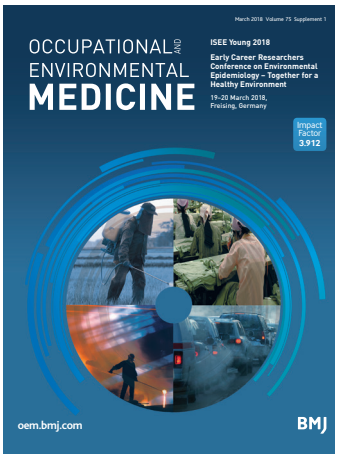
Occupational and Environmental Medicine



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Air pollution and neurological disorders

OP I – 1 AMBIENT AIR POLLUTION AND DEPRESSIVE SYMPTOMS IN ELDERLY WOMEN: RESULTS FROM THE SALIA STUDY

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Background/aim Numerous epidemiological studies have shown effects of long-term exposure to air pollution on cardiovascular, respiratory and cognitive health. However, studies investigating the effects of air pollution on depressive symptoms are limited and results are conflicting. We aimed to examine the association between long-term exposure to ambient air pollution and depressive symptoms in elderly women.

Methods Our analyses were based on 821 women (age ≥65 years) living in the Ruhr area and Southern Münsterland, Germany (SALIA cohort, follow-up examination, 2008–2009). Annual average concentrations of particulate matter (PM) size fractions and nitrogen oxides (NO*x*) were assigned to home addresses by land-use regression (LUR) models. Self-reported depressive symptoms were evaluated using the Centre for Epidemiological Studies – Depression Scale (CES-D) and a CES-D score ≥16 as a dichotomous outcome was used in analyses. Our adjusted logistic regression models included age, body mass index, smoking status, environmental tobacco exposure at home, educational status, urban/rural living, physical activity, cardiovascular disease, respiratory diseases and diabetes as covariates.

Results A total of 129 women (15.7% of the individuals) had a CES-D score ≥16. We observed significant positive associations between an interquartile range (IQR) increase of PM10 (OR=1.294; 95% CI: 1.022 to 1.640), PM2.5 (OR=1.594; 95% CI: 1.120 to 2.270), NO2 (OR=1.418; 95% CI: 1.044 to 1.924) and NO*x* (OR=1.507; 95% CI: 1.108 to 2.051) with the presence of depressive symptoms. No significant associations were observed for an IQR increase of absorbance of $PM_{2.5}$, coarse fraction of PM and traffic indicators (traffic load and residential proximity).

Conclusion In this study, mean annual concentrations of PM_{10}, $PM_{2.5}$, NO_2 and NOx were positively associated with depressive symptoms in elderly women. Findings of our study suggest that air pollution is not only a risk factor for physical health but might also have adverse effects on mental health among elderly women.

OP I – 2 LIVE BIRTH BIAS MAY PLAY A ROLE IN EPIDEMIOLOGICAL ANALYSES OF AIR POLLUTION AND AUTISM SPECTRUM DISORDER

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10.1136/oemed-2018-ISEEabstracts.2

Background/aim Findings regarding air pollution and of autism spectrum disorder (ASD) are inconsistent. A recent publication testing associations between exposure to NO2 and autism used a distributed lag model with ASD data and weekly NO2 exposures from Israel in order to identify windows of vulnerability. When mutually adjusted, prenatal associations reached a negative peak around week 15 of gestation.

Methods A directed acyclic graph (DAG) was built to represent the causal structure and the underlying assumptions needed for live birth bias to create biassed negative associations between prenatal exposure to air pollution and risk of ASD.

Results Live-birth bias could arise from the fact that ASD can only be assessed in live-born children, and many pregnancies are lost and do not end in a live birth. This inevitable selection of only live births into the analysis may lead to bias of the observed association from the actual causal association if a) air pollution is a risk factor for pregnancy loss (this assumption is supported by some literature); and b) there are other factors ('U', likely unmeasured, even unknown) that influence both pregnancy loss and ASD. A possible 'U' is prenatal stress, which is implicated in both pregnancy loss and ASD. Selection of live births opens the backdoor path ASD <– U –>Pregnancy Loss <– Air Pollution, associates air pollution and ASD and biases the causal association in question.

Conclusion Live-birth bias can create a negative association between air pollution and ASD. This bias has implications for all air pollution-ASD studies, and it may also be relevant to other neurodevelopmental conditions.

OP I – 3 LONG-TERM EXPOSURE TO AIR POLLUTION AND FIRST HOSPITALISATION FOR DEMENTIA

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10.1136/oemed-2018-ISEEabstracts.3

Background/aim Only recent studies have explored the role of air pollution exposure on neurodegenerative processes. The aim of this study is to evaluate the association of long-term exposure to particulate matter, nitrogen oxides and summer ozone with the first hospitalisation for dementia (overall, vascular dementia, Alzheimer's disease and senile dementia) in a large administrative cohort.

Methods We selected 3 50 872 subjects (free of dementia) aged 65–100 years at inclusion (21/10/2001) and we followed them until 31/12/2013. From the hospital discharge registry, we selected all subjects hospitalised for the first time with primary or secondary diagnoses of dementia (ICD-9CM: 46.1, 290.0–290.4, 294, 331.0, 331.1, 331.82). We estimated

exposure at residence using land use regression models for nitrogen oxides and particulate matter, and a chemical dispersion model for summer ozone. We used Cox models (HR, hazard ratio) to estimate the association between air pollution exposure and first hospitalisation for dementia and its subtypes, adjusted for age, education, marital status, place of birth, socioeconomic position index, and stratified by gender.

Results During the follow-up we selected 21 105 first hospitalizations for dementia (7500 for vascular dementia, 7671 for Alzheimer and 7571 for senile dementia). Overall we observed a negative association between exposure to NO2 (10 μg/m^3) and dementia hospitalisation (HR=0.97; 95% CI: 0.96 to 0.99) and a positive association with exposure to O3 (10 μg/m^3), HR=1.06 (95% CI: 1.04 to 1.09).

Considering different type of dementia we found a positive and statistically significant association between exposure to NOx, NO2, PM2.5, PM10, and vascular dementia; whereas, a negative association between exposure to NOx, NO2, PM2.5, PM10, and Alzheimer's disease was observed. Hospitalisation for senile dementia was positively associated with exposure to O3, HR=1.20 (95% CI: 1.15 to 1.24).

Conclusion Our results showed a positive association between exposure to O3 and hospitalizations for dementia and a negative association with NO2. In the separate analysis by type of dementia, exposure to all pollutants (except O3) was associated positively to vascular dementia and Ozone exposure was associated with senile dementia.

OP I – 4 HYPERACTIVITY/INATTENTION SYMPTOMS AND EARLY LIFE INDOOR MICROBIAL DIVERSITY IN URBAN CHILDREN

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10.1136/oemed-2018-ISEEabstracts.4

Background/aim The immune system and gut microbiota may play a role in the cognitive development. The home microbiota are a source of microbial exposure affecting immunological and maybe gut microbiota development. Thus, it may contribute to cognitive development. Here, we assess the association between early life home dust microbial diversity and hyperactivity/inattention symptoms at 10 and 15 years old.

Methods A random sample enriched with subjects with hyperactivity/inattention at age 15 years were selected from the German LISA birth cohort. Bedroom floor dust samples were collected at age 3 months and bacterial diversity was defined by richness (number of OTUs and Chao1) and diversity indices (Shannon and Simpson) calculated from Illumina MiSeq sequencing data of 16S rRNA gene DNA amplicons. Hyperactivity/inattention was defined based on the scores of the Strengths and Difficulties questionnaire (SDQ) at ages 10 (filled by parents) and at 15 years (self-administered), using a cut-off ≥7. With adjusted logistic regression models we investigate the associations between symptoms and 4 diversity indices in tertiles. At age 10, models were weighted by the inverse of the sampling weights.

Results We included 226 individuals with information on indoor microbial diversity and hyperactivity/inattention symptoms. The median values of the diversity indices were higher among children without symptoms at age 10 for bacteria and at age 15 for fungi. After adjustment, hyperactivity/inattention at age 10 was inversely associated with bacterial richness (number of observed OTUs medium vs low diversity: OR=0.4; CI: 0.2 to 0.8; Chao1 medium vs low diversity: OR=0.3; CI: 0.1 to 0.5; high vs low: OR=0.3; CI: 0.2 to 0.6), and positively associated with fungal Chao1 (high vs low: OR=2.1; CI: 1.1 to 4.0), Shannon (medium vs low: OR=2.8; CI: 1.3 to 5.8), and Simpson (high vs low: OR=4.7; CI: 2.4 to 9.3). No significant associations were observed between the indices and hyperactivity/inattention at age 15.

Conclusion Our results suggest that early life exposure to microbial diversity may play a role in the development of hyperactivity/inattention during childhood. Exposure to rich bacterial environment may protect from developing hyperactivity/inattention, while high fungal diversity may have the opposite effect. Further larger studies are needed to confirm our results.

OP I – 5 PRENATAL AND POSTNATAL EXPOSURE TO AIR POLLUTION AND WHITE MATTER MICROSTRUCTURE IN SCHOOL-AGE CHILDREN

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Background/aim Exposure to air pollution is related to brain structural variations but the relationship with white matter microstructure has not yet been established. Here, we aimed to assess whether pre- and postnatal exposure to a wide range of different air pollutants is related to white matter microstructure in school-age children.

Methods We used data from 2977 children aged 8–12 years from a birth cohort in Rotterdam, The Netherlands (2002–2006). Concentrations of nitrogen oxides, particulate matter (PM) and various components of PM were estimated at home addresses using land-use regression models for the entire prenatal period and from birth until the visit at the research centre. Diffusion tensor images were obtained during the magnetic resonance imaging session and fractional anisotropy (FA) and mean diffusivity (MD) values were computed. Deletion/substitution/addition algorithm was used to select the most predictive pollutants accounting for the covariance between them. The selected pollutants were then related to white matter microstructure, adjusting for various parental socioeconomic and life-style characteristics.

Results Overall, exposure to several air pollutants was associated with decreases in FA values and increases in MD values, which possibly indicate brain alterations. These results were consistent for both pre- and postnatal air pollution estimations, yet more profound with postnatal exposures (e.g. a

decrease in FA of 0.41 [95% Confidence Interval CI: −0.78 to −0.04] and an increase in MD of 0.05 [95% CI: 0.01 to 0.10] for each 1 ng/m^3 increase in polycyclic aromatic hydrocarbons (PAHs) during childhood).

Conclusion Exposure to various air pollutants during fetal life and childhood was associated with alterations in white matter microstructure in school-age children. Previous studies show that lower FA and higher MD values are associated with psychiatric and neurological disorders. Considering the ubiquity of the exposure, these results raise concern and point out the need for further research in this area.

OP I – 6 OUTDOOR AIR POLLUTION, GREENSPACE AND INCIDENCE OF ADHD IN SAXONY: A SEMI-INDIVIDUAL COHORT STUDY

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10.1136/oemed-2018-ISEEabstracts.6

Background/aim Attention deficit hyperactivity disorder (ADHD) is a frequent mental disorder with onset in childhood and largely unknown aetiology. It has been speculated that apart of genetic and lifestyle factors, the environment could also contribute to the ADHD onset but evidence is very scarce. We investigated whether outdoor air pollution and greenspace affect ADHD incidence in children residing in Saxony.

Methods 66 823 children from the population-based statutory health insurance company AOK PLUS born between 2000 and 2004 were followed until 2014. We considered any child with at least one ICD-10-GM F90 diagnosis ever by a child/adolescent psychiatrist, neuropaediatrician or psychotherapist an ADHD case. Children's home addresses were known up to their four-digit postal code area. Population-weighted mean values of particulate matter with diameter of less than 10 µm (PM10), nitrogen dioxide (NO2) and MODIS Normalised Difference Vegetation Index (NDVI) were calculated for 186 postal code areas. Associations with each exposure were assessed by two-level adjusted Poisson regression models.

Results 2044 children (3.06%) were diagnosed with ADHD within the observation period. Pearson correlation coefficients between PM10, NO2 and NDVI were $\geq|0.80|$. An increase of PM10 and NO2 by 10 µg/m^3 raised the relative risk of ADHD by a factor of 1.97 [95% CI: 1.35–2.86] and 1.32 [1.10–1.58], respectively. 0.1-unit increase in NDVI decreased the relative risk of ADHD by a factor of 0.82 [0.68–0.98]. Better access to child psychiatrists was the most important confounder that increased ADHD risk across all models.

Conclusion Our results provide some evidence that environmental factors might affect ADHD. Future studies with more detailed address information and better control for confounding, in particular for socioeconomic status and parental psychopathology, should clarify whether the observed associations are true.

Weather

OP II – 1 TEMPERATURE EFFECTS ON MORTALITY IN URBAN, SUB-URBAN AND RURAL SETTINGS: AN APPLICATION OF SATELLITE DERIVED HIGH RESOLUTION DAILY TEMPERATURE DATA

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10.1136/oemed-2018-ISEEabstracts.7

Background/aim The effect of heat on health is well known, however, exposure is usually limited to a single point measurement, potentially misclassifying the real exposure. The aim of the study is to estimate the effect of heat on mortality in urban, sub-urban and rural areas of the Lazio region in Italy using satellite derived, high resolution air temperature data.

Methods MODIS LST satellite data, NDVI, observed meteorological data and land- use variables were combined into a three-stage mixed model framework to derive estimates of daily temperature for the period 2000–2010 with a 1 × 1 km resolution for the Lazio region. Total mortality counts for each municipality were considered and municipalities were classified into 3 groups according to population size (small-rural, medium and large municipalities) and Rome was analysed alone as it has over 2.5 million inhabitants. We used an over-dispersed Poisson conditional regression model to estimate the% change in mortality for increases in mean temperature (lag 0–3) between the 75th and 90th percentile. We adjusted for long-term and seasonal time trends specific for each municipality and holidays.

Results A significant increase in mortality for temperature increases was observed for rural, sub-urban and large municipalities in the Lazio region. The temperature threshold set at the 75th percentile increased progressively from rural areas to the greatest urban agglomeration, Rome (from 22.9°C to 25.1°C), however a greater temperature range was observed in rural and sub-urban areas. The greatest effect was observed in sub-urban areas with a relative risk of 1.41 (95% CI: 1.25 to 1.58) followed by Rome with a relative risk of 1.29 (95% CI: 1.19 to 1.39). The smallest effects of heat were observed in rural areas 1.41 (RR=1.26; 95% CI: 1.25 to 1.58).

Conclusion The effects of heat is not only restricted to large urban areas, but effects are also observed in smaller cities, sub-urban areas and rural settings. Geographical mapping of these findings by municipality will highlight areas most at risk in the Lazio region to whom prevention measures should be targeted.

OP II – 3 EFFECT MODIFICATION BY SOCIO-ECONOMIC POSITION AND GREEN SPACES OF SHORT-TERM EXPOSURE TO HEAT AND AIR POLLUTANTS ON PRETERM-BIRTH RISK. A TIME SERIES STUDY IN ROME, 2001–2013

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10.1136/oemed-2018-ISEEabstracts.8

Background/aim Evidence of the impact of green spaces on pregnancy outcomes is still limited. We analysed green spaces

and socio-economic position (SEP) as effect modifiers of the effect of high temperatures and air pollutants (PM10, NO2 and O3) on the risk of preterm birth (PB).

Methods A cohort of new-borns in Rome, from April to October, 2001–2013, were analysed. Pre-terms, identified through the Certificate of Delivery Care Registry, were defined as births between the 22nd and the 36th week of gestation. A time series approach was used, with maximum apparent temperature (MAT), PM10, NO2 and O3 as exposure variables. We used a lag of 0–2 days for all exposure when analysing preterm births, except for PM10 (lag of 12–22 days). As green indicators we considered both the distance between mothers' residence address and green spaces and the Normalised Difference Vegetation Index (NDVI) within a 100 m buffer centred on woman's residence address. Women were also classified according to age, SEP and education level.

Results We enrolled 56 576 total births, 5.1% of which PB. In our cohort 24% of women were younger than 30 years, 36% had a low SEP and 33% completed primary school. We observed a 2.0% (*95% CI: 0.7 to 3.2*) increase in the daily number of PB per 1°C increase in MAT, adjusting by PM10. Among pollutants only PM10 was associated to a significant increase in PB (+0.7%; *95% CI: 0.1 to 1.3*) per 1 mg/m^3 increase in PM10 (adjusted by MAT). SEP was an effect modifier for both MAT/PB and PM10/PB relationship; MAT increased the risk of PB only among women of medium or low SEP while PM10 among those of high SEP. Green was an effect modifier of MAT/PB relationship, with the highest effect of MAT on PB among women living very close to green spaces (within 100 m).

Conclusion Socio-economic position resulted to be an important effect modifier for both MAT/PB and PM10/PB relationship. In particular we found the highest effect of temperature on preterm birth risk in women with low socio-economic position and living very close to green areas. How green acts in modifying this association should be further investigated.

OP II – 5 IMPACT OF METEOROLOGICAL PARAMETERS ON SUICIDE RATES: A CASE-CROSSOVER STUDY IN SOUTHERN GERMANY (1990–2006)

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Background/aim Researchers worldwide have reported a seasonal pattern of suicides with peaks in spring and early summer; however, only a limited number of studies has evaluated whether meteorological variables may trigger suicides. We therefore aimed to investigate the association between short-term changes of meteorological variables and suicides in Bavaria, Germany, for the period 1990–2006.

Methods Daily suicide and meteorological data were available for four Bavarian cities and ten counties. Immediate, delayed and cumulative effects of air temperature, sunshine duration, cloud cover, relative humidity as well as precipitation on suicides were analysed using a confounder-adjusted time-stratified case-crossover approach. In further analysis, we explored potential effect modifications by specific weather conditions (air temperature <median value or ≥median value; relative humidity <median value or ≥median value), personal characteristics (age, sex), place of residents (city or county), and season. Effect modifications were analysed by including an interaction term (meteorological variable*modifier) as well as the main effects of these two variables in the models.

Results A 5°C increase in air temperature was associated with a 4.1% (95%-confidence interval: 0.97; 7.4%) and 5.1% (2.0; 8.4%) higher suicide risk on the same day and with a delay of one day, respectively. Further, the suicide risk was 6.2% (0.6; 12.2%) higher on days with low/medium cloud cover (0–6 oktas) compared to days with high cloud cover (7–8 oktas). Temperature effects with a lag of one day were more pronounced in individuals older than 65 years (9.9% (4.3; 15.8%)). While temperature was not associated with suicides in spring we found positive associations in summer, autumn, and winter. The effects of cloud cover were strongest in summer and autumn and on days with temperature above the median (>8.8°C). The other meteorological variables were not significantly associated with suicides.

Conclusion We found a higher risk for suicides in association with short-term increases in air temperature and on days with low to medium cloud cover. This may highlight time periods when people are more likely to commit suicide.

OP II – 6 TEMPORAL VARIATION IN THE EFFECT OF HEAT AND THE ROLE OF THE ITALIAN HEAT PREVENTION PLAN

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10.1136/oemed-2018-ISEEabstracts.10

Background/aim Many studies showed that the effects of temperature vary over time. The aim of the paper is to evaluate the temporal change in the effect of heat on mortality in Italy in the last 12 years after the introduction of the national heat plan.

Methods Distributed lag non-linear models were used to estimate the association between maximum apparent temperature and mortality in 23 Italian cities included in the national heat plan in four study periods, one before the introduction of the heat plan (1999–2002) and three after the plan was in place (2005–2016). The Relative Risks and impact, in terms of attributable fraction and number of heat-related deaths, were estimated for mild (20th and 75th percentile) and extreme temperatures (75th and 99th percentile) in each study period during summer. We also estimated the potential change in the number of heat-related deaths between the first and subsequent periods by applying the dose-response relationship estimated in the first period to the mortality and exposure observed in the other periods.

Results Although summer temperatures are increasing in Italian cities, a reduction in heat-related mortality is observed progressively over time. After the introduction of the heat plan, a reduction in the effect of extreme temperatures was observed, while for mild summer temperatures the effect remains high (RR 1.23; 95% CI: 1.15 to 1.32). By the second period, when all cities had implemented local prevention programs for a number of years a further reduction in the effect of both extreme and mild temperatures was observed. The heat attributable fraction related to extreme temperatures declined from

6.3% in the period 1999–2002% to 4.1% in the last period (2013–2016). Considering the entire temperature range the total number of heat-related deaths spared over the entire study period was 1900.

Conclusion Considering future climate change and the health burden associated to heat waves, it is important to promote adaptation measures by showing the potential effectiveness of heat prevention plans.

Exposure assessment

OP III – 1 AN EMPIRICAL VALIDATION OF THE BIOSPECIMENS WITHIN-SUBJECT POOLING APPROACH

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Background/aim Within-subject biospecimens pooling was shown to be theoretically efficient in reducing bias in dose-response functions in presence of classical-type error. Its validity was never tested empirically, and collecting all daily urine samples is cumbersome. We evaluated the validity of a within-subject pooling approach relying on the collection of a small number of voids every day.

Methods In 16 pregnant women who collected urines over several weeks, we compared biomarker concentrations of 10 phenols in daily, weekly and pregnancy within-subject pools obtained using either three or all daily urine samples. Then, a simulation study using real data from the same women allowed us estimating the bias in dose-response functions when relying on one to 20 urine samples per subject to assess exposures to methylparaben (low within-subject variability) and bisphenol A (high variability).

