne bacterial strains to minimize the risk of respiratory health problems.

#### **P125: Systematic review on health effects of climate change and air pollution among people with disability**

by Seohyun Lee | Nakyung Rhim | Dankook University College of Medicine, Cheonan, Republic of Korea | Dankook University College of Medicine, Cheonan, Republic of Korea

This study aims to evaluate health effects due to climate change (CC) and air pollution (AP) among people with disability (PWD) by disability, disability type, and severity using systematic review (SR). SR was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) with population (PWD), exposure (heat, cold, and air pollutants), comparator (general population, non-disabled (ND), or mild disability), and outcome (all health outcomes) among only English or Korean literature in PubMed from Jul to Dec 2023. After excluding 419 articles for climate change and 329 articles for air pollution through review by title, abstract, or full article, 6 for climate change and 4 for air pollution were selected. Adverse health effects due to CC and AP were higher in PWD and severely disabled compared to ND and mild disabled, respectively. Especially in heat waves, multiple sclerosis, elderly, and nursing homes, patients had much higher morbidity and mortality from falling, heat-related disease. In cold waves, multiple sclerosis, children, rhinitis and asthma, and all types of disability were much higher rates of injury, functional disability, and post-traumatic stress. When exposed to air pollutants, PWD showed a higher risk of admission and mortality in cardiovascular disease and obesity than ND, especially in disability with brain lesions and visual, severely disabled. Moreover, those risks were increased among PWD with low socioeconomic status (SES) or physical activity less than once per week. In this study, we found PWD with low SES increased vulnerability to CC and AP.

#### **P126: Effects of tropical cyclones on diarrheal diseases: a scoping review**

by Szu Yu Lin | Paul LC Chua | Lei Yuan | Nasif Hossain | Jinyu He | Lisa Yamasaki | Lina Madaniyazi | Aurelio Tobias | Chris Fook Sheng Ng | Masahiro Hasbizume | Department of Global Health Policy, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

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Tropical cyclones pose health risks, strain vital infrastructures, and can trigger disease outbreaks in affected populations. Diarrheal diseases become increasingly hazardous post-cyclone due to their heightened sensitivity to environmental conditions. This scoping review aims to comprehensively examine the existing literature on the impact of tropical cyclones on diarrheal diseases, synthesizing research methodologies, key findings, underlying biological mechanisms, and identifying areas of research deficiency for an updated perspective. This scoping review adhered to the recommendations outlined by the Joanna Briggs Institute and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Review (PRISMA-ScR) reporting guidelines. The online databases of PubMed/MEDLINE, Web of Science, Scopus, Google Scholar, and ProQuest were used for the literature search. Ninety-six (96) records met the inclusion criteria, with 26 papers (27.1%) focusing on North America and 22 papers (22.9%) on East Asia and the Pacific. Notably, over 65 (67.7%) records were published after 2010. Further scrutiny was applied exclusively to epidemiological studies (23 studies) and found that 12 (52%) reported positive associations. Nine studies (39.1%) employed a pre-post comparison approach without considering the time-varying confounders such as time trend or seasonality. Exposure definitions varied across studies with 15 studies (65.2%) applying event-based definitions. Studies on tropical cyclones and diarrheal diseases are increasing. More than half of the studies showed increased diarrheal disease after a tropical cyclone. However, current variations in exposure definitions and methodologies suggested a need for a unified approach to consistently quantify the impact of tropical cyclones on diarrheal disease.

#### **P127: A systematic review and meta-analysis on long-term exposure to particulate matter and all-cause and cause-specific mortality in the Asia Pacific States**

by Jongmin Oh<sup>1,2,3,4\*</sup>, Gonzalo Hevia-Ramos<sup>5\*</sup>, Eunhee Ha<sup>1,2,6</sup>, Yun-Chul Hong<sup>3,7</sup>, Hyun Kim<sup>8</sup>, Youn-Hee Lim<sup>5</sup>. <sup>1</sup>Department of Environmental Medicine, College of Medicine, Ewha Womans University, Seoul, Republic of Korea. <sup>2</sup>Institute of Ewha-SCL for Environmental Health (IESEH), College of Medicine, Ewha Womans University, Seoul, Republic of Korea. <sup>3</sup>Department of Human Systems Medicine, College of Medicine, Seoul National University, Seoul, Republic of Korea. <sup>4</sup>Integrated Major in Innovative Medical Science, Seoul National University Graduate School, Seoul, Republic of Korea. <sup>5</sup>Section of Environmental Health, Department of Public Health, University of Copenhagen, Copenhagen, Denmark <sup>6</sup>System Health & Engineering Major in Graduate School (BK21 Plus Program), Ewha Womans University, Seoul the Republic of Korea. <sup>7</sup>Institute of Environmental Medicine, Medical Research Center, Seoul National University <sup>8</sup>Division of Environmental Health Sciences, School of Public Health University of Minnesota, Minneapolis, Minnesota