Results Regarding the estimation of daily, weekly and pregnancy exposures, except for benzophenone-3 and triclosan (daily time-window), correlations between pools of all or only three voids were above 0.8. Using one biospecimen resulted in an attenuation bias in the dose-response functions of 30% (methylparaben) and 68% (bisphenol A); four and 18 samples, respectively, were required to decrease bias to 10%.

Conclusion For short half-lived compounds, collecting and pooling three instead of all daily voids allows efficient estimation of exposures over time windows of a week or more. Collecting a few dozen urine samples allows to strongly limit attenuation bias for highly temporally variable chemicals such as bisphenol A. This provides further (empirical) validation of the within-subject pooling approach.

OP III – 2 AIR POLLUTION EXPOSURE ASSESSMENT FOR THE ELAPSE PROJECT USING HYBRID LUR MODELS

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10.1136/oemed-2018-ISEEabstracts.12

Background/aim In order to investigate associations between air pollution and adverse health effects fine spatial air pollution surfaces are needed to provide cohorts with exposures. In the ELAPSE project we developed hybrid land use regression models for multiple pollutants and linked these to 11 individual and 7 administrative cohorts in 10 countries for a total of 35 million participants.

Methods Europe-wide hybrid LUR models were developed for 2010 estimating annual mean PM2.5, NO_2, O_3 and BC (including cold and warm season O_3 estimates). Models were developed based on AirBase routine monitoring data (PM2.5, NO_2, O_3) and ESCAPE monitoring data (BC), incorporating land use and traffic data plus satellite observations and dispersion model estimates as additional predictor variables. Universal kriging was performed on residual spatial variation. Main model was developed using all sites. To evaluate robustness, five more models were developed, each built on 80% of monitoring sites with remaining 20% used for validation. Models were applied to 100 × 100 m grids across Europe to allow for exposure assignment for all ELAPSE cohorts.

Results Main models explained: $NO_2$58%, PM2.5 71% (59% LUR +12% kriging), $O_3$62% and BC 51% of spatial variation in measured concentrations. Validation R2 ranged 0.55–0.60 for NO_2, 0.63–0.77 for PM2.5, 0.51–0.69 for O_3 and 0.43–0.57 for BC. Dispersion model estimates, road density, nature and residential area were predictor variables in NO_2 model. PM2.5 model consisted of satellite derived and dispersion model estimates, altitude, road density, nature, ports and residential area. Satellite derived and dispersion model estimates, road density, residential area, urban green and Y-coordinate were predictors in BC model. O_3 model included dispersion model estimates, road density, ports, residential area and altitude. Kriging proved an efficient technique to explain part of residual spatial variation.

Conclusion We were able to develop robust NO_2, PM2.5, O_3 and BC hybrid LUR models to provide exposure estimates for all cohort participants in the ELAPSE project.

OP III – 3 USING SATELLITE OBSERVATIONS TO ESTIMATE EXPOSURE TO FLARING: IMPLICATIONS FOR FUTURE STUDIES OF THE HEALTH IMPACTS OF UNCONVENTIONAL OIL AND GAS OPERATIONS

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10.1136/oemed-2018-ISEEabstracts.13

Background/aim Unconventional oil and gas (UOG) operations may increase exposure to hazardous air pollutants and several studies suggest they can harm the health of nearby residents. However, research is hampered by a lack of data on pollutant emissions from drilling sites and few studies have examined the potential health impacts of flaring, the common practice of combusting petroleum waste products on site.

Methods We utilise a novel remote sensing data source to estimate exposure to flaring among residents of the Eagle Ford Shale region of Texas, U.S. This rural region has experienced a roughly tenfold increase in oil and gas production since 2010 and is the highest oil-producing and fourth highest gas-producing region in the U.S. We investigate the potential of the VIIRS Nightfire product – which includes satellite observations of infrared radiation at night from combustion sources – to characterise exposure to flaring and compare estimates of exposure to UOG operations derived from VIIRS and those derived from more traditional data sources

(permit and self-reported production data) that have been used in previous epidemiological studies.

Results Nearly 8 00 000 people live less than 5 km from one or more of the 22 000 active, permitted UOG wells in the study region. Nighttime infrared observations from VIIRS confirm reports of extensive flaring in close proximity to homes. We construct VIIRS-derived indices to characterise exposure to flaring based on residential proximity to flaring locations, flaring frequency and duration, temperature of combustion, and areal extent. We discuss the strengths and limitations of these measures for estimating air pollutant emissions, and the implications of this exposure assessment method for future epidemiological research on the health impacts of UOG operations.

Conclusion While previous studies have relied on self-reported information on the location, timing, and productivity of oil and gas extraction activities, careful processing of VIIRS observations can provide novel, objective estimates of exposure to flaring that are likely better capture exposure to air pollutants resulting from UOG operations.

OP III – 4 EXPOSURE ASSESSMENT MODELS FOR NO2 AND PM2.5 IN THE ELAPSE STUDY: A COMPARISON OF SUPERVISED LINEAR REGRESSION AND MACHINE LEARNING APPROACHES

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Background/aim Recent studies suggested machine learning as an alternative for supervised linear regression (SLR) in developing Land Use Regression models for air pollution exposure assessment. However, few studies have made direct comparisons. This study aimed to develop novel models using machine learning approaches, and compare the model performance to SLR models using an external dataset for validation.

Methods A set of novel European-wide models were developed to estimate 2010 annual means for NO2 and PM2.5, based on AIRBASE routine monitoring data. Satellite observations, chemical transport model estimates, land use and traffic data were used as predictor variables. The alternative algorithms we used included shrinkage techniques (lasso, elastic net, ridge), ensemble learning (bagging, boosting, random forest), support vector machine and a super-learner algorithm. Besides 5-fold cross-validation, we also performed external validation using data from the ESCAPE study to evaluate the model performance. The novel models were compared to the previously developed models (SLR for both NO2 and PM2.5, with additional kriging on residuals in PM2.5 models).

Results Random forest suggested a moderate improvement in cross-validation with R2 of 0.66 for NO2 models compared to the conventional supervised linear regression model (R2=0.58), while the external validation R2 was lower (0.46 compared to 0.50). The super-learner algorithm had the highest external validation R2 of 0.51, which was less than 0.01 higher than the original supervised linear regression model.

For PM2.5, most of the machine learning methods showed similar or worse performance compared to the original supervised linear regression model. The super-learner algorithm had the highest cross-validation R2 of 0.72, which was 0.02 higher than the supervised linear regression model. However, no machine learning algorithm showed better performance in external validation.

Conclusion Machine learning algorithms did not perform better than supervised linear regression in our Europe-wide datasets.

OP III – 5 LAND USE REGRESSION MODELLING OF OUTDOOR NO2 AND PM2.5 CONCENTRATIONS IN THREE LOW-INCOME AREAS OF THE URBAN WESTERN CAPE, SOUTH AFRICA

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Background/aim Intra-urban air pollution has been associated with adverse health effects, such as cardiovascular or respiratory disorders. Land Use Regression (LUR) modelling is one method to describe small-scale spatial variation in air pollution levels based on several measurements and geographical predictors.

Methods The main goal of the study is to characterise and model the spatial distribution of air pollutants in three neighbourhoods in the Western Cape, South Africa. Weekly measurements of NO2 and PM2.5 were performed in these areas (Khayelitsha, Marconi-Beam and Masiphumulele) during 2015–2016. They were temporally adjusted to obtain seasonal means using routinely monitored pollution data in Cape Town region. We developed six LUR models (four seasonal and two annual averages) using supervised forward stepwise regression for NO2 and PM2.5. Predictor variables, like road, land use and emission data were either obtained or collected on site. The models were validated using leave-one-out-cross-validation (LOOCV) and were tested for spatial autocorrelation.

Results Measured air pollution levels were generally low. The annual mean NO2 levels were 21.5 µg/m3 and 10.0 µg/m3 for PM2.5. The NO2 annual model explained 45% of the variance (R2) in the study areas and was found to have a satisfactory internal validity (LOOCV R2=70%). The PM2.5 annual model presented lower explanatory power (R2=25%, LOOCV R2=13%). The best predictors for NO2 modelling were traffic-related variables (major roads and bus routes) and proximity to some land-use features. Smaller local sources such as open grills and waste burning sites were good predictors for PM2.5 spatial variability, together with population density. NO2 and PM2.5 mean exposure will be predicted for home and school locations of about 400 pupils at primary schools involved in an epidemiological health study.

Conclusion This research shows that land use regression modelling can be successfully applied to informal urban settings in South Africa using similar predictor variables to those performed in European and North American studies. We could also provide NO2 and PM2.5 seasonal exposure estimates and maps for the selected study areas.

OP III – 6 ON THE MODEL ACCURACY AND ERROR PROPAGATION OF DIFFERENT INDOOR AIR QUALITY MODELS FOR HEATH ESTIMATE FROM INDOOR EXPOSURE TO OUTDOOR ORIGINS: A CASE STUDY OF FIVE CHINESE MEGA CITIES

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Background/aim Recent epidemiological studies linking indoor exposure and health consequence relied mostly on the annual-averaged indoor exposure concentration from a steady-state modelling rather than that aggregated from a dynamic modelling approach.We hypotheses that such simplification could lead to a bias on the derivation of the indoor concentration, which could further propogage on health assessment.
Methods The increase of envelope air tightness and installation of mechanical ventilation with effective filtration are considered as two building ventilation retrofit strategies to reduce indoor PM2.5 exposure to outdoor origin. The integrated modelling framework considering health benefits and energy costs of different intervention strategies is employed for a representative urban residential building in five Chinese mega cities being exposed to different levels of outdoor air pollution.Three indoor air quality models (annual-average steady-state, hourly steady-state, and dynanic) are adopted to compare their accuracies and error propagations.
Results The comparison of the modelling methodologies shows that modelling indoor concentrations by the annual average steady-state method could lead to relative error from −10.5% to 18% in some cases. The relative errors in indoor PM2.5 modelling caused by simplification methodologies can be greatly enlarged in the assessment of health and economic impacts (from −524% to 249%).The total economic benefits for building ventilation interventions are largest in Shenyang (~800 yuan/capita), but marginal or even negative in Chengdu and Guangzhou. For Beijing and Shanghai, to achieve significant benefits, the air tightness level should be at least National Level 7 while the filtration efficiency should be no less than 90% if mechanical ventilation systems are installed.
Conclusion We have modelled the health benefit and energy cost for different building ventilation retrofits in five mega cities in China using three types of indoor air quality models. Our modelling results show that there are large errors using annual-averaged indoor exposure concentration especially for the assessment of health and economic consequence.

Air pollution and cardio-metabolic outcomes

OP IV – 1 CHILDHOOD TYPE 1 DIABETES; AN ENVIRONMENT WIDE ASSOCIATION STUDY (EWAS) ACROSS ENGLAND

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Background/aim Type 1 Diabetes (T1D) is an autoimmune disease with ~4 00 000 people currently affected across the UK. T1D results from gene-environment interactions, with environmental factors likely triggering the disease process in genetically susceptible individuals. We aim to assess the influence of a wide range of environmental factors on childhood T1D incidence in England.
Methods We undertook an ecological EWAS at the Local Authority District level (LAD) using a national Hospital Episode Statistics (HES) based incident T1D dataset, containing ~1300 cases per year. There are 354 LAD's in England with an average of 1 39 689 persons. We compiled LAD-level estimates for a range of environmental exposures including sunshine duration, air temperature, ultraviolet radiation (UV), radon, air and light pollution, nitrates in drinking water, metals in soil, pesticides and green space; as well as information on land cover type, urban/rural status, tobacco expenditure as a smoking proxy, population density, socioeconomic deprivation, and ethnicity. The associations between T1D incidence and these environmental variables were assessed via Negative Binomial regression.
Results The HES dataset included 13 948 eligible T1D cases aged 0–9 years old over the period April 2000 – March 2011. Case counts by LAD varied from 1 to 236; mean 39.4 (SD 25.7), with an overall incidence of 21.2 (95% CI: 20.9 to 21.6) per 1 00 000. Age and sex standardised incidence rates varied from 4.45 to 80.55 per 1 00 000. 22 out of 52 environmental exposures were significantly associated with diabetes incidence after adjusting for multiple testing using the Bonferroni correction (p values above the Bonferroni Corrected level of 0.0009). These included air pollutants PM10, PM2.5, NO2 and CO, light pollution, UV, population density and ethnicity.
Conclusion Our analysis contributes to evidence that a range of environmental exposures are associated with T1D in children in England. Variables identified as associated with T1D at the ecological level are being further assessed at the individual level in a case control study, using data from the After Diabetes Diagnosis Research Support System-2 (ADDRESS-2).

OP IV – 2 LONG-TERM EFFECTS OF AIR POLLUTION ON ANKLE-BRACHIAL INDEX

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Background/aim Atherosclerosis and arterial stiffness have been linked to air pollution. However, the association between long-term exposure to air pollution and abnormal ankle-brachial index (ABI) has not been fully investigated. We aimed to examine the long-term effects of air pollution on the prevalence of low and high ABI, and the potential effect modification by individual characteristics.
Methods This cross-sectional study involved 4544 participants from the KORA F3 (2004–2005) and F4 (2006–2008) surveys in the region of Augsburg, Germany. Participants' residential annual mean concentrations of particulate matter and nitrogen dioxide were predicted with land-use regression models, and information on traffic indicators was collected from geographic information systems. We assessed the effects of air pollution on the prevalence of low and high ABI by multinomial logistic regression models adjusted for demographic, socioeconomic, and lifestyle confounders. We also applied quantile regression models to explore the non-monotonic relationship between air pollution and ABI. Potential modification effects were examined for age, sex, physical activity, overweight, and comorbidities.

Results Long-term exposure to particulate matter with aerodynamic diameter ≤10 µm (PM10) and ≤2.5 µm (PM2.5) was significantly associated with the prevalence of low ABI, with the respective odds ratios (ORs) of 1.78 (95% CI: 1.09 to 2.92) and 1.63 (95% CI: 1.03 to 2.58) for an increment from the 5th to the 95th percentile in concentration. For high ABI, the association was significant for PM2.5 absorbance (OR=1.54, 95% CI: 1.07 to 2.24) and traffic load within 100 m of the residence (OR=1.39, 95% CI: 1.04 to 1.86). Quantile regression analyses revealed similar results. The effect of air pollution on having low ABI was stronger in participants who did little or no physical exercise.
Conclusion Long-term exposure to air pollution was associated with an increased risk of having abnormal ABI, and the association was modified by physical activity. This study provides evidence for the air pollution effects on atherosclerosis and arterial stiffness in lower extremities.

OP IV – 3 LONG-TERM AIR POLLUTION EXPOSURE AND THE IMPACT ON METABOLIC CONTROL IN CHILDREN AND ADOLESCENTS WITH TYPE 1 DIABETES - RESULTS FROM THE DPV REGISTRY

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Background/aim Studies on the association between air pollution and metabolic control in children and adolescents with type 1 diabetes are rare. We examined the relationship between particulate matter with an aerodynamic diameter <10 µm (PM10), nitrogen dioxide (NO2) and accumulated ozone exposure (O3-AOT) and HbA1c and daily insulin dose (IU/kg body weight) in children and adolescents with type 1 diabetes.
Methods We investigated 32 879 type 1 diabetes patients<21 years documented between 2009 and 2014 in 340 German centres of the diabetes prospective follow-up registry (DPV). Long-term air pollution exposure (annual and quinquennial means) was assigned to 5-digit postcode areas of residency. Cross-sectional multivariable regression analysis was used to examine the association between air pollution and metabolic control. Models were adjusted for sex, age, diabetes duration, migration background, year of treatment, type of insulin treatment and Nielsen area to account for regional differences.
Results After comprehensive adjustment, HbA1c was significantly lower with higher O3-AOT-quartiles (O3-AOT-Q4: 7.89% [95%-confidence interval: 7.85; 7.93], O3-AOT-Q1: 8.20% [8.15; 8.24]). The inverse association between O3-AOT and HbA1c persisted after additional adjustment for degree of urbanisation or additional adjustment for PM10. Moreover, the inverse association remained stable in further sensitivity analyses. No significant associations between HbA1c and PM10 or NO2 were found. No association was observed between any of the three air pollutants and insulin dose.
Conclusion The inverse association between O3-AOT and HbA1c could not be explained by regional differences in diabetes treatment or other differences between urban and rural areas. Further studies on the association between air pollution and metabolic control in children and adolescents with type 1 diabetes are needed to confirm our observed association and to elucidate underlying mechanisms.

OP IV – 5 LONG-TERM AIR POLLUTION AND INCIDENCE OF THE METABOLIC SYNDROME IN THE POPULATION-BASED HEINZ NIXDORF RECALL STUDY

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Background/aim Recently, epidemiological studies have found a link between air pollution (AP) and individual components of the metabolic syndrome (MetS), a condition predisposing to cardiometabolic diseases. However, very few studies have explored a possible association between air pollution and MetS.

We analysed the effects of long-term exposure to AP on incidence of MetS.
Methods Data from the population-based prospective Heinz Nixdorf Recall study without MetS at baseline (2000–2003) were used in this study (n=3086). Mean annual exposure for size-fractioned particulate matter (PM2.5 and PM10) and nitrogen dioxide (NO2) was assessed with a land use regression model. MetS at the 5.1 year follow-up examination was defined as central obesity plus two out of four additional risk factors (i.e., elevated triglycerides, reduced high-density lipoprotein cholesterol, elevated blood pressure or elevated fasting plasma glucose). We estimated odds ratios (ORs) of MetS incidence per interquartile range (IQR), adjusting for demographic and lifestyle variables. In a two-exposure model, we investigated combined effects of air pollution and road traffic noise.
Results 299 participants developed MetS during a mean follow-up of 5.1 years. Mean air pollution exposure at baseline examination was 18.4 µg/m^3 for PM2.5, 27.7 µg/m^3 for PM10, and 30.0 µg/m^3 for NO2. All air pollutants were borderline positively associated with MetS. For example, adjusted ORs per IQR for PM10 and PM2.5 were 1.14 (0.98–1.32) and 1.19 (0.98–1.44), respectively. For NO2, the OR was lower than the PM estimates (1.03; 0.88–1.21). In the two-exposure models with both PM and noise, ORs per IQR for PM10, PM2.5, and NO2 increased slightly to 1.16 (1.00–1.35), 1.21 (0.99–1.48), and 1.06 (0.89–1.25), respectively.
Conclusion Long-term exposure to air pollution might increase the risk of developing MetS in the general population, with strongest effects seen for PM10 and PM2.5. This association remained when adjusting for long-term traffic noise exposure.

OP IV – 6 ASSOCIATIONS BETWEEN DAILY MORTALITY AND AMBIENT NO2 AND O3 IN PERSONS HAVING CONGESTIVE HEART FAILURE: NESTED CASE-CONTROL ANALYSES USING DIFFERENT EXPOSURE MODELS

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Background/aim To meet some of the limitations of previous studies using grouped-analysis, we developed a cohort of persons with congestive heart failure and used a nested case-control design to estimate whether daily non-accidental mortality was associated with spatially-resolved, daily exposures to ambient NO2 and O3, and whether these associations were modified according to worsening of health.
Methods We constructed the cohort from health databases. For each case we randomly selected 100 controls matching on the calendar day and gender. We assigned daily NO2 (all year) and O3 (May-September) exposures from the following methods to predict spatially-resolved, daily concentrations at participants' residence:

- measurements at the nearest monitor;
- inverse–distance weighting interpolation (IDW);
- back–extrapolation from a land–use regression model from a dense monitoring survey.

We modelled air pollution using DLNMs over lags 0 to 3 days. We adjusted for age and area-based contextual variables, whereas weather and temporal trends were controlled by design. We assessed potential effect modification by some indicators possibly reflecting a worsening of health.
Results The cohort included 65 534 individuals followed on average for four years. For NO2 and O3 all response functions were linear. For NO2, we found positive association using the back-extrapolation method (MPC: 3.0%; 95% CI: −0.8% to 7.0%) but negative associations using the nearest station (MPC: −5.5%; 95% CI: −8.0 to −2.8%), and IDW (MPC: −8.8%; 95% CI: −15.0 to −2.1%). For O3, we found positive cumulative effect for the nearest station (6.7%; 95% CI: 0.3% to 13.5%), inverse-distance weighting (18.5%; 95% CI: −2.6% to 44.1%) and back-extrapolation (7.3%; 95% CI: 3.0% to 11.9%). For both pollutants, we found evidence of effect modification according to the prescribed dose of an important drug used to treat heart failure.
Conclusion Exposure to ambient NO2 and O3 was associated with daily mortality in congestive heart failure. The methods used to assess daily exposure can have considerable influence on the estimated acute health effects.

Environmental contaminants and children's health

OP V – 1 PRENATAL EXPOSURE TO ORGANOCHLORINE COMPOUNDS AND LUNG FUNCTION UNTIL EARLY ADULTHOOD

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Background/aim Prenatal exposure to organochlorine compounds (OCs) can increase the risk of adverse respiratory symptoms in children and adolescents, but evidence is mainly based on reported symptoms and it is still unknown whether these compounds can impact on lung function. We assessed the longitudinal association between prenatal exposure to OCs and lung function until early adulthood.
Methods We included 2750 participants belonging to the INMA (Infancia y Medio Ambiente) prospective birth cohort in Spain in Menorca, Valencia, Gipuzkoa, and Sabadell regions. Prenatal concentrations of OCs (hexachlorobenzene [HCB], dichlorodiphenyltrichloroethane [DDT], dichlorodiphenyldichloroethylene [DDE], and four polychlorinated biphenyls [PCB-118, PCB-138, PCB-153, and PCB-180]) from each participant were measured in maternal or cord serum. Lung function was measured by spirometry at 4, 7, 9, 11, 14, and 18 years of age. Multivariate linear regression models were used to assess the association between prenatal OCs concentrations and lung function.
Results High percentage of samples presented quantifiable levels of all the analysed OCs. DDE, HCB, and PCB-153 were the compounds with higher median concentrations (e.g. median for DDE=1.03 ng/mL; Inter quartile range=1.37 ng/mL). Preliminary results in the Menorca cohort (n=327) revealed that prenatal exposure to the second tertile of PCB-153 concentrations was associated with reduced forced vital capacity (FVC) and reduced forced expiratory volume in 1 s (FEV1) when compared to the lowest tertile at 11 and 14 years (e.g. β for FVC at 14 years=-0.17 L; 95% CI: −0.31 to −0.03). Exposure to the second tertile of DDE and PCB-118 was associated with reduced FVC at 11 years, compared to the lowest tertile. No other associations were found. Final results including all cohorts will be presented.
Conclusion Preliminary results showed that prenatal exposure to OCs was associated with reduced lung function until adolescence. Such exposure might alter the structural development of the lung and predispose for chronic respiratory diseases later in life.

OP V – 2 PRENATAL FLUORIDE EXPOSURE AND NEUROBEHAVIOR AMONG CHILDREN 1–3 YEARS OF AGE IN MEXICO

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Background/aim Recent studies report an inverse association between fluoride (F) exposure and IQ in children, but few included individual measures of exposure or assessed associations with prenatal exposure using a prospective study design.
Methods This study utilised the Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) birth cohort and archived pregnancy samples to study prenatal F exposure and its association with subsequent child neurobehavioral outcomes at ages 1, 2 and 3 years. A Generalised Mixed Model (GMM) was used to model the association between mean creatinine-adjusted urinary F (MUFcr), averaged over three trimesters, and Mental Development Index (MDI), a subscale of the Bayley Scales of Infant Development-II (BSID-II) test, among 401 mother-infant pairs. The analysis controlled for maternal age, education, marital status, ELEMENT cohort, child's sex, and child's age.
Results The median MUFcr was 0.835 mg/L (minimum: 0.195, maximum: 3.673). MUFcr was significantly inversely associated with offspring MDI scores, with an increase in MUFcr of 0.5 mg/L (roughly the interquartile range value) corresponding to a decrease in MDI of −1.20 points (95% CI: −2.19,–0.20).
Conclusion Our findings add to our team's recently published report on prenatal fluoride and cognition at ages 4 and 6–12 years by suggesting that higher *in utero* exposure to F has an adverse impact on offspring cognitive development that can be detected earlier, in the first three years of life.

OP V – 3 PRELIMINARY RESULTS OF MATERNAL EXPOSURE TO ORGANOPHOSPHATE PESTICIDES AND FETAL GROWTH IN JERUSALEM – THE ENVIRONMENT, MOTHER, AND CHILD STUDY

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Background/aim Little is known about the association between maternal exposure during pregnancy to organophosphate pesticides (OP) and fetal growth. We aimed to study whether maternal exposure to the dialkyl phosphate (DAP) metabolites during the first half of pregnancy was associated with fetal growth as estimated by ultrasonographic prenatal examinations (US).
Methods An ongoing cohort study of pregnant women recruited at 11–18 weeks of gestation, who were interviewed and gave a urine specimen upon recruitment. In order to analyse the fetal growth, we used repeated US fetal measurements of head circumference (HC), femur length (FL), abdominal circumference (AC) and biparietal diameter (BPD). Urine specimens were analysed for DAP metabolites in the Institute for Occupational, Social and Environmental Medicine of the University Erlangen-Nürnberg, Germany. Linear and mixed linear models (with DAP, gestational age and gender as fixed effects and mothers as random effects) were constructed to study the associations between OP exposure and US measurements.
Results A total of 826 US measurements were conducted in 211 women for each of the four US parameters. 165 women had more than two US measurements and 99 women had 4–7 measurements during pregnancy. Linear regression models for the association between DAP and the last US measurement adjusting for gender, suggested negative associations; HC (ß=-15.3, p=0.07), FL (ß=-3.8, p=0.07), AC (ß=-15.3, p=0.08), BPD(ß=-4.06, p=0.08). Mixed linear models with all US data did not support any association between maternal DAP level and fetal growth (HC: ß=-0.21, std=1.03, p=0.8; FL: ß=-0.01, std=0.23, p=0.9; AC: ß=-0.03, std=1.23, p=0.9; and BPD: ß=0.05, std=0.31, p=0.8).
Conclusion In this preliminary analysis, there was a suggested inverse association between DAP exposure and fetal growth. To our knowledge, this analysis is the first to use repeated fetal measurements and early maternal DAP levels. Further analyses controlling for gestational age will be conducted.

OP V – 4 IN-UTERO EXPOSURE TO PHENOLS AND PHTHALATES AND THE INTELLIGENCE QUOTIENT OF BOYS AT 5 YEARS

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Background/aim There are concerns neuro-developmental due to exposure to endocrine disrupting chemicals. Previous epidemiological studies have mainly focused on phthalate metabolites and bisphenol A. Our study aimed to assess associations between in-utero exposure to the afore mentioned compounds and other ubiquitous phenolic compounds and the Intelligence Quotient (IQ) of boys at 5–6 years.
Methods In 452 mother-son dyads from the French EDEN cohort, we measured 11 phthalate metabolites and 9 phenolic compounds (4 parabens, benzophenone-3, bisphenol A, 2 dichlorophenols and triclosan) in spot urine samples collected between 22 and 29 gestational weeks. Verbal and performance IQ of children was assessed at 5–6 years by a psychologist using the Wechsler Preschool and Primary Scale of Intelligence (WPPSI). We used adjusted Structural Equation Models (SEM) and the Benjamini and Hochberg false discovery rate (FDR) correction to assess the associations between maternal urine phenol and phthalate metabolite concentrations considered simultaneously and the boys' IQ.

Results No phenol or phthalate metabolite concentration was negatively associated with child verbal or performance IQ (p-values≥0.09). Mono (3-carboxypropyl) phthalate tended to be associated with increased verbal IQ (β=0.136, 95% confidence interval, 0.01; 0.27) but this association disappeared after correction for multiple comparison (corrected p- 64 value, 0.71).
Conclusion To our knowledge, our study is the first to consider developmental exposure to parabens, dichlorophenols, triclosan and benzophenone-3 in relation to child cognitive development. Our findings did not suggest an inverse association between in-utero phenols and phthalates exposure and child verbal and performance IQ.

OP V – 5 THE EXPOSURE TO ORGANOPHOSPHATE PESTICIDES AMONG PREGNANT WOMEN IN JERUSALEM – THE ENVIRONMENT, MOTHER, AND CHILD STUDY

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Background/aim Organophosphate Pesticides (OP) aim to target the nervous system. Associations between maternal urinary levels of dialkyl metabolites of OP (DAP) and adverse outcomes in neonates and children were reported. Between 2012 and 2014, the Israeli Ministry of Agriculture restricted or banned eighteen active ingredients. We studied trends in OP exposure among pregnant women in the era of new regulation.
Methods An ongoing cohort study of pregnant women recruited at 11–18 weeks of gestation, who were interviewed and gave a urine sample upon recruitment. Soon after birth, data collection included maternal interview and neonatal examination and urine sample collection. Urine specimens of 273 mothers and 107 offspring were sent for DAPs analysis in the Institute for Occupational, Social and Environmental Medicine of the University Erlangen-Nürnberg, Germany. Trends in DAP metabolites were tested using spearman correlation and linear regression models to estimate the association between time in months and DAP level over the period between September 2012 and March 2016.
Results Over the study period, the median maternal DAP level decreased from 250 nmol/L to 148 nmol/L. Time of recruitment was inversely significantly correlated with total DAPs metabolites($r=-0.237$, $p<0.0001$) and remained significant in linear regression model after controlling for maternal fruit consumption($\beta=-21$, $p<0.05$). Similar trend was found for DAP metabolites in neonatal urine. The median total DAP exposure decreased from 49 nmol/L to 21 nmol/L and was inversely significantly correlated with birth month($r=-0.326$, $p<0.001$). In linear regression model adjusting for urinary creatinine and birthweight, neonatal DAP levels decreased significantly over time ($\beta=-5$, $p<0.05$). Compared to other studies, pregnant women in Jerusalem had higher OP exposure, even at the end of the study period.
Conclusion We observed a reduction in maternal and neonatal DAP urinary level during the period of 2012–2016. Regulations restricting the use of OP in agriculture are probably responsible and seem to be effective in reducing the exposure of the population to OP. Yet, exposure levels are still higher than the reported levels in other Western countries.

OP V – 6 A STUDY OF SCHOOL-GOING CHILDREN ON NEUROBEHAVIOR AND CURRENTLY USED AGRICULTURAL PESTICIDE EXPOSURE IN THE RURAL WESTERN CAPE, SOUTH AFRICA

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Background/aim There is limited and conflicting epidemiological evidence on the long-term health effects of currently used agricultural pesticides in children. We aim to investigate neurobehavioral effects due to pesticide exposure in school children in the rural Western Cape (WC), one of the largest fruit producing agricultural areas in South Africa.
Methods The 3 year cohort study entails a baseline (2017), 4 monthly exposure assessments covering all seasons in the second year and a final follow-up (2019) examination of 1.000 children aged 9–16 years old, from three different agricultural farming areas in the WC region. Exposure to neurotoxic pesticides is measured in urine and hair samples and questionnaires related to pesticide contact including confounding variables. Further, pesticides measured in air and water samples will describe environmental occurrence over the study period. The primary outcome of cognitive functioning is measured through the iPad-based Cambridge Neuropsychological Test Automated Battery (CANTAB) including dimensions for attention, memory, executive functioning, and processing speed.
Results Between April and September we enrolled 950 children in the baseline survey, including 53% females and 47% males, 9 to 16 years (11±1.69) in grade 1 to 8 (4±1.6) distributed equally over the three farm areas (~30%). Almost half of the children (47%) have parents who are farmworkers and live on a farm (45%). Majority of participants (96%) coresponded accurately on all 10 preliminary assessment trials to continue further cognitive testing. As an example, the reaction time in the motor screening test ranged from 475 to 3730 milliseconds, median time 875 ms (25th percentile=703 ms; 75th percentile=1266 ms). The response latency during the average correct responses when measuring sustained attention, ranged from 179 to 1739 ms, median time 443 ms (25th percentile=361 ms; 75th percentile=531 ms)
Conclusion Preliminary data suggest adequate data distribution for farm and non-farm exposure, to investigate effects. We present for the first time a study using the CANTAB test battery and pesticide exposure in South Africa. Further analysis will determine potential associations between the exposure and neurobehavior of children by controlling for a wider range of confounders from a guardian survey

Radiation

OP VI – 1 RADIOFREQUENCY ELECTROMAGNETIC FIELDS EXPOSURE AND SLEEP IN ADOLESCENTS

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Background/aim Previous epidemiological studies have assessed the relationship between the use of wireless communication devices, mainly mobile phones, and poor sleep affecting daytime functioning showing inconsistent results. The objective of the study is to assess the association between the use of wireless communication devices and sleep quality and sleep parameters in adolescents of 17.5 years of age.
Methods We used data from a population-based birth cohort established in Menorca in 1997–1998 (n=485), as part of the Spanish INMA –Environment and Childhood– Project. Information about wireless communication devices use was collected using self-reported questionnaires. ActiGraph xGTX3X-BT placed on wrist for seven nights and sleep diaries were used to objectively assess sleep parameters (sleep latency, sleep efficiency, sleep duration, and Wake After Sleep Onset) (n=110). Pittsburgh Sleep Quality Index was used to asses sleep quality (n=226). Logistic and linear regression models adjusted by parental and adolescent socioeconomic and lifestyle variables were used to estimate the association between the use of wireless communication devices and sleep quality and sleep problems.
Results Adolescents that made more than one mobile or cordless phone call per week were more likely to have a worse subjective sleep quality than those making less calls [OR=2.88 (95% CI: 0.93 to 8.97) and OR=2.21 (95% CI: 1.07 to 4.58), respectively]. Adolescents that reported a higher problematic mobile phone use were more likely to have a worse subjective sleep quality than those reporting no problematic use [OR=3.64 (95% CI: 1.32 to 10.02)]. Adolescents that used the tablet 30 min or more daily were more likely to have lower objective sleep efficiency [β=-6.63 (95% CI: −12.49 to −0.77)].
Conclusion This study suggests that higher mobile phone and cordless phone use, which both represent a higher exposure to RF-EMF to the head, and problematic mobile phone use was associated with poor sleep quality and that higher tablet use decreases sleep efficiency in adolescents.

OP VI – 2 ORGAN-SPECIFIC INTEGRATIVE EXPOSURE ASSESSMENT FOR RADIO-FREQUENCY ELECTROMAGNETIC FIELDS: GENERAL POPULATION EXPOSURE AND DOSE CONTRIBUTION OF VARIOUS SOURCES

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Background/aim The daily dose of radio-frequency electromagnetic fields (RF-EMF) received by the human body depends on source, use, and body characteristics. We developed a model capable of estimating total RF-EMF dose (J/kg) for 64 body tissues as well as the contribution of specific sources to total dose based on personal characteristics, source characteristics, and scenarios of use.
Methods The Integrated Exposure Model (IEM) uses personal characteristics and scenarios of use to estimate daily RF-EMF dose from mobile phones, DECT phones, tablets, body area networks, laptops, on/near body devices, smartwatches, virtual reality headsets, WiFi routers, and far field sources. Specific absorption rates (SAR) in various tissues were calculated for each source using transfer algorithms based on source and body characteristics. These were then adjusted for scenarios of use. Lastly, the model calculated the integrative dose from all sources combined and the relative contribution of each source. To estimate population exposure levels, we used data from an online survey on use of mobile communication devices deployed in four countries (France, the Netherlands, Spain, Switzerland).
Results The online survey resulted in a dataset of 1768 participants, with a mean age of 52 years. Preliminary results indicate an average whole body dose of 0.15 J/kg per day, and an average whole brain dose of 0.09 J/kg per day. Women tended to have slightly higher doses than men, particularly in the youngest age group, due to higher reported use of mobile phones for voice and data. Source specific contribution varied depending on tissue. For the brain, the highest contribution (32%) came from mobile phones. Phone, tablet, and WiFi use together account for 91% of total brain dose. For the whole body: phone data use, WiFi, tablet, and laptop use accounted for 97% of the average total dose in our population.
Conclusion We developed a model capable of estimating integrative RF-EMF dose from both current and novel devices. Using survey data on device use we were able to estimate average whole brain (0.09 J/kg) and average whole body (0.15 J/kg) dose. Device output powers in various scenarios of use were found to strongly influence model results.

OP VI – 3 SOCIO-DEMOGRAPHIC PREDICTORS OF MOBILE PHONE OWNERSHIP AND USE IN THE STUDY OF COGNITION, ADOLESCENTS AND MOBILE PHONES

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Background/aim Mobile phone use in children and adolescents has steadily increased over the past decade, and public health concerns about the potential effects of exposure to radio-frequency electromagnetic fields remain. The aim of the present study was to explore socio-demographic predictors of mobile phone ownership as well as call frequency and call time duration.
Methods We analysed data from the baseline assessment of the Study of Cognition, Adolescents and Mobile Phones (SCAMP), which was collected between 2014 and 2016. SCAMP is a prospective secondary school-based cohort study established to investigate whether the use of mobile phones and other wireless devices is associated with cognitive, behavioural,

educational, and physical and mental health outcomes. Pupils from 39 secondary schools (26 state, 13 independent) in and around London provided self-report data on mobile phone ownership and mobile phone use, including phone call frequency and call time duration. Multiple logistic regression analyses were performed using age, sex, ethnicity and parental socioeconomic classification to predict current mobile phone ownership and mobile phone use.

Results n=6616 pupils participated in the computer assessment at baseline, 83% of whom reported to own a mobile phone. We found a 62% increase in the odds of owning a phone for every year increase in age. Black, Asian and Mixed ethnicity was associated with lower odds of owning a phone compared to White ethnicity. Membership in a lower socioeconomic class was associated with lower odds of mobile phone ownership. We found that with increasing age pupils reported more frequent phone calls, and longer call time duration on weekends. Females reported more phone use than males. Black or Mixed ethnicity was associated with higher levels of phone use compared to White ethnicity, while Asian pupils reported lower phone use. No associations between phone use and socioeconomic classification were found.

Conclusion We have shown that differences in the socio-demographic characteristics of pupils are associated with variation in mobile phone ownership as well as call frequency and call time duration. The socio-demographic characteristics that were associated with higher levels of mobile phone ownership were in most cases not associated with higher levels of mobile phone use.

OP VI – 5 SPATIAL AND TEMPORAL VARIABILITY OF PERSONAL EXPOSURE TO RADIO FREQUENCY ELECTROMAGNETIC FIELDS IN CHILDREN IN EUROPE

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Background/aim Exposure to radiofrequency electromagnetic fields (RF-EMF) has rapidly increased and little is known about exposure levels in children. This study aims to describe personal RF-EMF environmental exposure levels from handheld devices and fixed site transmitters in European children and its day-to-day and year-to-year repeatability.

Methods Environmental RF-EMF exposure ($\mu W/m^2$) was measured in 529 children (ages 8–18) in Denmark, the Netherlands, Slovenia, Switzerland, and Spain using personal portable exposure metres over 3 days in 2014–2016, and repeated in 28 children one year later. Metres captured exposure every 4 s. Activity diaries collected children's location and use of mobile devices. Six general frequency bands were defined: total, digital enhanced cordless telecommunications (DECT), television and radio antennas (broadcast), mobile phones (uplink), mobile phone base stations (downlink), and WiFi. We used mixed effects models with region random effects to estimate associations between mobile device use and exposure. Day-to-day and year-to-year repeatability was calculated through Spearman correlations.

Results Median total exposure was 75.5 $\mu W/m^2$. Downlink was the largest contributor to total exposure (27.2 $\mu W/m^2$) followed by broadcast (9.9 $\mu W/m^2$). Exposure from uplink was lower (4.7 $\mu W/m^2$). WiFi and DECT contributed very little to exposure levels. Exposure was higher during day (94.2 $\mu W/m^2$) than night (23.0 $\mu W/m^2$), and slightly higher during weekends than weekdays, although varying across regions. Exposure was generally highest while children were travelling (171.3 $\mu W/m^2$) and outside (157.0 $\mu W/m^2$). Children living in urban environments had higher exposure. Older children, girls, and users of mobile phones had higher uplink exposure but not total exposure. Repeatability was high for total, downlink, and broadcast in the year-to-year repeatability (rho between 0.54 and 0.66).

Conclusion Largest contributors to total RF-EMF exposure were downlink and broadcast, which was consistent one year later. Location of home (region and urbanicity) was associated with higher exposure. More frequent mobile phone use was associated with higher uplink exposure. It is important to continue evaluating RF-EMF exposure in children as mobile devices, use habits, and technologies continue to evolve.

OP VI – 6 A COMPARATIVE ANALYSIS OF CANCER RATES DUE TO ENVIRONMENTAL RADIOACTIVE CONTAMINATION WITHIN IDENTIFIED ZONES IN THE TOWN OF MAILU-SUU, FROM 2006–2015

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Background/aim The town of Mailuu-Suu in Jalalabad Province was, during the time of the USSR, a uranium ore mining and processing town consisting of 23 uranium tailing pits and 13 dumps. The objective was to study cancer rates and death cases within three identified zones of contamination in the town of Mailuu-Suu.

Methods Researcher's fieldwork and archival data from the Mailuu-Suu hospital were used. An Eberline (FH40 F2)gamma radiation radiometer and dosimeter was used to measure the power of absorbed doses of a gamma radiation.

Radiometric measurements were carried out in the houses and in the yards (if a private house, then on the entire area of the farm). A total number of 89 measurements were taken at various areas or zones of the city.

Results In 10 years (2006–2015) in the town of Mailuu-Suu 197 people was dying because of cancer and 235 new cases of cancer disease were known.

Zone 1 – Sary-Bee. Background gamma radiation was recorded within 40 mR/h – 640 mR/h in this zone. Total new cases of cancer disease was 22 with attributable 23 deaths.

Zone 2 is located in the centre of the town of Mailuu-Suu. Background gamma radiation was recorded within 40 mR/h – 145 mR/h in this zone. Strong contrations of Radon were found in the air. Total new cases of cancer were 193 with 163 attributable deaths.

Zone 3 – Kok-Tash is located in the lower part of the town and downstream of the tailing pits, dumps Total new cases of cancer were 20 with 11 attributable deaths.

Conclusion The greatest number of cancer patients identified in this study were located in Zone 2 or the central part of the town. A primary cause of the high cancer rates found here are attributable to the high concentrations of radon in the air. Lung, stomach and breast cancer were found to be the most common types of cancer in the town of Mailuu-Suu.

Air pollution and health

OP VII – 2 DOES TEMPERATURE CONFOUNDING CONTROL INFLUENCE THE MODIFYING EFFECT OF AIR TEMPERATURE IN OZONE-MORTALITY ASSOCIATIONS?

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Background/aim Recent epidemiological studies investigating the modifying effect of air temperature in ozone-mortality associations lack consensus as how to adjust for nonlinear temperature effect in addition to including an interaction term.