The increasing level of air pollution, particularly the concentrations of particulate matter (PM) in the atmosphere, is associated with adverse health outcomes. This underscores the urgent need for comprehensive

investigations into the long-term impacts on overall and cause-specific mortality. While Global Burden of Disease studies have proposed integrated exposure-response models based on Western studies (U.S. and Europe), applying them directly to Asian countries may not be suitable. We aimed to explore the association between prolonged exposure to ambient particulate matter and cause-specific mortality through a systematic review and meta-analysis. We searched three databases (PubMed (n=8,326), EMBASE (n=4,709), and Cochrane Library (n=357)) during study period between 1<sup>st</sup> January 1990 and 31<sup>st</sup> July 2023. We searched only studies conducted in Asian countries, and the outcome variables were considered all-cause deaths (or non-accidental deaths), cardiovascular diseases (CVD), ischemic heart diseases (IHD), cerebrovascular diseases (stroke), acute lower respiratory infection (ALRI), chronic obstructive pulmonary diseases (COPD), lung cancer deaths, diabetes mellitus type 2 and chronic kidney disease. We conducted the meta-analysis for three or more studies. We identified 72 articles investigating association of long-term exposure to PM and cause-specific mortality. For 10  $\mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{2.5}$  concentrations, the pooled relative risk with 95% confidence intervals (CI) for all-cause mortality was 1.115 (95% CI: 1.070, 1.161). Long-term exposure to  $\text{PM}_{2.5}$  was associated with cause-specific mortality with RR of 1.139 (95% CI: 1.069, 1.213) for cardiovascular disease (CVD), 1.149 (95% CI: 1.040, 1.270) for ischemic heart disease (IHD), 1.129 (95% CI: 1.031, 1.236) for Stroke, 1.201 (95% CI: 1.025, 1.407) for chronic obstructive pulmonary disease (COPD), 1.179 (95% CI: 1.006, 1.382) for acute lower respiratory infection (ALRI), 1.119 (95% CI: 1.079, 1.161) for lung cancer. We found positive association between long-term exposure to PM and all-cause and cause-specific mortality for CVD, IHD, Stroke, COPD, ALRI, and lung cancer in Asian countries.

#### **P128: A protective role of urban greenspace on the association between night-time heat and suicide in Seoul, South Korea**

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Suicide, a leading cause of death among the youth, has shown a positive association with high temperatures. However, few studies have explored the association between tropical nights and suicide and the potential role of greenness on this association. We investigated the association between suicide and two hot night indices: hot night duration (HNd) and hot night excess (HNe), representing heat duration and excess heat during night-time. We also explored whether the association was modified by urban greenspace, measured by normalized difference vegetation index (NDVI), across 25 districts in Seoul, South Korea from 2000 to 2020. We performed a space-time-stratified case-crossover analysis with a distributed lag linear model with lags of up to 7 d for HNd and HNe, adjusting for daily mean temperature and relative humidity. We added an interaction term between the hot night index and NDVI to assess the effect modification of greenness. In total, 14,693 suicides were included in this study. The relative risk (RR) of suicide per 10% increase in HNd was 1.059 (95% CI: 1.017–1.103) in low NDVI areas and 1.031 (95% CI: 0.988–1.075) in high NDVI areas. The RR per 1 °C increase in HNe was 1.011 (95% CI: 0.998–1.024) and 1.005 (95% CI: 0.992–1.018) in low and high NDVI areas, respectively. Greenspaces

have expanded over time in all districts of Seoul, and the risk of suicide for night-time heat decreased over time in both low and high NDVI areas. Our findings suggest that exposure to night-time heat is associated with an increased risk of suicide, but this risk may be mitigated by greater greenspaces in urban areas. Prioritizing development and maintenance of urban greenspaces will be a critical co-benefit strategy for promoting public mental health in changing climates.