Methods We evaluated the influence of temperature confounding control on temperature-stratified ozone-mortality risks in a time-series setting in eight European cities and 86 U.S. cities, respectively. To investigate potential residual confounding, we additionally incorporated next day's ozone in models with differing temperature control.

Results Using only a categorical variable for temperature or only controlling nonlinear effect of low temperatures yielded highly significant ozone effects at high temperatures, but also significant residual confounding in both regions. Adjustment for a nonlinear effect of temperature, especially high temperatures, substantially reduced ozone effects at high temperatures and residual confounding. For example, when using a distributed lag nonliner temperature term, risk estimates at low, medium, and high temperatures were 0.23% (95% CI: −0.09% to 0.55%), 0.23% (95% CI: −0.06% to 0.53%), and 0.36% (95% CI: 0.04% to 0.68%) in European cities, and 0.11% (95% CI: −0.31% to 0.54%), 0.17% (95% CI: −0.07% to 0.41%), and 0.59% (95% CI: 0.32% to 0.85%) in U.S. cities.

Conclusion Inadequate control for confounding by air temperature leads to residual confounding and an overestimation of the temperature modifying effect in studies of ozone-related mortality.

OP VII – 3 OUTDOOR AIR POLLUTION ON LUNG CANCER MORTALITY, PRIOR AND DURING THE GREEK FINANCIAL CRISIS: MODELLING THE CURRENT AND FUTURE SPATIO-TEMPORAL TRENDS

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Background/aim The increasing burden of Lung Cancer (LC) in Crete, Greece has raised concern about potential association of environmental risk factors with LC. Main aim of this study was to assess Outdoor Air Pollution (OAP) and the risk for LC incidence, as well as the association of OAP with LC mortality and survival; for the first time in Crete using LC primary data.

Methods 5,000 LC cases (diagnosed from 1992 to 2013) were obtained and followed-up from the population-based Cancer Registry of Crete. The Age-Adjusted Incidence Rates (AAIR) and the Age-Standardised Mortality Rates (ASMR) were calculated. Data on outdoor air concentrations of particulate matter [PM2.5, between 2.5 μm and 10 μm (PM2.5–10) and PM10], PM2.5 absorbance (black carbon measure), nitrogen dioxide (NO2) and nitrogen oxides (NOx) were sampled using Harvard impactors (OAP time series1982–2014). Spatio-temporal statistics were used to explore associations between LC and OAP, and develop a multivariate predictive model of current and future risk. All tests were conducted at a=0.05 in STATA and ArcMap 10.3.1.

Results LC in Crete accounts for 40.2 new cases/100,000/year for both genders. Annual median estimates of environmental concentrations were: PM2.5=20.7 (±1.5) $\mu g/m^3$, PM10=38.9 (±2.5) $\mu g/m^3$, PM2.5–10=59.6 (±3.7) $\mu g/m^3$, PM2.5 absorbance=1.2 (±0.3) × 10−5 per m, NO2=15.2 (±3.8) $\mu g/m^3$ and NO*x*=20.1 (±4.9) $\mu g/m^3$. A strong positive association was found between LC and the OAP estimates. The highest risk for LC was observed in the major urban centres, several south-east and north-west rural regions (RR=3.2, 95% CI: 1.638 to 4.765). All associations were significantly increased, while LC hot spots due to OAP were identified, during the financial crisis. Significant increase of the RRs is estimated for the next 10 years, especially in north-west rural regions (RRexpected=3.9, 95% CI: 1.372 to 6.428).

Conclusion OAP seems to be an important determinant of LC, especially during the financial crisis. The joint contribution of OAP and other risk factors on LC outcomes has major adverse effects on LC outcomes with significantly diverse geographical patterns. Targeted interventions have to be performed in the current and future risk areas; even among this genetically homogeneous population.

OP VII – 5 LONG-TERM PM10 EXPOSURE AND CAUSE-SPECIFIC MORTALITY IN LATIUM REGION: A DIFFERENCE-IN-DIFFERENCES APPROACH

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Background/aim The link between particulate matter (PM) exposure and health has been widely explored in epidemiological literature. However, the availability of environmental data is limited to urban settings and little is known about the

health effects of PM in rural areas. Our aim is to evaluate a causal association between PM10 and cause-specific mortality in Latium Region (centre Italy) during 2006–2012.

Methods We used satellite data combined with spatial predictors in 3-stage mixed models to obtain daily PM10 values on a grid map of 1 × 1 km cells in the Region. For each municipality, we averaged daily PM10 values of each cell in a single yearly value. We used a difference-in-differences approach to estimate a causal relationship between annual PM10 exposure and non-accidental, cardiovascular, and respiratory mortality. We applied Poisson regression models adjusted for municipality and calendar year in order to focus on municipality-levels annual fluctuations of exposure and mortality. In addition, we also added terms for mean and standard deviation (SD) of winter and summer temperatures to account for potential meteorological confounders displaying different temporal trends across municipalities.

Results During 2006–2012 we observed 3 47 699 deaths for non-accidental, 92 787 for cardiovascular and 16 509 for respiratory causes in 378 municipalities of Latium Region. The average PM10 concentration during the period was 21.9 mg/m^3 (SD 4.9) in Latium. The mean winter and summer temperatures were 11.9, and 17.8°C, while the respective SDs were 2.7°C and 3.9°C. For each IQR (6.8 μg/m^3) increase in annual PM10, we estimated a 5.9% (95% CIs: 3.3, 8.5%) increase in non-accidental, 6.2% (1.3, 11.4) cardiovascular, and 17.0% (4.1, 31.5%) in respiratory mortality, respectively. As sensitivity approach, we excluded Rome from the analysis and we found percent increases of risk of 4.2% (1.4, 7.1%) for non-accidental, 4.9% (-0.5, 10.5%) for cardiovascular, and 18.1% (3.8, 34.3%) for respiratory mortality.

Conclusion Our analysis suggests a causal effect of PM10 on cause-specific mortality in Latium Region, with a strongest effect on mortality for respiratory causes. We can conclude that PM10 represents a strong risk factor for human health not only in urban settings but also in suburban and rural areas.

Green, physical activity, mobility

OP VIII – 1 GREENSPACE EXPOSURE AND CARDIOVASCULAR DISEASE: ASSESSING THE CONTRIBUTION OF THE ENVIRONMENTAL PATHWAY

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Background/aim Cardiovascular disease (CVD) causes more than a quarter of deaths in the UK each year. A beneficial association of greenspace and CVD has previously been observed, however the underlying mechanisms require further investigation. We aim to assess the contribution of an environmental pathway-specific exposure – air pollution – that is proposed to partially drive associations of greenspace and CVD.

Methods A hybrid air pollution model was developed using output from a dispersion model within a land-use regression (LUR) model to estimate long-term nitrogen dioxide (NO2) concentrations for Greater London. LUR variables offered to the model included building volume, household census data, land use and high-resolution vegetation data in multiple buffer sizes (range: 25 m–5000 m). London Air Quality Network monitoring sites with sufficiently complete data (n=54) were used to develop the model. Model validation was via grouped (leave-25%-out) cross-validation. The regression coefficient of the vegetation cover variable was multiplied by the 10th minus 90th percentile to estimate the reduction in NO2 concentration at sites with the lowest compared to the highest vegetation cover area.

Results The hybrid model for NO2 yielded an adjusted R2 of. 82 for modelled versus monitored NO2. Grouped cross-validation R2 was. 82. The dispersion model output explained a large portion of the variance in NO2 concentrations – 55%. The building volume and vegetation cover variables added 25% and 2% explained variance, respectively. Despite a small increase in R2, contrasts in vegetation cover area at sites (10th-90th percentile) resulted in a substantial reduction in NO2 concentration of 10.75 μg/m^3. The estimated reduction of NO2 attributed to vegetation cover was not in excess of the difference in average concentrations at roadside compared to background monitoring sites – 23.51 μg/m^3 – indicating a feasible contribution.

Conclusion Vegetation cover on average reduced ambient NO2 at London monitoring sites by 5.09 μg/m^3, suggesting the environmental pathway is a plausible mechanism by which greenspace influences cardiovascular health. Further assessment of the mediating role of air pollution in greenspace and CVD morbidity/mortality associations in the London-based UK Biobank population (~60,000) is underway.

OP VIII – 2 GREEN SPACE EXPOSURE IS ASSOCIATED WITH SLOWER COGNITIVE DECLINE IN OLDER ADULTS: A 10-YEAR FOLLOW-UP OF THE WHITEHALL II COHORT

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Background/aim Cognitive functioning is one of the most important indicators of healthy ageing. Evidence on beneficial associations of green spaces with cognitive function at older age is scarce and limited to cross-sectional studies. This study aimed to investigate the association between long-term green space exposure and cognitive decline.

Methods This longitudinal study was based on three follow-ups (10 years) of 6506 participants (45–68 years old) from the Whitehall II cohort, UK. Residential surrounding greenness was obtained across buffers of 500 and 1000 metre around the residential address at each follow-up using satellite-derived Normalised Difference Vegetation Index (NVDI) for each follow-up. A battery of four cognitive tests were applied in each follow-up to characterise reasoning, short-term memory, and verbal fluency. The cognitive scores were standardised and summarised in a 'global cognition' z-score. Linear mixed effects models were used that included an interaction between age and greenness to estimate the impact of greenness exposure on trajectories of cognitive decline.

Results An interquartile range increase in NDVI was associated with a difference in the global cognition z-score of 0.020 (95% confidence interval (CI): 0.003 to 0.037, p=0.02) over 10 years. Comparing study participants of 55.7 years old, this

difference was equivalent to a 4.6% slower decline over 10 years. Similar positive associations were also observed for reasoning (0.022, 95% CI: 0.007 to 0.038) and verbal fluency (0.021, 95% CI: 0.002 to 0.040), but not for short-term memory (−0.003, 95% CI: −0.029 to 0.022). We observed some suggestions for stronger associations among women and participants with secondary school education.

Conclusion Higher residential surrounding greenness was associated with slower cognitive decline. Further research is needed to confirm our findings and provide information on the specific characteristics of green spaces that can maximise healthy cognitive ageing.

OP VIII – 4 TYPE OF PHYSICAL ACTIVITY, DIET, BMI AND TOBACCO/ALCOHOL CONSUMPTION RELATIONSHIP: WHICH OF THEM AFFECT MORE OUR HEALTH?

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Background/aim Many studies related to health include such parameters as physical activity, diet, BMI and substances consumption. The purpose of this article was to check the magnitude of their effects on health together with other parameters as age, sex and level of education.

Methods Design The study was based on epidemiological data (9617 participants from 19 to 81 y.o. for whom we have health indicators over a period of 11 years) together with questionnaires about diet, alcohol, tobacco and the frequency of different types of physical activities together with sociodemographical parameters. Methods Descriptive statistics and non-parametric correlational analysis of epidemiological data was performed with use of SPSS v.19.

Results The magnitude of association of factors with days of hospitalisation were the following ones (from greater to lesser):

1. physical activity type 3 (gardening);
2. sport activity type 1 (aerobic, swimming, running);
3. level of studies;
4. age;
5. BMI;
6. menu variability;
7. smoking;
8. weight maintenance;
9. alcohol consumption;
10. sport activity type 2 (Pilates, yoga) and
11. limitation of fats consumption (1–9 were statistically significant at p

Conclusion Our findings confirm that leading a healthy life style is an important issue since it has a significant relationship with physical and mental health indicators. Moreover, our results show different associations by ranking the studied factors with different health indicators (number of days spent in hospital, visits of doctors and psychiatrists, drug consumption, etc.).

OP VIII – 5 LONG-TERM EXPOSURE TO NEIGHBOURHOOD GREEN SPACES PROTECTS FROM ALL-CAUSE MORTALITY IN ADULTS (18 TO 65 YEARS OLD) LIVING IN THE FIVE LARGEST CITIES IN BELGIUM: A CENSUS-BASED STUDY

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Background/aim Prior research on the association between green spaces and all-cause mortality has generally shown a reduction in mortality rates. So far, the specific effects of green spaces on mortality have not been explored in Belgium. Our study investigates the association between long-term residential exposure to green spaces and all-cause mortality in adults living in urban areas in Belgium.

Methods We used the Belgian 2001 census linked to mortality follow-up data (2001–2011) among 18 to 65 year-old adults for the 5 largest cities in Belgium (*Brussels, Antwerp, Ghent, Charleroi and Liège* – about 2.5 million inhabitants). The data contain individual information on mortality (*ICD-10*), sociodemographic variables (*age, sex, education level, employment status and housing status*) and the duration of residence. Different measures of green (*percentage (+600 m buffer) and number of green patches in 3 categories (0, 1 to 4, and 5 to 9)*) based on land use data (CORINE land cover) and air pollution (*PM10 and NO2*) data were available at the scale of census tracts. Cox proportional hazards models, where age was used as the underlying time scale, were performed to probe into all-cause mortality.

Results Results showed relatively small inverse effects with all-cause mortality for both the *% of green space* in a neighbourhood and the *% of green in a buffer* around the residential neighbourhood and remained stable after control for age, sex, education and air pollution with a mortality hazard ratio (HR) of 0.996 (99% CI: 0.995 to 0.997) and 0.993 (99% CI: 0.992 to 0.994), respectively. Associations between all-cause mortality and green measured by the number of patches in a census tract were stronger. The HR for individuals living in areas with the highest number of patches was 0.665 (99% CI: 0.558 to 0.774) compared to individuals living in areas with no patches and after potential confounding adjustment for sociodemographic and air quality variables. Sensitivity analyses on non-movers only do not differ.

Conclusion Preliminary results suggest a beneficial association between exposure to green and mortality. Beyond the known effect of the percentage of green on mortality, our study shows that the number of green patches within an area has a stronger beneficial effect on health. Further analyses will be conducted within this study to confirm our results.

Health impact assessment

OP IX – 2 HEALTH IMPACTS OF BIKE SHARING SYSTEMS IN EUROPE

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Background/aim Bike sharing systems (BSS) has been implemented in several cities around the world as policies to mitigate climate change, promote physical activity, and improve public health.

This study aims to assess the health impacts (risk and benefits) of major BSS (with more than 2000 bikes) in Europe, with mechanical and electric bikes (e-bikes).

Methods We used a health impact assessment (HIA) approach to quantify the health risk and benefits of car trips substitution by bikes trips from European BSS. The estimated health outcome was the annual expected number of deaths (increased or avoided) due to physical activity, road traffic fatalities and air pollution (particulate matter less than 2.5 micrometres (PM2.5)) due to car trips substitution for BSS trips. The analysis was focused on BSS with more than 2000 bikes (with the mechanic and/or electric bikes (e-bikes)) in European cities. Four scenarios were created to assess the health impacts of shifting from car to BSS bike. An economic assessment included estimating the health cost related to each death.

Results Twelve BSS were included in the analysis, nine BSS with mechanic bikes (Brussels, Hamburg, Lille, Lyon, Paris, Seville, Toulouse, Valencia, Warsaw), two with mechanical and e-bikes (Barcelona and Milan) and one BSS with only e-bikes (Madrid). In all the cases (BSS and scenarios) were estimated that the car trips substitution by BSS trips results in health benefits. Also in all the cases, the health benefits of physical activity outweighed the health risk of traffic fatalities and inhalation of air pollution. The number of annual deaths avoided ranged from 5.17 (95% CI: 7.01 to 3.11) with an economical value of € 13 million (minimum shift between car-bike) to −73.250 (95% CI: −99.805 to −44.144) with an economical value of € 189 million (100% bike trips shifted from car trips) in the 12 cities.

Conclusion This study found that BSS in Europe could provide health and economic benefits. The health benefits are driven by physical activity, despite a decrease in the overall benefit due to exposure to air pollution (PM2.5) and road traffic fatalities. This study also highlights the need for transport data, especially for BSS, to promote better transport and urban planning policies.

OP IX – 3 ECONOMIC COSTS OF ARSENIC INDUCED ILLNESSES DUE TO GROUNDWATER CONTAMINATION IN BIHAR

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Background/aim Around 40% of the districts in Bihar have reported arsenic in groundwater. This comprises more than 67 blocks from 15 districts, covering more than 1600 habitations across the State. High arsenic levels in drinking water have been associated with Arsenicosis and lead to economic costs such as wage loss, cost of disease, loss of wages, and cost of averting activities.

Methods We surveyed 388 households from two blocks of Bihar between 2013 and 2014. A field test kit was used to test the arsenic concentration in drinking water collected from 935 hand-pump tube wells. COI was used to measure the indirect value of reduced morbidity through reduction in productivity and wage loss due to contaminated drinking water. The extent of the population exposed to arsenic through drinking water is estimated.

Results The results demonstrate that concentration of arsenic from deep hand-pump tube well water (>160 feet) is less than 10 ppb and is mainly found between the 45–160 feet range, which is the main source of drinking water in the study area. The water test results reveal that 61% of the drinking water contained arsenic in excess of 10 ppb, and 5.03% of the water samples contained arsenic between 300 and 500 ppb. The annual wage loss, cost of treatment, and COI for the sample households are estimated as $46.8, $114.26 and $161.15, respectively. The total annual COI is estimated as $5.11 million for the entire study area.

Conclusion The study estimates the COI for the households due to contaminated drinking water and finds that the poor households are more affected than the higher-income households. Therefore, providing safe drinking water is essential for socioeconomic reasons.

OP IX – 4 QUANTIFICATION OF ENVIRONMENTAL BURDEN OF DISEASE RELATED TO NITROGEN DIOXIDE EXPOSURE IN GERMANY

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Background/aim Epidemiological studies have shown associations of nitrogen dioxide (NO_2) with numerous health outcomes. EU-wide air quality limit values for NO_2 are in place but regularly exceeded at measuring stations near roads in Germany. Therefore, a health risk assessment for the NO_2-exposure of the German population was conducted.

Methods For 2007 up to 2014, maps of the annual spatial 1*1 km^2 distribution of a population-weighted NO_2 concentration indicator were calculated based on assimilated modelling data of background NO_2 within a 7*8 km^2 grid and population density within a 250*250 m^2 grid. For three model regions a small scale assessment of the NO_2 exposure was achieved by considering concentrations in the higher resolved urban background as well as close to highly polluted street sections. A systematic literature search of epidemiological studies was performed to ascertain the current evidence on long-term health effects of NO_2 and to identify exposure-response-functions transferrable to Germany. The Environmental Burden of Disease-concept was applied to quantify the NO_2-associated health risks for relevant outcomes.

Results The yearly mean of background NO_2 slightly decreased from 13 $\mu g/m^3$ (range: 4.3 to 37.3 $\mu g/m^3$) in 2007 to 11.8 $\mu g/m^3$ (3.4 to 32.7 $\mu g/m^3$) in 2014. Using a counterfactual value of 10 $\mu g/m^3$, 5966 (95%-confidence interval: 2031 to 9,893) premature deaths and 49,726 (16,929 to

82,456) Years of Live Lost (YLL) due to cardiovascular mortality attributable to NO_2 long-term exposure were estimated for the year 2014. Between 2007 and 2014 an overall slightly decreasing trend was observed for attributable premature deaths. The higher resolution of NO_2-concentration for the three model regions led to a substantial increase in the estimated number of premature deaths due to cardiovascular disease by 40% to 165%.

Conclusion The present estimates are based on NO_2 concentrations reflecting background exposure and thus underestimate the burden of disease. A better accuracy of the NO_2 exposure estimation accounting for the higher concentrations in urban areas close to traffic improves the burden of disease quantification and may enhance the distinction of health effects related to fine and ultrafine particles.

OP IX – 5 TRAFFIC-RELATED AIR POLLUTION AND THE LOCAL BURDEN OF CHILDHOOD ASTHMA IN BRADFORD, UK

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Background/aim Asthma is a burdensome disease which has been cited as the most common chronic disease in children. Traffic-related air pollution (TRAP) may be an important exposure in its development. Bradford, UK, is a multi-ethnic deprived city suffering from asthma rates higher than national and regional averages. TRAP is of concern to local communities and is thought to contribute to the asthma burden.

Methods We estimated childhood population exposure to traffic-related NOx and NO2 at the smallest census tract level in Bradford using three validated exposure assessment methods: two novel full-chain models linking transport, two different emission models and air dispersion models and one land-use regression (LUR) model, which was developed as part of ESCAPE and which also provided estimates for other pollutants including PM2.5, PM10 and black carbon. We extracted national and local childhood asthma incidence rates and used meta-analytic exposure-response functions. We calculated the relative risk and population attributable fraction of childhood asthma attributable to each pollutant. We estimated asthma cases attributable to each pollutant and exposure combination.

Results Depending on the exposure assessment method used and the pollutant studied, the estimated TRAP-attributable asthma cases varied between 279 and 687 annually, representing between 15% to 38% of all asthma cases in the city. The health impacts estimated were sensitive to the exposure assessment method used, the pollutant selected in the analysis but, differently from the initial hypothesis, not to the vehicle emission factors used in the full-chain models.

Conclusion TRAP is estimated to cause a large, but preventable, childhood asthma burden. This study is the first study undertaking full-chain health impact assessment that considers the full-chain from source, through exposure pathway to outcome. The study also adds to the scarce literature exploring the impacts of different exposure assessments on the estimated burden of disease.

OP IX – 6 HEALTH IMPACT ASSESSMENT OF RIVERSIDE REGENERATION IN BARCELONA

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Background/aim Urban regeneration is a growing-up tendency that aims to improve the conditions of an area. Studies have suggested an association between access to natural outdoor environments and increase of physical activity (PA). This study aims to quantify the health and economic impacts of the riverside regeneration performed in 2000 in a fluvial park in Barcelona metropolitan area.

Methods PA levels were estimated in metabolic equivalents of task (METs min/week), based on a riverside user's survey (n=661) performed in 2015 describing user's PA levels, duration and frequency of their visits to the Fluvial Park. A quantitative risk assessment approach was used to estimate the health impacts in mortality, morbidity and Disability-Adjusted Life Years (DALYs), as proposed by the World Health Organisation. Relative risks between PA and health outcomes were selected from meta-analysis. Health outcomes included in the analysis were all cause mortality, ischaemic heart disease, ischaemic stroke, diabetes type 2, colon and breast cancer, and dementia. An economic assessment was based on the value statistical life and the health direct cost per disease in Spain.

Results It was estimated that the riverside regeneration attracts 5.753 users (>18 years old) per day to perform different kind of PA (walk for pleasure or work, cycling and running). In those users it was estimated an annual reduction of 0.76 deaths, 6.18 cases of diseases and 10.01 DALYs due to the practise of PA along the riverbanks. It is monetized into 2.4 million € on mortality and 680.656 € on total direct health costs.

Conclusion Riverside regeneration was associated with health and economic benefits, increasing active living and promoting public health.

Ultrafine particles

OP X – 1 LONG-TERM EXPOSURE TO ULTRAFINE PARTICLES AND TYPE 2 DIABETES PREVALENCE IN A LONGITUDINAL SETTING

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Background/aim Recent studies suggested an association between long-term air pollution and type 2 diabetes (T2D). However, evidence is limited, especially for ultrafine particles (UFP, diameter <0.1 µm) having a high toxic potential due to their small size but comparably large surface. We investigated

the association between residential air pollution and T2D prevalence determined at up to three time points.

Methods We conducted a longitudinal analysis based on data of the baseline survey (1999–2001), first (2006–2008) and second follow-up (2013–2014) of the KORA S4 cohort in the Augsburg region, Germany. Long-term exposure to particle number concentration (PNC) as indicator for UFP, ozone, particulate matter with diameters <10 µm (PM_{10}), <2.5 µm ($PM_{2.5}$) and 2.5–10 µm (PM_{coarse}), soot and nitrogen oxides (NO_2, NO_x) was measured in 2013/14 and individual concentrations at the participants' residences were estimated by land use regression. We used generalised estimating equations adjusting for socio-demographic, lifestyle and clinical covariates to assess the association between annual average air pollution concentration and prevalence of T2D. Effect modifications were tested by use of interaction terms.

Results We analysed 9450 observations of 4217 participants aged 25 to 75 years at baseline. T2D prevalence increased from 4.4% at baseline to 9.9% at the second follow-up. Our results indicated an increased T2D prevalence in association with all air pollutants. Significant effect estimates were seen for PNC [odds ratio: 1.14 (95%-confidence interval: 1.03; 1.25) per 1958 particles/cm^3 (interquartile range) increase], PM_{coarse} [1.15 (1.03; 1.29) per 1.4 µg/m^3 increase] and NO_x [1.14 (1.02; 1.27) per 8.6 µg/m^3 increase]. Effect estimates were higher for smokers, residents of the rural counties and participants with high CRP, whereas age, sex, obesity, physical activity, education, and a history of cardiovascular disease did not modify the estimates significantly.

Conclusion As one of the first studies investigating chronic exposure to ultrafine particles and T2D in a longitudinal setting, our results point towards a positive association highlighting the role of ultrafine particles within the complex mixture of ambient air pollution.

OP X – 3 C-REACTIVE PROTEIN (CRP) AND LONG-TERM AIR POLLUTION WITH A FOCUS ON ULTRAFINE PARTICLES

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Background/aim Long-term exposure to ambient air pollution contributes to the burden of disease and particularly affects cardiovascular (CV) causes of death. We investigated the association between particle number concentration (PNC), a marker for ultrafine particles (UFP), and other air pollutants and high sensitivity C-reactive protein (hs-CRP) as a potential link between air pollution and CV disease.

Methods A cross-sectional analysis was performed on data of the second follow-up of the KORA S4 survey in Augsburg, Germany (2013–2014). Residential long-term exposure to PNC, particulate matter <10 µm and <2.5 µm in aerodynamic diameter (PM_{10} and $PM_{2.5}$, respectively), PMcoarse (2.5–10 µm), absorbance of $PM_{2.5}$ ($PM_{2.5abs}$), nitrogen dioxide (NO_2) and nitrogen oxides (NOx) was estimated by land-use regression models. Associations between annual air pollution concentration and hs-CRP were modelled in 2252 participants using linear regression adjusting for confounders. Possible effect-modifiers were examined by interaction terms. Two-pollutant models were calculated for pollutants with Spearman inter-correlation <0.70.

Results The results pointed to a positive association between PNC, PM_{10}, PMcoarse, $PM_{2.5abs}$, NO_2 and NOx and hs-CRP. For PNC, an interquartile-range (IQR, 2000 particles/cm^3) increase was associated with a 3.63% [95% confidence interval (CI): −0.86% to 8.33%] increase in hs-CRP. Effect estimates were higher for women, non-obese and participants without history of CVD. Effect modification was also seen for participants without diabetes with the highest effect estimate of 14.71% [95% CI: 5.47% to 24.77%] for an IQR increase of 2.1 µg/m^3 in PM_{10}. In two-pollutant models, adjustment for $PM_{2.5}$ strengthened the effect estimates for PNC and PM_{10} (increase per IQR 6.31% [95% CI: 0.42% to 12.53%] and 7.34% [95%CI: 0.40% to 14.77%], respectively).

Conclusion Our results highlight the role of UFP within the complex mixture of ambient air pollution and their inflammatory potential and help fill a research gap since studies on chronic exposure to ultrafine particles are still scarce.

OP X – 4 MULTIPOLLUTANT MODELS FOR ASSESSING PARTICLE NUMBER CONCENTRATION EXPOSURE AND CHANGES IN GLUCOSE METABOLISM IN THE HEINZ NIXDORF RECALL STUDY

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Background/aim Prior studies have shown possible links between medium-term air pollution (AP) exposure and glucose metabolism markers. We investigated whether associations between accumulation mode particle number concentration (PN_{AM}) and glucose metabolism measures are robust to adjustment for other potential co-pollutants.

Methods This analysis included observations from non-diabetic participants (n_{obs}=7,108) of the population-based Heinz Nixdorf Recall study at baseline (2000–2003) and follow-up examination (2006–2008). Particulate matter (PM), accumulation mode particle number (PN_{AM}), and NO_2 exposures were estimated for each examination at every participant's residence using the spatiotemporal EURopean Air pollution Dispersion (EURAD) chemistry transport model. Associations between a range of short- and medium-term PN_{AM} exposures (1- to 182 day average prior to blood draw) and glucose metabolism measures (blood glucose, HbA1c) were assessed for robustness to co-adjustment for $PM_{2.5}$, PM_{10}, and NO_2 using a mixed effects linear regression model

Results PN_{AM} exposure showed low to medium correlation with $PM_{2.5}$, PM_{10}, and NO_2 (e.g., 0.33–0.53 for 28 day exposures). In the model with only PN_{AM} and blood glucose, associations were seen for 14- to 91 day mean exposures windows with strongest associations observed for the 60 day window (1.05 mg/dL per 1580 n/mL (95% CI: 0.46 to 1.63)). Co-adjustment for $PM_{2.5}$ attenuated associations at all time points

(e.g., 0.67 mg/dL per 1580 n/mL (95% CI: −0.22 to 1.55) for the 60 day window) whereas associations for PN_{AM} remained largely unchanged upon adjustment for PM_{10} and NO_2. For HbA1c, strongest associations were apparent for the 105 day exposure window (0.096 p.p. per 1257 n/mL (95% CI: 0.075 to 0.116)). HbA1c model estimates were largely unchanged upon adjustment for co-pollutants.

Conclusion The associations between exposure to PN_{AM} and glucose metabolism measures were robust to adjustment for co-pollutants, possibly suggesting that exposure to small particles plays an independent role in influencing glucose regulation.

OP X – 5 LONG-TERM EXPOSURE TO AIR POLLUTION AND BIOMARKERS OF INFLAMMATION AND INSULIN RESISTANCE IN A LONGITUDINAL SETTING

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Background/aim Exposure to outdoor air pollution has been associated with systemic inflammation but results have been inconsistent. Evidence for deleterious effects on glucose metabolism and insulin resistance is still limited. We investigated the association of long-term air pollution exposure on biomarkers of systemic inflammation, glycaemia, and insulin resistance measured up to three times.

Methods We used baseline survey (1999–2001), first follow-up (2006–2008) and second follow-up (2013–2014) from the KORA study in Augsburg, Southern Germany. At each examination, we measured plasma high-sensitivity C-reactive protein (hsCRP), glycosylated haemoglobin (HbA1c) and homeostatic model assessment of insulin resistance (HOMA-IR) calculated from fasting glucose and insulin. We estimated residential long-term exposure to ultrafine particles (UFP), different size fractions of particulate matter, soot, nitrogen oxides and ozone by land use regression. Associations between annual pollutants and biomarkers were modelled using generalised estimating equations adjusting for socio-demographic, lifestyle and clinical covariates. Potential effect-modifiers were examined by use of interaction terms.

Results We included 9590 observations from 4255 participants aged 25 to 75 years at baseline in the analyses. Air pollutant concentrations at the participants' residences were well below the EU guidelines for regulated pollutants. Except for ozone, all pollutants were positively associated with at least one of the biomarkers. For UFP, the highest effect was seen for hsCRP with an increase of 3% (95% CI: 0.4 to 5.6) per 1900 particles/cm^3 increase. Particulate matter between 2.5 and 10 $\mu g/m^3$, soot and nitrogen dioxides were significantly associated with HbA1c and HOMA-IR. For the latter, effect estimates tended to be higher for males and elderly participants while this was not the case for the other two biomarkers.

Conclusion The findings of this longitudinal study add to a scarce body of literature on cardiometabolic health effects in association with chronic exposure to air pollution and help to fill the existing research gap, especially with regard to the effects of ultrafine particles.

Noise

OP XI – 1 LONG-TERM EXPOSURE TO ROAD TRAFFIC NOISE AND INCIDENCE OF MYOCARDIAL INFARCTION. A DANISH NURSE COHORT STUDY

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Background/aim Exposure to road traffic noise has been linked to adverse health effects, including cardiovascular diseases (CVD), however, evidence is inconsistent. In this study we examined the association between long-term exposure to road traffic noise and incidence of myocardial infarction (MI).

Methods We used the data from a nationwide Danish Nurse Cohort on 22 438 female nurses (age >44 years) who at recruitment in 1993 or 1999 reported information on CVD risk factors. We obtained data on incidence of MI from the Danish National Patient Register until end of 2014. Road traffic noise levels at the nurses' residences between 1970 and 2014 were estimated using The Nord2000 as the annual mean of a weighted 24 hour average (Lden). We used time-varying Cox regression models to examine the association between 24-, 10-, and 1 year running mean of Lden and MI incidence, in a crude model (adjusted for age and time of cohort enrolment) and in a fully adjusted model (adjusted for age, enrolment year, physical activity, alcohol, smoking, marital status, fruit consumption and use of hormone therapy).

Results Of the 22 438 women, 590 developed MI during a mean follow-up of 18.3 years. Residential road traffic noise levels ranged from 5–82.7 dB at the year of cohort baseline. We found no association between exposure to road traffic noise and MI in crude (hazard ratio; 95% confidence interval: 0.94; 0.83–1.05) or fully (0.92; 0.82–1.04) adjusted model, for each 10 dB increase in 24 year mean road traffic noise levels. Similar results were found with 10 year and 1 year exposure windows. We observed a possible trend of increased risk, although statistically non-significant, in nurses living in urban areas (1.29; 0.84–2.00), and none in those living in provincial (0.98; 0.77–1.23) or rural (0.91; 0.77–1.07) areas (p for interaction 0.38).

Conclusion We found no association between long-term exposure to road traffic noise and MI in the total population of Danish nurses. We present novel finding that nurses living in urban areas may be more susceptible to the effects of exposure to road traffic noise with respect to MI.

OP XI – 2 ASSOCIATIONS BETWEEN OUTDOOR AND INDOOR NOISE, COGNITIVE PERFORMANCE AND DEPRESSIVE SYMPTOMS – RESULTS FROM HNR STUDY

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10.1136/oemed-2018-ISEEabstracts.50

Background/aim Long-term exposure to traffic noise has been shown to be associated with cognitive function. Noise is associated with depressive symptoms, which in turn are adversely associated with cognitive performance. We aimed to analyse whether depressive symptoms mediate the association of long-term exposure to traffic noise assessed outdoors and indoors with cognitive performance.
Methods In a cross-sectional analysis cognitive function was assessed in 4086 participants at the first follow-up of German Heinz Nixdorf Recall study using five subtests. A global cognitive score (GCS) was calculated as a sum of all subtests. We assessed depressive symptoms using the Centre for Epidemiologic Studies Depression scale 15-item short form (CES-D). Long-term weighted 24 hour exposure to traffic noise was assessed according to the EU directive 2002/49/EC of the baseline residential addresses (LDEN), and corrected for type of window, bedroom orientation and ventilation (LDEN_IN). Multiple linear regression models adjusted for individual risk factors were calculated for the association of noise with cognitive function, with and without adjustment for depressive symptoms.
Results In the fully adjusted model, noise was negatively associated with cognitive subtests and with the GCS. For example, a 10 dB(A) increase in LDEN was associated with the GCS (β=-0.34 [95% confidence interval: −0.67; −0.01]). An association of indoor noise with cognitive performance was lower (i.e. for 10 dB(A) increase in LDEN_IN with GCS β=-0.18 [-0.25; −0.10]). Adjustment of noise for CES-D score ≥17 (indicating the presence of depressive symptoms) revealed an Odds Ratios of 1.22 [0.92; 1.62] and 1.04 [0.95; 1.14] for 10 dB(A) LDEN and LDEN_IN, respectively. However, the adjustment for CES-D score did not change the noise-cognitive outcome associations neither for outdoor nor for indoor noise (i.e. for LDEN and GCS β=-0.33 [-0.66; −0.01], and for LDEN_IN and GCS β=-0.18 [-0.25; −0.10]).
Conclusion We found associations between traffic noise and cognitive performance, which did not change after adjustment for depressive symptoms. Future longitudinal analyses might shed light on possible mediating pathways between noise, depression and cognition.

OP XI – 3 AIR POLLUTION, NOISE, GREEN SPACE AND OVERWEIGHT IN CHILDREN AGED 12 YEARS: THE PIAMA BIRTH COHORT STUDY

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10.1136/oemed-2018-ISEEabstracts.51

Background/aim Exposure to air pollution, noise and green space may be associated with children's body mass index. However, no studies have examined the combined effects of these environmental exposures on markers of adiposity in children. We investigated the individual and combined associations of air pollution, road traffic noise and green space with overweight in children aged 12 years.
Methods Weight and height were measured at age 12 years in 1508 participants of the Dutch PIAMA birth cohort study. Annual average air pollution levels (NO2, PM2.5, PM10, PMcoarse, and PM2.5 absorbance) at the children's homes were estimated by land-use regression models. Road traffic noise exposure was assessed by linking children's home addresses to modelled road traffic noise levels. We used different indicators to assess exposure to green space: the average Normalised Difference Vegetation Index (NDVI) and percentages of urban, agricultural and natural green space in buffers of 300 m and 3000 m around the children's homes, and the distance from the homes to the nearest park. We analysed the associations between the exposures and overweight by logistic regression.
Results Twelve percent of the children were overweight. Neither in single- nor in multi-exposure models we found significant associations of air pollution, road traffic noise, and green space with overweight. For example, we found an OR per interquartile range increase in exposure of 1.12 [95% CI: 0.90 to 1.39] for NO2, OR 1.03 [95% CI: 0.84 to 1.26] for PM2.5 absorbance, OR 1.15 [95% CI: 0.94 to 1.40] for road traffic noise and OR 0.85 [95% CI: 0.68 to 1.05] and OR 0.87 [95% CI: 0.71 to 1.06] for the average NDVI in the 300 m and 3000 m buffer, respectively, in single-exposure models. The associations changed only slightly when the other environmental exposures were added in multi-exposure models.
Conclusion Our results do not provide support for adverse effects of air pollution and road traffic noise or beneficial effects of green space exposure on overweight in children aged 12 years. We will perform longitudinal analyses to examine the associations of air pollution, road traffic noise and green space with overweight throughout childhood.

OP XI – 4 A COMPARISON OF MULTIPLE NOISE INDICATORS FOR THE ASSESSMENT OF SHORT-TERM ASSOCIATIONS BETWEEN PERSONAL EXPOSURE TO NOISE AND HEART RATE VARIABILITY: A SENSOR-BASED STUDY IN A REAL-LIFE SETTING

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10.1136/oemed-2018-ISEEabstracts.52

Background/aim Part of the complexity of noise assessment resides in its temporal variations as so, it is still unclear which indicators of exposure are appropriate. This study aims at (1) describing the concomitant associations between personal noise exposure summarised using various noise indicators and heart rate variability (HRV) parameters (2)identifying the noise indicators that best predict HRV parameters.
Methods The RECORD MultiSensor Study collected between July 2014 and June 2015 noise and heart rate (HR) data for 75 participants, aged 34–74 years, in their living environments for 7 days using an electrocardiography sensor on the chest and a personal dosimeter recording 1 s A-weighted equivalent sound pressure levels ($L_{Aeq,1s}$). HRV parameters and noise levels were calculated for 5 min windows. Noise was summarised

as L_{Aeq}, L_{AX} (noise level exceeded X% of the time) with L_{A90}, L_{A50}, L_{A10}, L_{A01}, L_{A10}-L_{A90} and the standard deviation of $L_{Aeq,1s}$. Short-term associations of noise level and HRV parameters were assessed using mixed effects models with a random intercept for participants adjusted for HR, accelerometry, context and short-term trends. The models' goodness of fit was assessed using the BIC.

Results The classically used indicator, the LAeq, was highly correlated with L_{A10} (r=0.94) and L_{A01} (r=0.97) and moderately with L_{A90} (r=0.66) and L_{A10}-L_{A90} (r=0.52). All of the noise indicators, when examined in separate models, were positively associated with the Standard deviation of N-N intervals (SDNN) and with the Low frequency on High frequency HRV ratio (LF/HF), with the exception of the association between the L_{A90} and SDNN which decreased by −0.17% (95% CI: −0.21 to −0.13) per increase of one dB(A). Based on the BIC, the noise indicators that best predicted HRV parameters were the standard deviation of $L_{Aeq,1s}$ for the SDNN followed by L_{A10}-L_{A90} (ΔBIC=221.66) and L_{A01} for the LF/HF ratio followed by L_{A10} (ΔBIC=190.36).

Conclusion The results suggest that short-term effects of noise on overall heart rate variability (SDNN) are better explained by the amplitude of noise level variations ($\sigma_{LAeq,1s}$), while those on the balance of the autonomic nervous system (LF/HF) are better explained by sporadic noise events (L_{A01}). In addition a negative association between the background noise level (L_{A90}) and SDNN was found.

OP XI – 5 THE PROPORTION OF HIGH NOISE SENSITIVITY AND ANNOYANCE IN THE HERMES COHORT STUDY OF SWISS ADOLESCENTS

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10.1136/oemed-2018-ISEEabstracts.53

Background/aim The World Health Organization considers children to be of particular risk of suffering negative cognitive and health consequences through exposure to transportation noise. However, little is known about how adolescents experience exposure to noise in their everyday life. The purpose of this study is to examine level of both noise annoyance and sensitivity in a cohort of adolescents.

Methods Noise sensitivity and annoyance was measured in a cohort of 892 participants aged 12 to 17 with one year follow-up. Noise annoyance for five different noise sources, including transportation vehicles, industry and people, was measured using a verbal 4 point Likert scale, where the annoyance was classified as follows: none (0), little (1), clearly (2), severely (3). Participants were classified as highly annoyed if they scored 2 or higher. Noise sensitivity was measured with the Zimmer/Ellermeyer (1998) scale ranging from 0 to 27. Individuals were classified as sensitive if they had a score over 13.5. Proportion of noise annoyed and noise sensitive participants are presented. Change between baseline and follow-up proportions were compared with the McNewmar-test.

Results 847 students participated at the baseline measurement of the annoyance of road noise. Follow-up participation was at 806 (participation rate: 95.1%). The proportion of highly annoyed students was 4.40% (n=39) at baseline and 2.74% (n=23) at follow-up. The change in proportion after a year was quite significant (p=0.028). The noise sensitivity questionnaire was filled out by 887 students at baseline and follow-up was at 840 (participation rate: 94.7%). The proportion of highly noise sensitive students was 24.32% (n=206) at baseline and 24.07% (n=194) at follow-up, with no indications for a difference between baseline and follow-up (p=0.834). Within all comparisons gender was not substantial, except for baseline noise annoyance of two noise sources.

Conclusion Our study suggests that prevalence of high noise annoyance is low in this age group and tends to decrease during puberty. Noise sensitivity seemed to be prevalent in a quarter of adolescents and stayed constant after a year. Future analyses should explore the relationship between annoyance, sensitivity, actual noise exposure and health outcomes.