#### **P129: Analyzing the impact of air mycobiome changes in urban parks on asthma allergic inflammation**

by *Yongsung Park* | *Soonhyun Kwon* | *Young Yoo* | *Wonsuck YOON* | *Allergy Immunology Center, College of Medicine, Korea University* | *Allergy Immunology Center, College of Medicine, Korea University* | *Department of Pediatrics, Anam Hospital, Korea University* | *Allergy Immunology Center, College of Medicine, Korea University*

This study presents a comprehensive investigation into the microbiological composition of air quality within urban parks and explores its potential implications for allergic inflammatory responses. We isolated fungi from outdoor air samples collected from an urban forest in Seoul, South Korea, and investigated their cytotoxic potential and ability to induce allergic inflammation in human mast cells (HMC-1) and an experimental model of asthma. The mycobiome of outdoor air in more than 23 areas of Seoul's city parks was systematically analyzed, with strains identified and tested. The results showed that *Cladosporium* (59%) and *Alternaria* (22%) were the most common airborne fungi in city parks. Furthermore, a weak negative correlation was observed between the number of urban parks per local resident and asthma prevalence. Exposure to three strains (*Fusarium*, *Trichoderma*, and *Penicillium*) collected from urban parks slightly suppressed allergic inflammation in activated HMC-1 cells. Notably, many strains from urban parks mildly suppressed allergic inflammation in an animal model of asthma. This study performed a microbiological analysis of the characteristics of urban parks, which constitute the majority of urban forests. The results showed that the diversity of fungal species in urban parks was greater than that in urban forests. This finding suggests the possibility that the microbiological diversity of urban parks may regulate the expression of allergic inflammation through the respiratory tract, given the negative correlation observed between the number of urban parks per capita and the incidence rate of asthma.

#### MODERATING POSTER

#### **P130: Examination of publication bias in a two-stage dose-response meta-analysis: three application examples**

by *Jinyoung Moon* | *Ewha Womans University Seoul Hospital*

No definitive method to examine the possibility of publication bias in a two-stage dose-response meta-analysis has existed until the present. In this study, the authors will address the examination of publication in a two-stage dose-response meta-analysis. For the investigation of the dose-response relationship between the years of night shift work (exposure dose) and the incidence of breast/prostate/colorectal cancer (response), a two-stage dose-response meta-analysis was conducted. The existence of publication bias was examined using Begg's funnel plot (asymmetry) and Egger's regression test. For Egger's regression test, only one representative effect estimate is needed for each study. Therefore, the authors applied the same two-stage dose-response meta-analysis method used in this study to each study separately. Through this step, the authors acquired a representative risk ratio (RR) or odds ratio (OR) of breast/prostate/colorectal cancer for each additional year of night shift work from each study. These RRs or ORs and calculated variance were used to conduct Egger's regression test. For breast/prostate/colorectal cancer, Begg's funnel plot for cohort studies and case-control studies were provided. For breast cancer, Egger's regression test results for cohort studies and case-control studies were a p-value of 0.1437 and

0.1430, respectively. For prostate cancer, Egger's regression test results for cohort studies and case-control studies were a p-value of 0.0847 and 0.0066, respectively. For colorectal cancer, Egger's regression test results for cohort studies and case-control studies were a p-value of 0.5934 and 0.2875, respectively. Considering the importance of correct exposure assessment, a dose-response meta-analysis could be an essential methodology of evidence synthesis in occupational and environmental health. This study could provide a valid methodology for the examination of publication bias in a two-stage dose-response meta-analysis.

**P131: Exploring hidden sources of bisphenol exposure through investigating daily activities and urinary analysis**

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Bisphenols (BPs) find widespread use in polycarbonate plastics and epoxy resins used for manufacturing consumer goods and packaging materials. Despite known sources, there is still exposure to BPs that remains unexplained. This study aimed to investigate the potential sources of BPs exposure by correlating urinary BPs levels with activities. Twelve adults with diverse characteristics were recruited. For seven consecutive days, participants completed a questionnaire and collected every urine void, recording the total urine volume and urination time along with 24-h time-activity diaries combined with food records. Urinary BPs (n=8) including bisphenol A (BPA) and bisphenol S (BPS) were measured. BPs content in the urine was related to the questionnaire and diaries helped identify associated exposure sources and activities with each peak exposure or trend of BPs. BPA and BPS were detected in over 70% of the 401 urine samples, whereas the remaining BPs were found in <15%. For each of the 12 participants, the median concentrations of BPA and BPS in urine ranged from <LOQ-1.46 ng/ml and <LOQ-0.85 ng/ml, respectively. Despite the questionnaire failing to reveal associations between urinary excretion and exposure sources for BPA and BPS, our analysis of diary records matched with urinary levels identified established sources of bisphenol exposure, such as food containers, personal care products (PCPs), detergents, and thermal-paper receipts. Additionally, potential sources were identified, including ointments, medical plasters, and tight stockings, as well as activities such as wallpapering, vinyl flooring, crop cultivation, and food preparation while wearing gloves. Our findings suggest that the time-activity diary approach is a valuable method for identifying potential sources of exposure. Future studies should aim to validate these newly identified sources further.