OP XI – 6 EVALUATION AND PREDICTION OF INDOOR AND OUTDOOR NOISE DIFFERENCES IN RESIDENTIAL DWELLINGS USING STATISTICAL MODEL

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10.1136/oemed-2018-ISEEabstracts.54

Background/aim Most epidemiological studies investigating the association between noise exposure and health use modelled outdoor noise estimates as exposure proxy. This study aims to explore the relationship between indoor and outdoor noise at residential dwellings in London and evaluates potential parameters of dwelling ad sound insulation characteristics to predict the indoor exposure.

Methods Measurements were done at 49 homes mostly in winter and spring seasons when windows are closed. Continuous noise measurement were made inside and outside each home for three consecutive days using an Optimus CR:171B sound level metre. Selected homes were located close to major roads, railway, under an aircraft flight path or any combination of them. Building survey and time activity diaries of the occupants were also collected.

Results From the unadjusted linear regression model, significant associations were found between indoor and outdoor noise for $L_{Aeq,16h}$ (β=0.413, 95% Confidence Interval (CI): 0.081–0.745, p=0.016) and L_{night} (β=0.332, 95% CI: 0.039 to 0.624, p=0.027). After adjusting for room volume, window size, source of noise, window type and number of occupants, the association remained significant in the adjusted model for $L_{Aeq,16h}$ (β=0.378, 95% CI: 0.071 to 0.685, p=0.018) and L_{night} (β=0.297, 95% CI: 0.013 to 0.580, p=0.041) with only a small reduced of the β coefficient from the unadjusted model. These linear models yield an explained variance of 64% (adjusted R^2) for $L_{Aeq,16h}$ and 51% for L_{night}. Based on the preliminary analysis, it is predicted that the indoor level could be 60%–70% lower than the outdoor.

Conclusion The wide CI suggests misclassification bias of exposure when conducting epidemiologiocal studies using the outdoor noise estimates. Further analysis will be done to improve the model by adding some more related sound insulation factors.

Methodological advances

OP XII – 1 ASSESSING THE CUMULATIVE HEALTH EFFECT FOLLOWING SHORT TERM EXPOSURE TO MULTIPLE POLLUTANTS: AN EVALUATION OF METHODOLOGICAL APPROACHES USING SIMULATIONS AND REAL DATA

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10.1136/oemed-2018-ISEEabstracts.55

Background/aim Assessment of the cumulative effect of correlated exposures is an open methodological issue in environmental epidemiology. Previous studies applied regression models with interaction terms or dimension reduction methods. The joint effect of pollutants has been also evaluated using weighted exposure scores with weights based on the strength of the specific pollutant-health outcomes associations.
Methods We compared three approaches addressing multipollutant exposures in epidemiological models: main effects models, the adaptive least absolute shrinkage and selection operator (LASSO) and a weighted exposure score. We assessed the performance of the methods by simulations under various scenarios for the pollutants' correlations. We further applied the three methods to time series data from Athens, Greece for 2007–2012 to investigate the combined effect of short-term exposure to six regulated pollutants on all-cause and respiratory mortality.
Results The weighted exposure score provided the least biassed cumulative estimate under all correlation scenarios for both mortality outcomes. The adaptive LASSO performed well in the case of low and medium correlation between exposures while models including all exposures linearly seriously biassed the estimate of interest. In the real data application, the cumulative effect estimate on overall mortality was similar between approaches ranging from 1.12% increase in main effects models to 0.73% in the score, while the cumulative effect on respiratory mortality resulted in variable estimates, that ranged from −0.61% increase for adaptive LASSO to 2.77% for the score approach, with overlapping confidence intervals.
Conclusion The use of a weighted exposure score to address cumulative effects of correlated metrics may perform well under different exposure correlation structures and different variability in the health outcomes. Future work should assess the performance of methods under variable lag structures per pollutant or non-linear associations between pollutants and outcomes.

OP XII – 2 AN AUTOMATED AND PHYSICALLY-SOUND REGRESSION MODEL FOR PRIMARY AIR POLLUTANTS

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10.1136/oemed-2018-ISEEabstracts.56

Background/aim Both mechanistic and Land-Use-Regresison (LUR) models have been extensively used for air quality assessment. Mechanistic models are expensive to collect the data for and run at a high spatial resolution. LUR models usually lack the required physical sensibility for a high temporal resolution. The Optimised Dispersion Model (ODM) is a fresh approach, which attempts to combine the two.
Methods Available data included: half-hourly ambient monitoring of nitrogen oxides; GPS-based traffic activity data; emission estimates from every registered industrial stack; and hourly wind fields at 1 km spatial separation. These data were combined into a puff-like model, which uniquely included 10 optimisation parameters. The values of the parameters were automatically calculated to provide a least-squares fit with measurements at each time-point. This new formulation included the concentrations in one time-point as sources for the next time-point, making the model more realistic and increasing computational efficiency, such that is was possible to only take into account a limited number of cells affecting each other cell.
Results The new model provided a modest improvement (half-hourly cross-validated MSPC of 0.25 vs 0.22) over a previous version at the coastal plain, and a much greater improvement (0.20 vs 0.05) at the Haifa district. The improvement was especially great for areas influenced by industrial stacks and at times when the wind direction was highly heterogeneous in space. The models were most similar when the wind was easterly. Re-circulation of pollutants was observed in the new model results, which may have played a part in the higher residuals obtained by previous versions.
Conclusion The new ODM can be used in different areas in an automated fashion and without changing the model formulation. For this, input of only reasonable quality is needed (continuous ambient measurements, wind direction and locations and relative magnitude of emission sources). Given these data, it performs better than other popular models and provides results in high spatio-temporal resolution.

OP XII – 3 OCCUPATIONAL EXPOSURE AND ASTHMA CONTROL: A LONGITUDINAL ANALYSIS CONTROLLING FOR THE HEALTHY WORKER EFFECT

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10.1136/oemed-2018-ISEEabstracts.57

Background/aim Occupational exposure is a risk factor for asthma. However, its impact on asthma control, the main target of asthma management, has rarely been studied. The healthy worker effect (HWE) can affect occupational studies. We aimed to investigate the effect of occupational exposures on asthma control in a longitudinal study, taking into account a potential HWE by a marginal structural model (MSM).
Methods Analyses were conducted in EGEA (Epidemiological study on the Genetics and Environment of Asthma), a case-control and family-based study (EGEA1: 1991–1995), with 2 follow-ups (EGEA2: 2003–2007; EGEA3: 2011–2013). Occupational exposure (no, 'irritants and/or low level of chemicals/allergens', 'known asthmagens') was defined using an asthma-specific job-exposure matrix. Asthma control was defined using international guidelines (GINA 2014); subjects with partly controlled/uncontrolled asthma were compared to those with

controlled or non-current asthma. Associations between occupational exposures and asthma control were evaluated among subjects with asthma using (1) a standard pooled multinomial logistic model and (2) a MSM to control the HWE modelled as a time-varying confounding situation.

Results Asthma was partly controlled or uncontrolled in 39% of person-periods (n=822). Occupational exposure to 'irritants and/or low level of chemicals/allergens' and to 'known asthmagens' was observed in 14% and 13% of all person-periods, respectively. In the standard analysis, after adjustment for age, sex, smoking status and time period, no statistically significant association was found between exposure to 'irritants and/or low level of chemicals/allergens' (OR [95% CI]: 0.91 [0.58–1.41]) or 'known asthmagens' (1.27 [0.79–2.04]) and partly controlled/uncontrolled asthma. Using the MSM, the association remained similar for exposure to 'irritants and/or low level of chemicals/allergens' (0.86 [0.55–1.35]) whereas the association increased for 'known asthmagens' (1.55 [0.96–2.52], p=0.08).

Conclusion No significant association between occupational exposure and asthma control was observed; however after correcting for a HWE using a MSM, a positive association between exposure to known asthmagens and partly controlled or uncontrolled asthma was suggested. Results support the presence of a healthy worker effect in the study and the deleterious effect of exposure to asthmagens on asthma control.

OP XII – 4 SIMULATION OF MULTI-POLLUTANT MODEL RESULTS IN THE PRESENCE OF MEASUREMENT ERROR

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10.1136/oemed-2018-ISEEabstracts.58

Background/aim Air pollution is a major public health concern. Multi-pollutant models are usually used in air pollution studies to identify the independent health effects of more than one pollutant. However, these model estimates can be unstable and biassed due to correlations between the exposures and exposure measurement error. Our goal is to assess and quantify this bias for $PM_{2.5}$ and NO_2 using simulations.

Methods A systematic review and meta-analysis on the differences between ambient concentrations and personal exposures only from outdoor origins was conducted. It has provided plausible values for the error structures to use as simulation input variables. Studies on building infiltration rates and activity patterns were reviewed and applied to total personal exposures for the calculation of personal exposure from outdoor sources. Then, hypothetical true and error-prone exposures of classical, Berkson and mixture types were created and the appropriate multi-pollutant models were fitted. Also, as a sensitivity analysis, we applied measurement error correction formulas (Regression Calibration and SIMEX) to check the effects of measurement error on real-life concentration-response functions.

Results Review results indicate that ambient concentrations of $PM_{2.5}$ are greater than personal exposure from ambient sources, by an average of 5μg/m^3. However, results present heterogeneity based on the area, climate and participants' age. NO_2 work is under investigation. Regarding the simulation results, we confirm the findings from the literature. For classical error, bias is observed in our preliminary results, especially when the variance of the errors is relatively high. For Berkson type, the effect estimates were, as expected, not statistically significantly different from the true ones. We will update our results with better informed input variables from our review, to identify the true independent effects of the pollutants. Also, we will compare the results of SIMEX and Reg Calibration.

Conclusion Simulations can lead to the quantification of the consequences of measurement error and adjusting for it can result in better model estimates. It may be inferred that certain potential interpretations are more unlikely than others. The ultimate aim of this work is to apply new understanding to the selection of concentration-response functions for health impact assessment.

OP XII – 5 SHORT-TERM EFFECTS OF DAILY WEATHER CHARACTERISTICS ON VIOLENT CRIMES IN THE BOSTON AREA

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10.1136/oemed-2018-ISEEabstracts.59

Background/aim Recently, attention has been given to the impact of climate change on crimes through weather variations. Associations between weather variables and crimes have been reported but causality still needs to be addressed. Our goal is to investigate whether there exists a causal relationship between temperature and violent crimes as well as between precipitations and violent crime.

Methods Since our study is based on data that were not collected in a randomised experiment, it is necessary to incorporate a design stage before any causal analysis stage. Our approach is to design observational data in a way that approximates a randomised experiment, using matched-sampling strategies. The framework considered in this paper is often denoted as the 'Rubin Causal Model' and sees causal inference as a missing data problem. Propensity score matching enables us to reconstruct four hypothetical randomised experiments before estimating the average causal effect (ACE). The ACE can be interpreted as the average number of daily violent crimes that are assumed to be caused by a high exposure level as compared to a lower exposure level.

Results In this manuscript, we observe that changes in heat index (apparent temperature) or the occurrence of rainfalls were followed by changes in daily violent crimes in Boston between July 2012 and February 2017. For instance, while we found increased daily crimes on temperate days compared to cold days (2.33, 95% CI=[1.56; 3.09]), it was not the case when comparing extremely hot days to hot days (0.59, 95% CI=[−1.36; 2.68]), suggesting a 'plateau' in the dose-response of heat index and violent crimes. As expected, the occurrence of rainfalls tended to decrease crimes (−1.45, 95% CI: −2 to −0.91).

Conclusion These results suggest that:

- meteorology should be used to prevent future crimes in Boston, and
- the weather–crime relationship should be taken into account when quantifying the impact of climate change.

We want to encourage researchers to use matching strategies when only observational data is available and no randomised experiment can be conducted but causal estimates need to be quantified.

Best abstract award: presented in plenary

1 THE COMBINED EFFECTS OF AMBIENT PARTICULATE MATTER (PM) AND SOLAR ULTRAVIOLET (UV) RADIATION ON FACIAL PIGMENT SPOT FORMATION IN CAUCASIAN WOMEN

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10.1136/oemed-2018-ISEEabstracts.60

Background/aim Development of facial pigment spots is generally believed to result from chronic exposure to solar UV radiation. More recently, it was discovered that exposure to traffic related air pollutants including PM is also associated with more pigment spots. Since humans are exposed to a combination of UV and PM, we here investigated the combined effect of PM and UV exposure on pigment spot formation.

Methods We studied 799 women (mean age 73.5 years) of the SALIA cohort study using the SCINEXA^{TM} skin ageing score with pigment spots on cheeks and forehead. Long-term exposure to $PM_{2.5}$, PM_{10}, PM_{coarse} and $PM_{2.5absorbance}$ at residence was estimated with ESCAPE land use regression models. 5 year mean exposure to UV was obtained using the satellite data (AURA/NASA) and global radiation data from the German climate centre to yield higher resolution:

i. daily UVB exposure based on the whole daylight period and
ii. UV index based on the hour per day with maximal UV (proportional to the intensity of UV–radiation causing sunburn).

Associations between PM or UV with facial pigment spot formation and the interactions PM*UV were estimated in single and multi-pollutant multiple linear regression models.

Results UV exposure was associated with more pigment spots on the cheeks (7.6% higher score on average; 95% CI: 2.0% to 13.3%) and this effect was only slightly attenuated when adjusting for air pollution ($PM_{2.5}$: 5.0%; 95% CI: −1.2% to 11.3%). Similarly, the association between PM and pigment spot formation was still visible after adjusting for UV exposure (e.g. adjusting for UV index: $PM_{2.5}$ attenuation from 7.9%; 95% CI: 2.5% to 13.4%, to 5.9%; 95% CI: −0.2% to 11.9%). The interaction analysis showed that the association between UV and pigment spots depends on the level of PM. At lower PM levels, the UV effect was increasing (e.g. $UVBxPM_{10}$ p(interaction)=0.0069). *Vice versa*, at lower UVB exposure levels, the PM effect was increasing. All of these interactions indicated linear dose-responses.

Conclusion To the best of our knowledge, this is the first study to suggest that a hallmark of extrinsic skin ageing, i.e. facial spot formation, is the consequence of a complex interplay of at least two ubiquitous, ambient relevant factors. The adverse effects of UV on human skin might be shielded by high levels of PM and *vice versa*.

Candidates for "best poster"

1 TRANSPORT MODES AND SUBJECTIVE GENERAL HEALTH: ROLES OF MENTAL HEALTH, SOCIAL CONTACTS, AND PHYSICAL ACTIVITY

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Background/aim Transport behaviours have been associated with several positive and negative health effects. The current study evaluates the association between different modes of transport and subjective general health in an adult population in seven European cities, and explores whether mental health, vitality, perceived stress, social contacts, and physical activity are mediators of this association.

Methods A longitudinal study was performed in seven European cities (Antwerp, Barcelona, London, Örebro, Rome, Vienna, and Zürich). Participants responded to two comprehensive questionnaires (Baseline and Final) concerning their transport behaviour and health, using an on-line platform. The transport mode usage was assessed using a frequency scale (days/month) of five different transport modes: car, motorbike, public transport, e-bike, bicycle, and walking. Participants were categorised as with 'good or more' or 'less than good' subjective general health. Multilevel regression models will be used to evaluate the association between transport mode and subjective general health, adjusting for potential confounders. We will follow Vander Weele's framework to establish the mediation roles.

Results (ongoing analyses): The sample had more than 7000 adults, fairly distributed in the seven cities (16% Antwerp, 16% Barcelona, 14% London, 10% Örebro, 14% Rome, 16% Vienna, 14% Zürich). In initial analyses we find positive associations between active transport modes (e-bike, bicycle, walking) and subjective general health and negative associations between motorised transport modes (car, motorbike, public transport) and subjective general health. We also expect to find indications for mediation of these associations by mental health, vitality, perceived stress, social contacts, and physical activity.

Conclusion We hypothesise that mental health, social contacts, perceived stress, and levels of physical activity may be important consequences of transport behaviours which could lead to different levels of subjective general health.

2 CHRONIC DIETARY EXPOSURE TO MULTIPLE PESTICIDES DURING PREGNANCY AND RISK OF HYPOSPADIAS: THE FRENCH ELFE BIRTH COHORT

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Background/aim Prenatal occupational exposure to pesticides has been associated to congenital malformations, but little is known about the effect of dietary exposure in the general population. Exposure to various pesticides through dietary intake has been recently assessed in French pregnant women. We aimed to study its association with the risk of hypospadias.

Methods Among 7035 boys enrolled in 2011 the French national birth cohort Elfe, 46 have been diagnosed with hypospadias. Maternal daily intakes were estimated for 317 pesticides, based on a validated self-administered food frequency questionnaire combined with data of national monitoring programs on pesticide residues in food. Among those with non-null daily intake in >10% women (n=105), we focused on substances (n=60) with suspected endocrine disrupting properties or susceptible to impair the development of male reproductive organs. We used logistic regression to assess the risk of hypospadias in association with the dietary daily intake of 1) pesticides grouped by chemical family, or 2) individual pesticides selected a priori as the best predictors using cross-validated Elastic-Net model.

Results An increased risk of hypospadias was found statistically significant for the group of anilinopyrimidine pesticides (3rd vs 1 st and 2nd tertiles of exposure; OR=2.26, 95% CI: 1.25 to 4.11), for the organochlorine pesticides family (3rd vs 1 st and 2nd tertiles; OR=2.16, 1.20; 3.91) and for the group of amide pesticides (3rd vs 1 st and 2nd tertiles; OR=1.95, 1.08; 3.52). Three individual pesticides (among 60) were selected by the Elastic-Net procedure and showed increased risk of hypospadias for λ-cyhalothrin (3rd vs 1 st and 2nd tertiles, OR=2.34, 1.26; 4.42) and for cyprodinil (3rd vs 1 st and 2nd tertiles; OR=1.66, 0.90; 3.10) and DDT (3rd vs 1 st and 2nd tertiles; OR=1.72, 0.95; 3.15).

Conclusion Although the number of cases is small, our results are consistent with existing literature that have suggested increased risk of hypospadias in association with organochlorine pesticides. A confirmation with biomonitoring data would be give strength to the results.

3 SOCIAL INEQUITIES IN THE RISK OF DEATH FOR WOMEN DIAGNOSED WITH AN INVASIVE BREAST CANCER IN THE GIRONA PROVINCE, SPAIN

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Background/aim The residential environment of women diagnosed with breast cancer (BC) has been suggested to be a key modifier of their survival outcomes, with area deprivation and remoteness (i.e. rural/urban) as chief indicators. Here, we aimed to describe the survival of women diagnosed with an invasive BC in the Girona province (Spain) during 2000–2013 based on the characteristics of their residential area.

Methods We restricted our analysis to incident invasive BC tumours (ICD-10: C50.X) diagnosed in the Girona province (2000–2013). Data on tumour characteristics and vital status of patients were collected from the population-based Girona Cancer Registry. Bilateral tumours, death certificate and autopsy only cases were excluded. The last updated address of the patients was used to spatially assign them to a census area. We updated and improved a previously validated census area level deprivation index for Spain1. For area remoteness, we used the recommended standard of 150 inhab/km^2. A multivariate hazard model for relative survival with frailty and spatial adjustment was fitted. The models were fully adjusted for all available clinical and demographic variables, and hazard ratios (HR) were estimated

Results A total of 4609 women were diagnosed with invasive BC in the Girona province during 2000 and 2013. Women living in areas classified by our deprivation index as being affluent and deprived, showed slightly higher hazards of death (HR=1.12, 95% CI=0.93 to 1.34 and HR=1.08, 95% CI=0,91 to 1,29, respectively) compared to those with an intermediate deprivation level, yet differences were not significant. Nevertheless, women living in urban areas did show a slightly significant decreased risk of death compared to women living in rural areas (HR=0.84, 95% CI: 0.71 to 0.99).

Conclusion This is the first study to assess the effect of census area deprivation and remoteness on BC survival in the Girona province, and one of a few in Spain. Our results suggest there is no significant inequity by census-area deprivation. However, there exists a slightly poorer survival for women living in rural areas. This can be used to support regulatory approaches to tackle social inequities.

4 COMPARISON OF TWO ALTERNATIVE METHODOLOGIES TO ESTIMATE THE WEEKLY INTAKE OF CADMIUM IN AN ITALIAN POPULATION

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Background/aim Cadmium (Cd) is a human carcinogen. In non-smoking and non-occupationally exposed subjects diet is the main source of exposure. The Tolerable Weekly Intake-TWI of 2.5 µg/kg body weight has been recently set by the European Food and Safety Authority in order to guarantee a high protection to general population. In this study, we aimed to compare two different methods to estimate its weekly intake.

Methods In a random sample of the adult general population of Modena, Northern Italy, we collected information about personal characteristics and life styles and dietary habits using the European Prospective Investigation into Cancer and Nutrition-EPIC semi-quantitative self-administered food frequency questionnaire. Then we measured Cd levels in a fasting serum sample using inductively coupled plasma mass spectrometry

(ICP-MS). Two methods assessing Cd intake were implemented, the first one through dietary questionnaire and the second one from levels of biomarker. To do that, we considered the ratio between total and circulating Cd, the percentage of absorption of Cd ingested with foods and the contribution of tobacco smoke.

Results We recruited 51 subjects (male/female: 26/25) with mean age of 50 years (range: 35–71). Median (interquartile range-IQR) of dietary Cd intake was 13.4 µg/day (IQR: 10.4–16.8) estimated with the EPIC questionnaire. Serum median level of Cd was 0.041 µg/L (IQR: 0.030–0.054). The weekly intake (WI) of Cd was 1.34 µg/kg body weight (IQR: 0.85–1.70, range: 0.26–3.18) and 0.78 µg/kg body weight (IQR: 0.62–1.09, range: 0.27–2.47) based on dietary questionnaire and biomarker data, respectively. In this Italian population, we found higher WI of Cd using the dietary questionnaire than using serum sample. This difference in Cd WI highlights the importance in evaluating the relation between dietary intake and levels of biomarker when assessing the individual exposure.