**P132: Hypertensive disorders during pregnancy, trajectory of children's body size up to 6 years of age: the Hokkaido birth cohort study in Japan**

by Kritika Poudel | Sumitaka Kobayashi | Chihiro Miyashita | Takeshi Yamaguchi | Naomi Tamura | Atsuko Ikeda- Araki | Yu Ait Bamai | Sachiko Itoh | Keiko Yamazaki | Hiroyoshi Iwata | Mariko Itoh | Reiko Kishi | Center for Environmental and Health Sciences, Hokkaido University | Center for Environmental and Health Sciences, Hokkaido University | Center for Environmental and Health Sciences, Hokkaido University | Center for

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Hypertensive disorders during pregnancy (HDP) increase the risk of offspring with a low birth weight, preterm birth and small-for-gestational age; however, evidence of the anthropometric measurements during early childhood remains limited. Therefore, we aimed to understand the associations between maternal HDP, and anthropometric measurements of children aged up to 6 years. The Hokkaido study on environment and children's health, Japan, a prospective birth cohort from 2002 to 2013 consisted of 20,926 pregnant women. Participants completed a baseline questionnaire, and medical records were used to identify HDP and birth outcomes. Anthropometric data were obtained from birth records and medical check-ups at different ages. Overall, we included the data obtained from participants from medical checkups at age 6 months (n = 10,329), 1.5 years (n = 9014), 3 years (n = 7211) and before school at 6 years (n = 6198), respectively and was sex-stratified. The prevalence of HDP in this study was 1.7% (n=209). The birth height of male children born to HDP mothers was smaller as compared to those born to non-HDP mothers. Differences were more significant in male than female children. When adjusted with covariates, the linear regressions showed significant smaller birth weight ( $\beta$ : -79.3; 95% confidence interval [CI]: -154.8, -3.8), birth height (-0.67; 95% CI: -1.07, -0.26), whereas larger weight at six years (1.21; 95% CI: 0.13, 2.29), and weight gain between three and six years (1.12; 95% CI: 0.28, 1.96) of male children exposed to HDP than not exposed to HDP. Our study showed that despite lower birth weight, male children exposed to HDP caught up with their growth and gained more weight by six years of age compared with male children not exposed to HDP, whereas no such differences were observed in female children. Study shows HDP impact on male child growth catch-up, underlining sex-specific considerations in developmental outcomes understanding.

**P133: Association between air pollutants and lung function and exhaled carbon monoxide**

by Ya-Yun Cheng | National Sun Yat-sen University

With the rapid development of global industrialization and economy, the potential impact of air pollution on human health has attracted widespread attention. This study focuses on the correlation between air pollution factors and human lung function in southern Taiwan (Pingtung County), including particulate matter, nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and ozone(O<sub>3</sub>) on lung function indicators. Using air pollution data collected from southern Taiwan in July 2023 and physiological and biochemical indicators of 115 local residents, which exhaled carbon monoxide (eCO) gas analyzers and blood tests were used to collect. In addition, we measured lung function (FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second). Applying logistic regression model, linear regression model, and linear mixed model to analyze the relationship between the above biochemical indicators and air pollution factors. The cross-sectional study recruited 115 subjects, including 51 males (44.3%) and 64 females (55.7%). The youngest subject was 34 years old and the oldest subject was 94 years old, with an average age of 63.7 years. There was significant positive association between air pollution (CO, O<sub>3</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>) and eCO & lung function (FEV, FVC). This study demonstrated the potential hazards of exposure to air pollutants on lung function effect. But, we still need further follow-up study to explore and figure out. The significance

of this study is to gain an in-depth understanding of the effects of air pollutants on lung function. Through the interaction between lung function indicators and the environment, we are expected to better predict an individual's risk of disease and provide more precise treatment guidelines for the people.

### **P134: Long-term air pollution exposure, green spaces, and chronic cardiopulmonary disease**

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Exposure to air pollution and residential green space distribution are associated with chronic disease. However, the complex and interactive effects of long-term air pollution and green space on chronic disease such as cardiovascular and respiratory diseases remain unclear. National Health Insurance Service data of Korea were used to evaluate chronic health effects by cohort study method. Exposure to PM<sub>2.5</sub> and NO<sub>2</sub> was evaluated through existing city-scale models and hybrid modeling that can predict local pollution distribution, and green space was estimated by the Normalized Difference Vegetation Index. Using the Cox proportional hazards regression model, we investigated the association between air pollution and residential green space and the risk of chronic disease, and analyzed the complex effects and effect modification between green space and air pollutants. PM<sub>2.5</sub> was associated with increased cardiovascular and respiratory disease risk (HR 1.13, 95% CI: 1.12-1.14, and HR 1.11, 95% CI: 1.09-1.14, per IQR increase each), whereas green space showed protective effects (HR 0.95, 95% CI: 0.82-0.98, and HR: 0.98, 95% CI: 0.89-1.00, per IQR increase each). NO<sub>2</sub> was also positively associated with the risk of cardiopulmonary disease. Interactions were identified between greenness and air pollution on cardiovascular and respiratory diseases, with higher effect estimates in greener areas. We found that exposure to higher air pollution and lower green space were associated with higher risk of cardiopulmonary disease. The role of green space in the combined effects of air pollution on chronic disease needs to be further investigated.

### **P135: Climate variability, El Niño-southern oscillation, and seasonal effects on dengue fever risks from 2009-2019 in Semarang, Indonesia: a time series analysis**

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Over the past decade, dengue has become a significant health threat, particularly in Southeast Asia, straining healthcare systems and economies. This study investigated associations between climate variables (average temperature, cumulative rainfall, sunshine hour, and relative humidity), and El Niño Southern Oscillation (ENSO), season (dry and wet), and dengue fever (DF) incidence in Semarang, Indonesia. Monthly DF and meteorological data were obtained from the Central Java Provincial Health Office and the Meteorology, Climatology, and Geophysical Agency from 2009 to 2019, respectively. We used negative binomial generalized estimating equations to assess the effects of climate variables up to a lag of 6 months, ENSO, and seasonal effects on DF incidence in Semarang. We found the effects of temperature on DF in Semarang, with the highest IRR at lag of four months (IRR: 1.969, 95% CI: 1.421—2.728). Cumulative rainfall was positively associated with DF in Semarang with IRR of 1.002 (95% CI: 1.001—1.003) at lag of four months. We did not find any significant effect of relative humidity and sunshine hour in this study. We defined the season into dry (Apr-Oct) and wet (Nov-Jan) season. We found that dry season (IRR: 2.094, 95% CI: 1.292—3.394) increased the risk of DF, whereas wet season did not show any significant effect. In addition, we did not found any significant effect of ENSO on DF risks in Semarang, Indonesia.

A multi-faceted approach that combines understanding of climate factors, effective control measures, and community engagement is necessary to address the complex challenges posed by dengue fever in the context of climate change. This study contributes to improve the understanding of the complex relationship between climate and dengue transmission. This is particularly relevant in the context of climate change, which may exacerbate dengue risk factors.

### **P136: Effects of humidifier disinfectant on developmental disorders in children**

by Hyowon Choi | Yeon-Soon Ahn | *Department of Prevention Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea* | *Department of Prevention Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea*

Humidifier disinfectant (HD) that has been used only in South Korea 1994~2011, is an indoor toxic environmental substance. It was especially widely used in children and pregnant women. There has been only one study conducted on the neuropsychiatric outcomes of childhood due to HD exposure in infancy. The purpose of this study is to examine the relationship between exposure to HD and developmental disorder (DD). This study was selected for subjects born between 2002 and 2011 up to 10 years of age from National Health Insurance Service (NHIS) claim data in Korea Environmental Industry & Technology Institute (KEITI)'s comprehensive portal for humidifier disinfectant damage support. 1:2 propensity score matching (PSM) was performed using birth year and residential area. Logistic regression analysis was performed, incorporating variables related to exposure history to HD. These variables included monthly age at the exposure start, total exposure duration, exposure duration after birth, exposure categorized by pediatric age group, category of HD, humidifier location, and natural ventilation within the subjects. Monthly age at start of exposure (OR=1.004, 95% CI 1.002-1.007) and prenatal exposure (OR=1.120, 95% CI 1.023-1.227) were statistically significantly increased in the group with DD compared to the group without DD. Adjusted with medical history at birth and respiratory disease (prematurity, asthma, ILD and ARDS), it was a significant increase in the OR of DD according to total exposure duration (OR 1.002, 95%CI 1.000001~1.004). In this study, prenatal exposure and total duration of exposure were associated with DD. However, there is a limitation of lack of information on diagnosis based on health insurance claim code and maternal history related to prenatal exposure, so further research is needed.