Conclusion Dietary assessment methods based on FFQ might therefore overestimate Cd WI, or alternatively a higher ratio between dietary and serum Cd has to be considered compared to what predicted by literature data. Finally, possible health concerns could be highlight for some subjects of the study population with Cd WI higher than level recommended by the European Food and Safety Authority.

5 ASSOCIATIONS OF MATERNAL TYPE 1 DIABETES WITH CHILDHOOD ADIPOSITY AND METABOLIC HEALTH IN THE OFFSPRING

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Background/aim Exposure to the intrauterine hyperglycemic environment has been suggested to increase the offspring's later overweight and metabolic risk, but conclusive evidence for pregnancies affected by maternal type 1 diabetes (T1D) is still lacking. Further, it is unknown whether changes in the offspring's metabolome are in the potential pathway.

Methods We analysed data from 610 and 2169 offspring having a first-degree relative with T1D from the TEENDIAB and BABYDIAB/BABYDIET cohorts, respectively. Associations of maternal T1D with anthropometric and metabolic outcomes in the offspring, assessed longitudinally at 0.3–18 years of age, were investigated using mixed regression models. Non-targeted metabolomics measurements were carried out in 500 fasting serum samples from TEENDIAB and associated with maternal T1D and offspring overweight.

Results Offspring of T1D mothers had a higher body mass index standard deviation score (SDS) and an increased risk for overweight than offspring of non-diabetic mothers (e.g. odds ratio for overweight in TEENDIAB: 2.40 (95% confidence interval: 1.41; 4.06)). Further, waist circumference SDS, fasting levels of insulin and C-peptide, as well as insulin resistance and abdominal obesity were significantly increased in offspring of T1D mothers, even when adjusted for potential confounders and birth weight. Metabolite patterns related to androgenic steroids and branched-chain amino acids were found to be associated with offspring's overweight, but no significant associations were observed between maternal T1D and metabolite concentrations in the offspring.

Conclusion Maternal T1D is associated with offspring's overweight and metabolic health in later life, but this is not likely due to alterations in the offspring's metabolome.

6 MOSS BIOMONITORING AS AN ALTERNATIVE TO ASSESS EXPOSURE TO ATMOSPHERIC METALS IN ENVIRONMENTAL EPIDEMIOLOGY: THE EXAMPLE OF THE BRAMM NETWORK AND THE GAZEL COHORT

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Background/aim Measuring atmospheric metals is challenging due to their low concentrations in the air and the cost of measurements using conventional devices in monitoring stations. To conduct epidemiological research on exposure to atmospheric metals we must expand the network of monitoring stations, or find different ways of quantifying levels of atmospheric metals.

Methods Fortunately, such an alternative exists in an unexpected form: the moss biomonitoring approach, based on the ability of mosses to proxy levels of atmospheric metals. Our objective is to assess the feasibility to assign atmospheric metals exposure estimates, using moss biomonitoring, in an epidemiological cohort.

Framed by BRAMM, the French network of moss biomonitoring, mosses were surveyed for their content in 13 metals including Hg and Pb in1996, 2000, 2006 and 2011 in 449–559 forest sites. After sample preparation and chemical analyses, data were interpolated by kriging to produce 2 × 2 km maps, from which we extracted levels of atmospheric metals at the residential address of GAZEL's participants.

Results As biomonitoring data comes from mostly rural areas, we estimated exposures to atmospheric metals for for 11 382 participants of the GAZEL population living in low to moderate population density areas. We obtained a high spatial and temporal variability of exposure for all metals (e.g. 38 to 139 ng.g-1 for Hg, or 1.8 to 49.8 mg.g-1 for Pb). Exposures to all metals followed gradients of population density and showed higher concentrations in industrial regions, such as the Parisian region, the North or the Rhone valley.

Conclusion Moss biomonitoring is a convincing tool to assess exposure to atmospheric metals, at least in non-urban areas, and can be easily associated to epidemiological data. Further research will investigate the possibility to collect and use moss biomonitoring in urban areas for epidemiological purposes.

7 AIR POLLUTION EXPOSURE DURING DIFFERENT TIME WINDOWS FROM BIRTH AND LUNG FUNCTION GROWTH UP TO ADOLESCENCE

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Background/aim Air pollution exposure has been associated with lower lung function in children. Evidence on relevance of exposure during various stages of childhood and potential effects of exposure on lung function growth into adolescence is lacking.

Methods Within the Dutch PIAMA birth cohort, we conducted cross-sectional (n=721) and longitudinal analyses (n=915) of associations of time window air pollution exposure with lung function at 16 years and lung function growth from 8 to 16 years respectively. We estimated average concentrations of nitrogen dioxide (NO2), particulate matter with aerodynamic diameters<2.5 (PM2.5),<10 (PM10), 2.5–10 µm (PMcoarse), and PM2.5 absorbance at home addresses since birth using land use regression models. Time window average exposures included: birth, preschool (birth–4 years), primary school (4–12 years) and secondary school (12–16 years) periods. We analysed associations of time window exposures with lung function and lung function growth using linear regression and linear mixed effects models.

Results Higher air pollution levels during all time windows were associated with lower forced expiratory volume in 1 s (FEV1) in adolescence, e.g. -2.36% (95% CI: −3.76 to −0.94) per interquartile range (IQR, 1.18 µg/m^3) increase in secondary school time window PM2.5, and with reduced FEV1 growth e.g. difference in 1 year growth per IQR (0.8 µg/m^3) increase was −0.28% (95% CI:−0.44 to −0.11) per IQR increase in PM10 at birth. Results were similar for all pollutants and prominent in males than in females.

Conclusion Air pollution exposure during all time windows was associated with lower lung function (growth) from childhood into adolescence.

8 THE INTERACTIVE EFFECTS BETWEEN PARTICULATE MATTER AND TEMPERATURE ON MORTALITY IN BEIJING, CHINA

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Background/aim The interactive effects between temperature and inhalable particulate matter (aerodynamic diameter <10 µm, PM_{10}) on mortality have been examined in some previous studies, but the results were inconsistent. This study aim to explore whether the effects of PM_{10} on daily non-accidental, cardiovascular and respiratory mortality are modified by temperature level in Beijing from 2006 to 2009.

Methods We applied bivariate response surface model and temperature-stratified model based on time-series Poisson generalised additive model (GAM) to examine the interactive effects in single- and two-pollutant models. The modification of age and gender were examined in subgroup analyses.

Results We found that the effect estimates of PM_{10} varied across temperature levels for non-accidental and different cause-specific mortalities. The PM_{10} effects in high levels of temperature were stronger than in low levels for non-accidental and respiratory mortality. For cardiovascular mortality, the effects were only statistically significant in low temperature level at current day, which was stronger than in high temperature level. The effects of PM_{10} for female were stronger than male in high temperature level, while in low temperature level, the effects were stronger for male group. The effects of PM_{10} were stronger for elder people (≥65) in both high and low temperature levels. Compared with low temperature, the effects were stronger in high levels for both of the age groups.

Conclusion The daily mortality attributed to PM_{10} could be modified by temperature. The interaction between air pollution and global climate change has potential strategy and policy implications.

9 RISK OF AMYOTROPHIC LATERAL SCLEROSIS AND PASSIVE RESIDENTIAL EXPOSURE TO PESTICIDES: COMPARISON OF QUESTIONNAIRE-BASED WITH GIS-BASED EXPOSURE ASSESSMENT METHODS

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Background/aim Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease with still unknown aetiology. Among environmental factors, pesticides have been investigated due to their potential neurotoxic effects. Within a population-based case-control study conducted in two Italian regions, we aimed to investigate ALS risk due to passive residential exposure to pesticides using two methodologies.

Methods The exposure assessment was carried with an individual questionnaire, which collected information of the entire residential history of subjects, focusing on rural residence or in the vicinity of agricultural areas. It was compared with assessment based on geographical information system (GIS), avoiding direct contact with study subjects. To do that, we computed the percentage (≥50%) of rural land use within the 100 m round buffer around each subjects' residence, according to cover maps of two periods available from the Department of Agriculture, recent (2003–2009) and historical (1978–1989) ones. Risk for passive residential exposure to pesticides was computed using a sex and age adjusted logistic regression model for both methods, and their agreement was assessed using Cohen's kappa (k).

Results The odds ratio (OR) with their 95% confidence intervals (CI) for passive residential exposure to pesticides was 1.67 (95% CI 0.87 to 3.20) from the questionnaire-based assessment, while ORs from the GIS-based assessment were 1.05 (0.40 to 2.73) and 1.13 (0.49 to 2.63) for the recent and historical period, respectively. The agreement between two methods considering all participants was generally moderate to high, with k of 0.564 (95% CI:

0.361 to 0.767) and 0.648 (0.494–0.802) for recent and historical periods, respectively. Analyses divided between cases and controls yielded similar results, with k of 0.468 (0.133–0.803) in cases and 0.630 (0.382–0.879) in controls for recent period, and 0.642 (0.380–0.904) in cases and 0.652 (0.464–0.840) in controls for historical one.
Conclusion Our results showed a slight increased risk of passive exposure to pesticides using the questionnaire-based assessment, with less conclusive results from the GIS-based one. The similar agreement either between periods and case/control status, suggested also that no substantial information bias and differential exposure misclassification occurred when assessing pesticides exposure in our population.

Air pollution I

P I – 1–1 ASSESSMENT OF VARIABILITY OF COMMUTING-RELATED AIR POLLUTANT EXPOSURES IN DIFFERENT IN-VEHICLE MICROENVIRONMENTS

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Background/aim In-vehicle microenvironments can contribute significantly to human daily exposure to traffic-related air pollutants, which have been associated with adverse respiratory, cardiovascular and reproductive health outcomes. Despite recent advances in commuters exposure research, variations in exposure between different routes and transport modes present a challenge for health effects studies.
Methods Commuters exposure to traffic-related air pollution was studied for two public transportation routes with different length and various car intensities in Kyiv city, Ukraine. Concentrations of PM10, PM2.5, PM1, CO and CO2 were measured between July and October on 42 weekdays during traffic peak hours while commuting by bus and by light vehicle. Light car microenvironment was tested for 2 cabin ventilation modes: windows opened without air conditioning system (A/C) working and windows closed with A/C turned on. Additionally, background measurements were conducted at an urban background location.
Results It was revealed that pollutants concentrations in all transport modes for both routes were higher than respective background values. The highest median PM10 exposures were registered in public buses (66 $\mu g/m^3$ for PM10, 33 $\mu g/m^3$ for PM2.5 and 0.25 $\mu g/m^3$ for PM1) following the longest route and lowest in cars with closed windows and working A/C (14 $\mu g/m^3$ for PM10, 11 $\mu g/m^3$ for PM2.5 and 17 $\mu g/m^3$ for PM1). Median CO exposure was highest in the car when windows opened without A/C (3.1 ppm), while median CO2 concentrations were the highest in the car with A/C turned on and closed windows (1841 ppm). It was observed that turning car cabin air conditioning system on could reduce PM exposure by 50%–60% depending on size as well as to further improve ventilation rate and filtration efficiency.
Conclusion The results revealed that observed variability of commuting-related pollution levels is predefined by commuting route, vehicle type and cabin ventilation mode. Findings of this research proved that exposure to air pollutants in vehicle microenvironments should be accounted in studies of impacts of daily air pollution exposures on human health.

P I – 1–2 AIR POLLUTION AND ELDERLY MORTALITY IN SÃO PAULO, BRAZIL: AN ANALYSIS OF CUMULATIVE RISK INDEX FROM MULTIPOLLUTANT MODELS

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Background/aim Considering the difficulty to separate the effects from individual pollutants present in mixtures, the cumulative risk index (CRI) estimates the combined effect from several pollutants together. We evaluated the association between air pollution exposure and daily elderly mortality using CRI from multipollutant models.
Methods This study was a daily time series of non-accidental and cause-specific mortality among the elderly living in São Paulo, Brazil, between 2000 and 2011. Effects of NO2, particulate matter smaller than 10 µm (PM10), carbon monoxide (CO) and ozone (O3) were estimated in Poisson generalised additive models. The single lag effect (lags 0 and 1) and the cumulative effect (lag 0 to 10) were evaluated in one, two-, three- and four-pollutant models and the CRI was estimated for each model. Air pollution effect estimates are presented as percentage increase or decrease in the number of deaths, and their 95% confidence interval (CI), for the interquartile range of air pollutants.
Results An association between NO2, PM10, CO and O3 exposures and deaths was found in one- and multipollutant models. For circulatory deaths, the CRI of NO2, for lag 1 (1.13%; CI: 0.69 to 1.57) and the cumulative lag 0–10, was close to the CRI of the four-pollutant model (1.49% for lag 1 (CI: 0.91 to 2.06)). For respiratory deaths, the CRI from the two-pollutant model with CO and O3 (12.34% for lag 0–10 (CI: 7.12 to 17.81)) represents the largest fraction of the CRI from the four-pollutant model (12.23% for lag 0–10 (CI: −2.65 to 29.38)). For non-accidental deaths, the pattern differs per lag. For lag 1 the CRI of all two-, three- and four-pollutant (1.49%; CI: 0.91 to 2.06) models was similar.
Conclusion The results suggest that air pollution mixtures have an effect on elderly mortality. The CRI documented that single pollutants did not fully capture the risk of the mixture.

P I – 1–3 MORTALITY AND MORBIDITY EFFECTS OF LONG-TERM EXPOSURE TO LOW-LEVEL PM2.5, BLACK CARBON, NO_2 AND O_3: AN ANALYSIS OF EUROPEAN COHORTS

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Background/aim Epidemiological cohort studies have consistently found associations between long-term exposure to outdoor air pollution and a range of morbidity and mortality

endpoints. Recent evaluations by World Health Organisation and Global Burden of Disease study suggested that these associations may be non-linear and persist at very low concentrations.

Methods We focus on analyses contributing to knowledge about health effects of air pollution concentrations at low concentrations, defined as less than current EU, EPA and WHO Limit Values or guidelines for PM2.5, NO_2 and O_3. Studies have focused especially on PM2.5, but increasingly associations with NO_2 are reported. Very few studies have evaluated long-term morbidity and mortality effects of O_3.

We perform analyses of all-cause and cause-specific mortality and morbidity endpoints in a pooled dataset of 10 ESCAPE study cohorts and the Danish Nurse Cohort with detailed individual data (~3 80 000 subjects) and in seven very large European administrative cohorts (~35 million subjects). We focus on PM2.5, NO_2, O_3, and exploit rich monitoring data of black carbon (BC) available from the ESCAPE study.

Results The first results are expected mid 2018. So far, we completed exposure assessment – using hybrid LUR models we made European maps of 2010 concentrations for PM2.5, NO_2, O_3 and BC. As individual cohort data are pooled, we developed common codebook harmonising variables between cohorts. We also obtained additional residential addresses histories. Further, we developed data transfer and management procedures. Data from all cohorts has been transferred and checked. Follow up is extended until 2013. We established secure remote access environment so that analysts involved can perform analyses without physically travelling to Utrecht. Finally, common statistical analysis scripts have been developed and afterwards demonstrated and discussed during the Stat Workshop (Utrecht, 25–27 Oct 2017).

Conclusion There are no conclusions yet from this study.

P I – 1–4 SOURCE-RELATED COMPONENTS OF PM2.5 AND LONG-TERM HEALTH EFFECTS: EPIDEMIOLOGICAL FINDINGS OF SUPERSITE PROJECT IN ITALY

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Background/aim Supersite project collected detailed measurements on chemicals, physical and toxicological parameters of atmospheric aerosols in Emilia-Romagna region (Northern Italy) in 2012–2014. Aim of the present study was the assessment of long-term effects of PM2.5 and its sources on natural, respiratory and cardiovascular mortality in an open residential cohort.

Methods We built a cohort (age ≥29 years) in 47 municipalities for 2001–2010. We collected mortality data for 2009–2013. 3 year measurements of daily concentration and constituents of PM2.5 were made at 4 sites and were analysed through a Source Apportionment approach identifying 6 sources. For each source, the annual percentage contribution in each site was estimated, and these data were used to estimate exposure, according to both the site and to the yearly average value of PM2.5 at each address, derived from a LUR model. Yearly concentration map from regional dispersion models were also used to consider temporal variations. We used Cox models with time-dependent exposures. Bi-pollutant model was performed, adjusting for the remaining PM2.5 mass, to verify independent effect of each source.

Results The cohort includes about 2 million inhabitants (6,011,667 person-years) with 82 624 deaths for natural causes. Identified sources were Traffic, Biomass Burning, Oil Combustion, Anthropogenic Mix; Secondary Nitrates and Secondary Sulfate. We observed an association between PM2.5 total mass and natural mortality (HR=1.007; 95% CI: 1.004 to 1.011 per 1 $\mu g/m^3$ PM2.5). 1-unit increment of BB and OC were associated with an increased risk of natural mortality, independent from the remain part of PM2.5 (HR=1.015; 95% CI: 1.005 to 1.025 and HR=1.035; 95% CI: 1.005 to 1.065, respectively). Respiratory mortality showed HR comparable to natural mortality (HR=1.008; 0.995–1.020 per 1 µg/m3 PM2.5), while association with cardiovascular mortality were equal to 1.003 (95% CI: 0.998 to 1.009 per 1 $\mu g/m^3$ PM2.5).

Conclusion A large residential cohort was built to examine the long-term impact on mortality of exposure to Source-related components of PM2.5. This study suggests an effect of long-term exposures for some specific sources, both on natural and respiratory mortality indicating a relevant role of Biomass Burning and Oil Combustion. These findings can be useful to orientate the pollution reduction policies

P I – 1–5 ASSOCIATION BETWEEN AIR POLLUTION AND SEVERITY OF RHINITIS IN TWO EUROPEAN COHORTS

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Background/aim Little is known about the effects of outdoor air pollution on severity of rhinitis. The objective is to assess the association between modelled PM_{10}, $PM_{2.5}$ and NO_2 concentrations and severity of rhinitis in two multicenter European cohorts on respiratory health (EGEA and ECRHS).

Methods 1603 adults with data on air pollution and on severity of at least one rhinitis symptom were included. Annual exposure to NO_2, PM_{10} and $PM_{2.5}$ was estimated at participants' residential address using land use regression models thanks to the ESCAPE project. Severity of rhinitis was defined in two ways:

- according to the importance of the disturbance due to four symptoms of rhinitis (runny nose, blocked nose, sneezing and itchy nose) categorised in 3 groups: no (reference), mild or high severity,
- using an overall score of severity including disturbances to all symptoms, varying from 0 to 12.

Polytomous logistic or linear regression was used, and the city was further included as a random effect. Adjusted odds ratio are presented for an increase of 10 $\mu g.m^{-3}$ of NO_2 and 5 $\mu g.m^{-3}$ of $PM_{2.5}$.

Results The 1603 adults (mean age=52.5 years, 45% men, 73% from ECRHS) from 17 cities had a median[Q1-Q3] score of severity of 4[2–6]. Exposure to air pollution was associated with an increased score of severity of rhinitis (aOR [95% CI] for NO_2: 1.13 [1.03–1.25], for $PM_{2.5}$: 1.85 [1.47–2.33]). Exposure to NO_2 was also associated with an increased severity of blocked nose (aOR for NO_2: 1.17 [1.06–1.30] for mild and 1.21 [1.10–1.33] for high severity) and similarly with runny nose, but not with itchy nose or sneezing. Exposure to $PM_{2.5}$ or PM_{10} was associated with mild severity for blocked nose and with high severity for all symptoms (aOR for blocked nose for $PM_{2.5}$: 1.41 [1.06–1.88] for mild and 1.91 [1.46–2.51] for high severity). Similar results were found when considering city as a random effect.
Conclusion Severity of rhinitis and particularly blocked nose symptoms are associated with air pollution exposure.

P I – 1–6 AMBIENT AIR POLLUTION AND DIABETES – A SYSTEMATIC REVIEW

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Background/aim Outdoor air pollution exposure is suggested to induce changes in glucose tolerance, insulin sensitivity and β-cell function, which are considered markers of type 2 diabetes (T2D) and suggest a causal relationship with ambient air pollution and diabetes development. However, patients with diagnosed diabetes have also shown more vulnerability to the morbid effects of air pollution exposure.
Methods The last comprehensive systematic review was published more than two years ago and summarised the knowledge based on papers published 3–4 years ago. Since the last searches for this review, several high quality papers have been published, which makes an extended systematic review highly warranted. The aim of this epidemiological systematic review is to investigate and critically analyse the relationship between the exposure to ambient air pollution and diabetes with a specific focus on publications of the last 3–4 years.
Results The search string included keywords such as 'air pollution', 'PM10', 'PM2.5', 'type 2 diabetes', 'insulin resistance' and 'glucose tolerance', yielding 173 articles from which 65 studies were abstract screened. Many of the publications included were recently published, within the past three years, making this review notable and well-timed. Preliminary analyses show, most studies indicate positive associations between exposure to air pollutants and T2D prevalence. Furthermore, groups susceptible to adverse outcomes after ambient air pollution exposure have been identified, among which are the obese and those diagnosed with myocardial infarction or diabetes. Further meta-analysis is still being conducted.
Conclusion Recent publications strengthened the body of evidence for adverse effects of exposure to ambient air pollutants on T2D and that diabetics are particularly vulnerable when exposed to air pollutants. Better understanding of patho-mechanisms is important and would contribute considerably to the public health impact given the global exposure to air pollution and the growing diabetes epidemic.