### **P137: Heat risk mapping: A spatial modeling approach for prioritizing areas with high heat-related health risk**

by *Chaeyon Park* | *Vera Ling Hui Phung* | *Yuya Takane* | *Hiroaki Kondo* | *Dongkun Lee* | *National Institute of Advanced Industrial Science and Technology (AIST)* | *The University of Tokyo* | *National Institute of Advanced Industrial Science and Technology (AIST)* | *National Institute of Advanced Industrial Science and Technology (AIST)* | *Seoul National University*

Urban heat islands and climate change have worsened the heat environment in many cities. The increased intensity and frequency of extremely high temperatures significantly impact the rise in heat-related morbidity and mortality, especially among the elderly population, who are vulnerable to heat. It is essential to consider heat-related health risks during the urban planning stage, identifying how different urban contexts contribute to excess morbidity or mortality. Numerous studies have highlighted the impact of temperature on morbidity and mortality. For instance, Yuan et al. (2023) uncovered patterns between temperature and mortality and morbidity at the prefecture and county levels in Japan. However, there is a scarcity of urban planning tools that incorporate this temperature-health risk association. Therefore, we propose temperature-related health risk mapping as a tool for urban planning to create safer cities. We simulated the spatial distribution of air temperature and its attributable morbidity and mortality during current summer in Tokyo. The air temperature was simulated by using multi-layer urban canopy model which considers heat and mass interactions between atmosphere, buildings, and vegetation areas. We used the developed risk functions between air temperature and heat related morbidity and mortality. Then, we identified the urban characteristics in areas where health risk is the highest. High-density building areas experienced the highest temperatures, contributing to elevated heat-related mortality and morbidity in Tokyo. These areas must be prioritized during the urban planning stage to address current and future urban heat risks. This study is constrained by its use of a single association function between air temperature and heat-related morbidity and mortality, and by its application to the entire Tokyo area. However, future research should explore diverse urban contexts when developing risk associations. Our methods and results, serving as a decision support tool, will be instrumental in creating sustainable and safe cities.

### **P138: Study on application of the risk assessment method based on personal oriented location for exposure to chemical by chemical accident**

by *Si-Hyun Park* | *Ji-Yun Jung* | *Ji-Eun Moon* | *Yong-Sung Jo* | *Cheol-Min Lee* | *Hee-Seok Kim* | *Sung-Won Yoon* | *Seokyeong University* | *Seokyeong University* | *Seokyeong University* | *Seokyeong University* | *Seokyeong University* | *Seokyeong University* | *Seokyeong University*

This study developed personal oriented exposure and risk assessment methods for hazardous chemicals caused by chemical accidents and presented case studies applying these methods. The methods were developed to distinguish indoor and outdoor acute or chronic exposure and evaluate health risks based on the concentrations of hazardous chemicals in the atmosphere in personal oriented locations. In the hypothetical chemical accident scenario, ammonia, which is the most commonly occurring chemical accident substance in Korea, was selected as the target substance. According to the created hypothetical chemical accident scenario, a multimedia environmental dynamics model was used to calculate the concentration of hazardous chemicals over time. Personal oriented location data was collected by simultaneously collecting the GPS-based method and writing the time location table method. Acute and chronic exposure and risk were calculated according to the developed personal oriented location-based acute and chronic exposure and risk assessment method. As a result of the acute and chronic risk assessment, no health effects occurred after the hypothetical ammonia leakage accident as the risk index did not exceed 1 in all cases. Although

the cases showed similar activity patterns, the acute and chronic exposure concentrations and risks showed significant differences between cases. In a comparison of cases 1-3, based on the calculated chronic risk in case 1, the risk was approximately 215-fold higher in case 2 and around 0.18-fold higher in case 3. In the comparison of cases 5-7, it was expected that case 6, which was the lowest out of the assessment range, would have the highest risk; case 5, which was the highest out of the assessment range, would have the lowest risk. However, the chronic risk appeared high in the order of case 7, case 5, and case. These results suggest that personal oriented location-based assessments are necessary for exposure and risk assessment of chemicals caused by chemical accidents.

### **P139: Analysis of Individual PM2.5 Exposure Concentrations According to Occupied Spaces Using Portable Monitors: targeting children**

by *Kim young hyun* | *Seokyeong University*

Modern individuals spend approximately 90% of their day indoors, occupying various microenvironments such as homes, offices, schools, and transportation facilities (Park, 2018). Personal monitoring provides more detailed information about indoor air quality. Therefore, to analyze fine particulate matter (PM2.5) exposure more accurately, it is necessary to understand individual PM2.5 exposure levels and verify exposure levels based on individual activity patterns. This study utilized portable monitors to measure individual PM2.5 concentrations, considering individuals' activity patterns, and surveyed individuals' occupancy spaces through time-activity logs. The aim was to ascertain the average individual exposure level and confirm space-specific occupancy times and exposure concentrations, thereby providing foundational data on individual exposure. The study was conducted from November 2023 to February 2024, involving nine children as participants. Individual PM2.5 concentrations were measured in real-time at one-minute intervals. Participants' occupancy spaces were surveyed in 30-minute intervals using time-activity logs, distinguishing between home, school or academy, transportation, outdoor, and other indoor locations. Data analysis was conducted using SPSS Ver 23. The results of measuring individual PM2.5 concentrations among the children showed a daily average of  $22.67 \pm 6.92 \mu\text{g}/\text{m}^3$ . When categorizing individual PM2.5 concentrations based on residential spaces using time-activity logs, the highest concentration was observed during public transportation/private vehicle use, with  $36.48 \pm 38.62 \mu\text{g}/\text{m}^3$ , followed by  $27.70 \pm 22.66 \mu\text{g}/\text{m}^3$  at home. Regarding occupancy time, participants spent the most time at home, with  $17.75 \pm 3.27$  hours, followed by school, academy, other indoor spaces, public transportation/private vehicle use, and outdoor activities. Considering both concentration and exposure duration, the highest exposure concentration was observed during public transportation/private vehicle use, while the occupancy time was the second lowest. These results emphasize the importance of considering various indoor environments when evaluating individual exposure levels, and comprehensive assessments that take into account both pollutant concentration and exposure duration are necessary.

### **P141: The role of couple relationship in the link between urban green land use characteristics and behavior development among children aged 3**

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Accumulating research evidence indicates that green spaces benefit children's behavioral development. However, little is known about how urban green spaces, such as land use characteristics (UGLUCs), affect children's behavioral development. In addition, while couple relationships also play a critical role in children's behavioral development, little is known about whether they modify UGLUCs and children's behavioral development. This study aims to explore the relationship between UGLUCs and children's behavioral development of 3-year-old children, and whether there are differences due to different couple relationships. Participants were selected from an ongoing cohort study: Longitudinal Examination across Prenatal and Postpartum Health in Taiwan (LEAPP-HIT). We analyzed the data from November 2019 to March 2024, with 216 participants included for examination. UGLUCs, including forest, park, and school area, utilized data from the Taiwan National Land Surveying and Mapping Center. We estimated the neighborhood UGLUCs area (in km<sup>2</sup>) by using geocoded home addresses within designated radii of 250, 500, 750, 1000, 1500, and 2000 meters. Self-administered questionnaire was used to assess children's behavior development and couple relationships. Subsequently, we categorized the scores into high and low groups. A multiple regression model was employed to examine the relationship and stratified analysis was employed to investigate the moderating effect. After adjustment for other covariates, school area with a buffer radius of 2000m around home was associated with the better attention ( $\beta=-0.18$ ,  $p<0.05$ ) and aggressive behavior ( $\beta=-0.50$ ,  $p<0.05$ ). In the stratified analysis, the association between schools and attention problem was significant in the group with poorer couple relationships ( $\beta=-0.19$ ,  $p<0.05$ ). No moderating effect was found in aggressive model. UGLUCs have a soothing effect on attention problems in 3-year-old children, especially for those families with poorer couple relationships. Living near to UGLUCs when the poor couple relationship may present an opportunity for early prevention of children's attention problems.

#### **P142: Environmental determinants of childhood allergies and sensitization during the first year of life**

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**Introduction:** The prevalence of childhood allergies is increasing in recent decades, especially in developing nations, but its risk factors remain unclear. This study aims to determine the associations between environmental factors, allergen sensitization, and allergic diseases among infants during their first year of life.

**Methodology:** This prospective cohort study involved 380 mother-child pairs recruited from six selected government health clinics in Selangor and Kuala Lumpur, Malaysia. Environmental exposures during the pre- and postnatal periods, as well as the development of allergic diseases in infants were obtained through parental reports. Blood samples were collected from infants at 12 months of age to determine their specific IgE levels against 16 types of inhalant allergens.

**Results:** Eczema was observed in 27.6% of the infants, 6.1% exhibited wheezing, and 10.8% of infants had sensitization to inhalant allergens. The top three inhalant allergens sensitized by the infants were Dermatophagoides farina (6.4%), Dermatophagoides pteronyssinus (5.4%), and Blomia tropicalis (4.1%), respectively. After adjusting for confounders, infants with indoor exposure to dampness had a lower risk of eczema (OR=0.55, 95%CI=0.31-0.98). Sensitization to Dermatophagoides farinae (OR=3.64, 95%CI=1.42-9.32), Dermatophagoides pteronyssinus (OR=4.25, 95%CI=1.50-12.01) and Blomia tropicalis (OR=2.83, 95%CI=0.90-8.91) were associated with higher odds of eczema, respectively. Other environmental factors including number of siblings, use of antibiotics during pregnancy and infancy, pet ownership, daycare attendance, indoor mould exposure, and tobacco smoke exposure were not associated with any of the allergic outcomes.

**Conclusion:** Environmental exposures and allergens sensitization play a role in the development of eczema in infants during the first year of life. Further research is warranted to elucidate the mechanisms underlying the association between indoor exposure to dampness and eczema.

**Significance of the study:** These findings emphasize the importance of considering environmental factors in understanding and preventing allergic outcomes in early infancy.

#### **P143: Bias reduced estimation for association between Air Pollution and Mortality in South Korea**

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**Introduction:** It is well known that air pollution is highly associated with human death in several studies. However, there can be various biases in the study of this association although they are usually not considered. This study aimed to conduct a study with bias reduction adjusting potential confounders including temporal exogenous confounders applying general propensity score (GPS) methods (matching and inverse weighting) with case-crossover design (using conditional Poisson regression).

**Methodology:** From January 2015 to December 2021, daily records of nationwide mortality in South Korea were obtained from the Korean National Death Registry. As exposure data, we used daily average concentrations of ambient PM<sub>2.5</sub> and O<sub>3</sub> predictions from machine learning-based ensemble model developed by AiMS-CREATE team. As confounders, we obtained daily average concentrations of relative humidity, wind speed, temperature at 2m (with 21-day single lags), total precipitation and aerosol optical depth in Google Earth Engine. We applied time-stratified case-crossover design with conditional Poisson regression. We conducted the analysis (1) only adjusting temperature, (2) adjusting the defined confounders as covariates, and (3) applying general propensity score (GPS) matching to the confounders at the exposure variable.

**Results:** During the study period, 2,058,814 deaths were observed. For the association between the mortality and prediction values for PM<sub>2.5</sub>, the estimated odds ratios were (1) 1.002539; 95% CI: 1.000576-1.004506, (2) 1.0002070; 95% CI: 0.9999740-1.000440, and (3)

1.0001797; 95% CI: 0.9998197-1.000540. In case of O<sub>3</sub>, the estimated odds ratios were (1) 1.0002298; 95% CI: 1.0001154-1.000344, (2) 1.0002244; 95% CI: 1.0000885-1.000360, and (3) 0.9998888; 95% CI: 0.9992714-1.000507.

**Conclusion:** We found that the significant associations were found to be insignificant when considering the exogenous meteorological confounders we defined. This shows that these variables should be considered as important confounders in air pollution epidemiology in the future research.

#### **P144: Ambulance Call Outs In Association With Ambient Particulate Matter Concentrations Among Elderly In Kaohsiung, Taiwan**

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**Background:** Heightened air pollution is frequently associated with diverse health risks, particularly among elderly population (≥65 years). Therefore, this study evaluated the risk of ambulance call-outs among

the elderly in Kaohsiung, Taiwan, using PM<sub>2.5</sub> concentration as a surrogate marker for air pollution.

**Method:** Daily ambulance call data for elderly was obtained from the Kaohsiung city Government Fire Bureau from 2013 to 2019. Distributed lag-nonlinear model (DLNM) with lag of 5 days was used to estimate the exposure-response relationship between daily PM<sub>2.5</sub> concentrations and ambulance calls from Chest pain, Coma, Nausea, Headache/dizziness/fainting, Cardiopulmonary arrest and Respiratory diseases (wheezing, shortness of breath).

**Results:** The exposure-response curves indicated an increased risk of ambulance calls from Coma, Headaches, Cardiopulmonary arrest and Respiratory diseases among elderly in Kaohsiung. In contrast, no significant association curves were seen with Chest pain and Nausea. The World Health Organization (WHO) daily limit of 15 µg/m<sup>3</sup> was used as reference concentration. Interestingly, different concentration range were identified for ambulance call outs among elderly for different causes, significant risk of Coma was identified within the PM<sub>2.5</sub> concentration range of 60-80 µg/m<sup>3</sup>, whereas a significant risk of cardiopulmonary arrest was identified within 30-80 µg/m<sup>3</sup> PM<sub>2.5</sub> concentration. While, any concentration above WHO standards results in heightened risk of ambulance call outs from respiratory diseases among elderly.

**Conclusion:** Despite rigorous efforts to control PM<sub>2.5</sub> emissions, vulnerable sub-populations continue to face elevated health risks within the city. Therefore, there is a pressing need for practical interventions and policies aimed at reducing PM<sub>2.5</sub> exposure among the elderly.

**Significance/contribution of the study:** This study addresses a critical public health concern, by evaluating the risk of ambulance call-outs among the elderly associated with air pollution. It provides insights into the specific health risks faced by vulnerable populations, due to their increased susceptibility to air pollution-related health conditions.