P I – 1–7 EFFECTS OF AIR POLLUTION AND PHYSICAL ACTIVITY ON BLOOD PRESSURE

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Background/aim The increased inhalation rate during physical activity in urban environments may result in increased inhaled dose of traffic-related air pollutants. Short-term exposure to traffic-related air pollutants has been associated with increasing blood pressure. The current study assesses the main effects and interaction effects of traffic-related air pollution and physical activity on blood pressure.
Methods A panel study was performed in three European cities (Antwerp, Barcelona, and London) with 122 healthy adults (approx. 40 participants/city) who completed 7 day measurement periods in winter, summer, and mid-season, between February 2015 and March 2016. The participants wore sensors to measure exposure to black carbon (marker of traffic-related air pollution) and physical activity levels. Blood pressure was measured three times during each measurement period. Participants also completed a questionnaire about their personal characteristics and lifestyle behaviours. Multilevel regression models will be used to assess associations and interaction effects. All models will be adjusted by potential confounders.
Results (ongoing analyses): Participants had a median (IQR) moderate-to-vigorous physical activity of 71 (49–111) min/day measured by an accelerometer. Mean black carbon exposure over all sample in coinciding time periods was 1636±673 ng/m^3. The mean black carbon exposure increased with higher levels of physical activity. In initial analyses we find associations between the two exposures (black carbon and physical activity) and blood pressure. We also expect to find that physical activity levels moderates the negative effects of black carbon exposure on blood pressure.
Conclusion We hypothesise that the cardiovascular effects from traffic-related air pollution exposure could be attenuated by physical activity levels.

P I – 1–8 ASSOCIATIONS BETWEEN EXPOSURE TO DIFFERENT AIR POLLUTANTS AND SEVERAL BLOOD PRESSURE (BP) PARAMETERS

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Background/aim Thus far, several studies examined the short-term effects caused by exposure to air pollution, on the development of high blood pressure and hypertension, whereas these studies presented contradicting conclusions, the following

study aims to confirm some of the conclusions reached before, by using a continuous peripheral BP measuring machine.

Methods The study sample included 50 Individuals at the ages of 18–55, free of cardiovascular disease, with normal blood pressure values at the beginning of the experiment. A blood pressure test was conducted while performing the following successive activities: 60 s of resting, 15 s of hand exercise using power grip, 30 s of resting.

Data from Israel Ministry of Environmental Protection monitors, placed in Haifa, were used in order to estimate ambient of fine particles (PM2.5), aerodynamic diameter ≤10 µm (PM10), nitrogen oxide (NO), nitrogen dioxide (NO2) and general nitrogen oxides (NOx) exposures at the test day.

Results No correlations were found between the simple blood pressure test conducted and the concentrations of air pollutants measured in the study area, or when trying to match the rate of increase in blood pressure during the hand exercise, to any specific air pollutant.

However, the results did show good correlations between the concentrations of air pollutants measured and the variance of the systolic, diastolic and the difference between this two. It seems that as higher the pollutants concentration, as the difference between the maximum and the minimum of the BP values is smaller.

Conclusion The results have shown interesting connexion between the variety in BP rate at the tested population and the pollutants concentration in the tested area. Nevertheless, it may be needed to use a larger sample size and to improve the measurement of the health outcome. Specifically, it may be beneficial for each patient to carry a body monitor while performing the test.

P I – 1–9 HEALTH EFFECTS OF ULTRAFINE PARTICLES – A SYSTEMATIC LITERATURE REVIEW

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Background/aim Evidence from toxicological studies suggests that Ultrafine Particles (UFP) can be inhaled deeply into the lungs and can infiltrate the blood stream. Therefore, UFPs might be more harmful for human health than larger particles. Since the last systematic review, new epidemiological studies were published. Thus, we aimed for an updated review of studies evaluating the health effects of UFPs.

Methods We systematically searched in MEDLINE and the LUDOK database applying two search strategies identifying relevant epidemiological studies published after the HEI-review from 2013 until May 2017. We considered quantitative health effects of environmentally related UFPs (with at least one of the following measurements: UFP particle mass <100 nm, Quasi-UFP particle mass <250 nm, particle number concentration <100 nm, Nucleation mode, Accumulation-mode, Aitken-mode and/or surface area concentration). Studies investigating effects of industrially generated nanoparticles or particles emitted in workplace settings, as well as toxicological and controlled exposure studies were excluded. No limitations were set concerning the health endpoints. Only German and English articles were included.

Results We identified 80 epidemiological studies for our review, including 29 panel, 13 time-series, 9 crossover, 8 cross-sectional, 7 cohort, 6 case-crossover, 4 scripted exposure, and 2 case-control studies. Two studies were not classified according to our categories. Most studies (73) had a short-term study design. The analyses are ongoing and the results will be presented at the conference.

Conclusion The variety and number of studies identified through our literature review poses the need to systematically reassess the health effects of UFPs. Consequently, there is also the need to assess the study quality to further appraise the harmful effects of UFPs.

Environmental contaminants and pesticides

P I – 2–1 LITERATURE REVIEW OF WORKPLACE INTERVENTIONS WITH RESPECT TO RISK MANAGEMENT MEASURES AND THEIR IMPACT ON EXPOSURE LEVELS & COMPARISON OF OBSERVED AND PREDICTED EXPOSURE REDUCTIONS TO HAZARDOUS SUBSTANCES

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Background/aim Control banding tools (CBT) offer an easy approach to identify risk management measures (RMMs) reducing worker exposure to hazardous substances. Intervention studies play an important role in monitoring the effectiveness of specific RMMs and their predicted potential to reduce exposure. We review a collection of published intervention studies comparing observed with CBT-predicted exposure changes.

Methods Intervention studies published in English from 1999 up to January 2017 were considered for inclusion based on a systematic search of Pubmed. Events were defined as workplace interventions when they aimed at reducing occupational exposure to hazardous substances due to a change in or an introduction of RMMs or where reductions occurred as a side effect, e.g. due to changes in the production process.

Where applicable, observed/monitored reductions in exposure are compared with predicted or anticipated exposure changes according to a qualitative CBT and the respective reduction factors and their estimated relative effectiveness for RMMs.

Results In total 50 intervention studies have been included in this review with a very broad scope spanning a variety of approaches at a variety of workplaces in different industries including, but not limited to, studies in the metal industry, rubber manufacturing, bakeries, printing, on welding or dust in construction. Methods and findings varied considerably between the reviewed studies and hence limit the scope to directly compare results and subsequently the effectiveness of the different interventions.

Overall the interventions reviewed have succeeded at reducing exposure levels. The comparison of observed exposure reductions with changes predicted according to CBT will facilitate an assessment and evaluation of the efficacy of RMMs.

Conclusion There is evidence that decreases in workplace exposure levels followed a variety of interventions in a variety of industries underlining the benefits of implementing RMMs

at workplaces. However, at this point neither a clear tendency regarding the best choice of RMMs/or classes of RMMs can be ascertained nor any specific recommendations for workplace risk assessment can be made.

P I – 2–2 DEMOGRAPHIC AND DIETARY RISK FACTORS IN RELATION TO URINARY METABOLITES OF ORGANOPHOSPHATE FLAME RETARDANTS IN TODDLERS

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Background/aim Organophosphate flame retardants (OPFRs) are increasingly used in consumer products and are widely detected in adults. Carcinogenicity and damage to immunologic, neurologic and developmental systems are observed in human cell lines along with reproductive changes in adult males. Young children are vulnerable to OPFR exposure, but little is known about children's exposure levels or risk factors.
Methods We examined parent-reported demographic and dietary survey data in relation to urinary metabolite concentrations of three OPFRs [Tris (1,3-dichloro-isopropyl) phosphate (TDCPP), triphenyl phosphate (TPP), and isopropylated triphenyl phosphate (ITP)] in 15- to 18 month old toddlers (n=41) residing in Seattle, Washington State, USA. Urinary metabolite concentrations were $\log_{10}$-transformed and adjusted for urinary specific gravity. Multiple linear regression, adjusting for lab, annual maternal income, and child sex, was used to evaluate associations between metabolite concentrations and demographic and dietary predictors.
Results OPFR metabolites were detected in 100% of subjects. The metabolite of TPP, diphenyl phosphate (DPP) was detected most commonly (100%), with TDCPP metabolite, bis (1,3-dichloro-2-propyl) phosphate (BDCPP), detected in 85%–95% of samples, and ITP metabolite, monoisopropylphenyl phenyl phosphate (ip-DPP), detected in 81% of samples (n=21). Toddlers of mothers earning <$10 000 annually had geometric mean DPP concentrations 66% higher (p=0.05) than toddlers of mothers earning > $10,000/year (7.8 ng/mL, 95% CI: 5.03 to 12.11 and 4.69 ng/mL, 95% CI: 3.65 to 6.04, respectively).
Conclusion Our study confirmed ubiquity of OPFR exposure in toddlers. Very low maternal income was a significant predictor of OPFR metabolite concentrations. While no dietary factors were significantly associated with exposure levels, results suggested meat and fish consumption may be associated with higher OPFR levels while increased dairy and fresh food consumption may be associated with lower OPFR levels.

P I – 2–3 THE PROBLEMS OF CONTAMINATION OF BREAST MILK BY ORGANOCHLORINE PESTICIDES IN THE OSH PROVINCE OF THE KYRGYZ REPUBLIC

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Background/aim The aim is to study the contamination of breast milk (BM) by organochlorine pesticides (OCPs) in the Osh Province.
Methods Determination of organochlorine pesticides (OCPs: HCH: α-HCH, γ-HCH, β-HCH, DDT, DDE and DDD, aldrin and dieldrin, heptachlor) in breast milk samples of 95 lactating women were performed by gas chromatography on a chromatograph 'Tsvet-164'.
Results The following OCPs were detected in breast milk samples: HCH: α-HCH, γ-HCH, DDT and DDE, the other OCPs were not identified. Positive results for OCPs were reported in 58 (61.0%) samples. One type of OCPs was detected in 34 (58.6%), 2 types of OCPs in 18 (31.0%), 3 types in 5 (8.6%) and 4 types in 1 (1.7%). α-HCH was found in 23 (39,7%), γ-HCH in 18 (31,0%), DDE in 16 (27.6%) and DDT in 1 (1.7%). The highest number (80%) of OCPs was found in samples of women who lived near the former pesticide storehouses and agro-airstrips. The lowest (20%) – in samples of women who lived in mountain areas. The total maximum concentration of OCPs in breast milk samples was 2.24 μg/L.
Conclusion Thus, children of the women with OCPs detected in breast milk are 7 times more likely to have pathologies as compared to children of women whose breast milk samples do not contain any OCPs. The higher the concentration of OCPs in breast milk, the higher the number of pathologies diagnosed in children.

P I – 2–4 EXPOSURE TO PERSISTENT ORGANIC POLLUTANTS AND RISK OF METABOLIC SYNDROME IN THE POPULATION OF CATALONIA

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Background/aim Persistent organic pollutants (POPs) are man-made chemical compounds usually produced for agricultural and industrial applications, and possess notable toxicity potential and persistence, hence posing a threat to humans and the environment.

Exposure to POPs has been related to increased risk of some diseases such as diabetis and most recently, Metabolic Syndrome (MetS).
Methods Metabolic Syndrome is a group of risk factors characterised by central obesity, dyslipidemia, glucose intolerance and arterial hyperthension. The relationships between POPs and MetS are, however, not well established yet. Moreover, the relationships between POPs and lipid-related factors such as the body mass index (BMI) or blood cholesterol and tryglicerides can unmask the real associations between concentrations of POPs and MetS. Different statistical methodologies have been used to assess the relationships between exposure to POPs and MetS, including generalised linear modelling (GLM), environment-wide association studies (EWAS) and mediated models, a kind of structural equation modelling (SEM).
Results This research assesses the prevalence of Metabolic Syndrome in a Mediterranean general population (that of Catalonia, in Southern Europe, n=919) against a set of persistent organic pollutants, including organochlorine pesticides (OCPs), polychlorobiphenyls (PCBs) and polybromodiphenyl ethers (PBDEs), using several statistical approaches. The models were

additionally adjusted by several covariates such as age, sex, social class, educational level, physical exercise, smoking habit and alcohol consumption. Alike GLM or EWAS, mediated models allowed to take into account mutual confounding effects between variables in both sides of the equation, including age, sex, the BMI and blood lipid content. Those variables had also an effect in the accumulation patterns of POPs in human populations.

Conclusion Using structural equation modelling, several organochlorine pesticides (including hexachlorobenzene, beta- and gamma-HCHs and 4,4'-DDE) and one polychlorobiphenyl (PCB-118) have been found to be strongly associated with Metabolic Syndrome. Also the OCPs alpha-HCH and 4,4'-DDT, and the PBDE congeners' 66 and 71 have shown an association with MetS, but to a lower degree (90% of probability).

P I – 2–5 URINARY CONCENTRATIONS OF ORGANOPHOSPHATE AND PYRETHROID METABOLITES FROM TWO SPANISH POPULATIONS

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Background/aim Organophosphate (OP) and pyrethroid (PYR) pesticides have a strong potential to disrupt the brain and nervous system of insects. This neurotoxic effect is not highly selective and therefore the compounds are also toxic to other non-target species, including humans. Once in the human body, OP and PYR pesticides are typically metabolised and excreted in urine within 4–48 hours after exposure.

Methods A new analytical methodology for the quantification of OP and PYR urinary metabolites has been developed taking into account the wide range of concentrations of these compounds in humans from general and highly exposed populations (e.g. rural or agricultural areas). Six biomarkers of OP pesticides and two biomarkers of PYR compounds have been quantified by ultra-performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS). This methodology has been externally checked-out by participation in rounds of the G-Equas programme.

A total of 125 urine samples from two adult Spanish populations have been analysed: farmworkers (n=45) and individuals living in urban and rural areas (n=80) from Catalonia and Galicia.

Results The most abundant OP metabolites were PNP (metabolite of parathion and methyl paration, found in all samples analysed), followed by TCPY (metabolite of chlorpyrifos, found in 95% of the samples) and DEAMPY (metabolite of pirimiphos, 77% of detection), with median concentrations of 1.8 ng/ml, 1.1 ng/ml and 3.2 ng/ml, respectively. None of the samples had MDA (metabolite of malathion), and a few of them (<5%) had detectable concentrations of IMPY and CMHC (metabolites of diazinon and coumaphos, respectively).

Concerning PYR metabolites, 3-PBA (metabolite of several commercial pyrethroids) was found in 81% of the samples (median concentration of 1.5 ng/ml) and 4-F-3-PBA (metabolite of cyfluthrin) was found in half of the cohort, with a median concentration of 0.076 ng/ml.

Conclusion Metabolites of OP and PYR pesticides were observed in both farmworkers and general populations living in rural and urban areas, the former showing twofold average concentrations of OP metabolites than the second. These differences are consistent with occupational activity. The results show that both populations are generally exposed to pesticides such as chlorpyriphos, pirimiphos and parathion.

P I – 2–6 AN INTEGRATED MODELLING FRAMEWORK TO ESTIMATE RESIDENTS EXPOSURE TO PESTICIDES FROM BOOM SPRAYER APPLICATIONS

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Background/aim Pesticides can migrate from the place of application to houses via different routes (i.e. drift, volatilization, deposition, transport of contaminated soil- and dust particles). Different models exist for pesticide exposures but often these do not cover all exposure routes nor focus on residential exposures. Given the public health concern over pesticides, validated integrated models are needed.

Methods We carried out a systematic review of models describing pesticide concentration gradients related to spraying events using a boom spray. This review comprised articles published until June 2017. Subsequently we assessed the best suitable combination of models to assess residents' exposure to pesticides. We selected these models based on how well they are described in the literature, their usability, validation, whether they can be used on different spatial scales, possibility to link with other models, open source or accessibility, sensitivity to parameterization and how they account for uncertainty.

Results We report and discuss each pathway by looking at input parameters, such as physic-chemical properties of compounds, description of surface–air interaction, meteorological variables. We present a summary of each model by commenting on the stronger features and on the less fit for the purpose of modelling residents' exposure. We also inform on the pathways and sources that are lacking attention in literature or that need to be more emphasised when studying residents' exposure. The resulting chain of models is presented and discussed in more detail. Finally, an integrated framework to study residents' exposure to pesticides is proposed.

Conclusion Although identified models appear to cover all processes needed to describe residents exposure to pesticides no integrated model exists to date. We propose and describe an integrated modelling framework from source to residence and inhabitants, which takes into account all relevant routes leading to residents exposure, by combining deterministic and statistical modelling approaches.

P I – 2–8 EARLY-LIFE EXPOSURE TO PERSISTENT ORGANIC POLLUTANTS AND ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: A MULTI-POLLUTANT ASSESSMENT OF A NORWEGIAN BIRTH COHORT

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Background/aim Numerous ubiquitous environmental chemicals are established or suspected neurotoxicants, and infants are exposed to a mixture of these during the critical period of brain maturation. Evidence for associations with the risk of attention-deficit/hyperactivity disorder (ADHD) is sparse. We investigated measured perinatal and estimated postnatal chemical exposure levels in relation to ADHD.
Methods We used a birth cohort of Norwegian mother–child pairs enrolled 2005–2009 (HUMIS-NoMIC). In a subset of 1199 oversampled for neurodevelopmental outcomes, 27 persistent organic pollutants were measured in maternal breastmilk samples (14 PCBs, 5 organochlorine pesticides, 6 brominated flame retardants, and 2 perfluoroalkyl substances). We modelled pre- and postnatal exposures using a pharmacokinetic model. ADHD (n=40) was identified based on an ICD-10 diagnosis of hyperkinetic disorder in the national patient registry by 2014 (median age of 10.3 years). To identify associations and adjust for co-exposure confounding, we used elastic net penalised logistic regression models, and then used multivariable logistic regression models to obtain effect estimates for the selected exposures.
Results Perfluorooctane sulfonate (PFOS) and β-hexachlorocyclohexane (β-HCH) were associated with increased odds and hexachlorobenzene (HCB) with decreased odds of ADHD diagnosis [confounder-adjusted odds ratio (OR) per interquartile range increase in breastmilk levels: 2.04 for PFOS; OR=1.64 for β-HCH; OR=0.36 for HCB]. Postnatal exposures showed similar results, whereas effect estimates for other chemicals were imprecise.
Conclusion In a multi-pollutant analysis of four classes of chemicals, early-life exposure to several persistent organic pollutants was associated with ADHD.

Pregnancy, childhood and indoor environment

P I – 3–1 VITAMIN D DEFICIENCY/INSUFFICIENCY- FROM CHILDHOOD TO ADULTHOOD: INSIGHTS FROM A SUNNY COUNTRY

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Background/aim Vitamin D deficiency is widely prevalent worldwide. Vitamin D is known to be a key regulator of bone metabolism and is associated with muscle strength.

The objective of this study was to learn also about additional implications of vitamin D deficiency in adults and to investigate the extent of vitamin D deficiency in children worldwide, especially in a sunny country like Israel.
Methods The extent and severity of vitamin D deficiency, in adults and in children, were surveyed worldwide and especially in Israel, through a comprehensive review of previous reports and research studies done during the last 30 years in Israel and worldwide.
Results In adults, vitamin D deficiency has also been implicated in numerous health conditions including osteoporosis, cancer, diabetes, and autoimmune diseases.

In children, vitamin D deficiency was associated with metabolic syndromes and obesity. It was more prevalent in children who spend less time on outdoor activities, in obese children, and in cases when there was an imbalance between nutritional intakes and requirements. Vitamin D deficiency is common even in children living in sunny places like Israel.
Conclusion Vitamin D deficiency has many previously unknown implications.The doctors should be aware of the fact that although vitamin D deficiency is prevalent in the elderly population, it can also appear in the children, and can be associated with different illnesses. We encourage supplementation of vitamin D to special populations and encourage implementation of international food fortification programs.

P I – 3–2 ASSOCIATION OF MATERNAL DIET DURING PREGNANCY AND METABOLITE PROFILE IN CORD BLOOD

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Background/aim Maternal diet before and during pregnancy can contribute to an offspring's mental and physical health. Moreover, maternal food intake can modulate overweight or obesity issues and the development of adverse metabolic related outcomes/diseases later in life. Thus, this study aims to evaluate the association of maternal diet during pregnancy with the metabolite profile in cord blood.
Methods An analysis of maternal diet was conducted to study diet variability and patterns and to derive a set of factors, which would then be used in association analyses with cord blood metabolites. These analyses were done in the German LISA birth cohort (n~650 with information available on maternal diet and cord blood metabolome). Maternal food intake during the last 4 weeks of pregnancy was assessed by using a semi-quantitative food-frequency questionnaire (FFQ) comprising of 45 food items administered shortly after childbirth. Glycerophospholipid fatty acids (GPL-FA), polar lipids, non-esterified fatty acids (NEFA), and amino acids were analysed with gas chromatography (GPL-FA) or targeted liquid chromatography-tandem mass spectrometry based metabolomics platforms.
Results Factor analysis shows ten factors accounting for 28% of the total variance that could be classified into different dietary patterns. Some of the categories are 'meat-eaters', 'healthy/vegetable-eaters' and 'sweet-eaters' additionally a seasonal pattern in some maternal diets has emerged. A regression score is used in an effort to provide the highest correlations between the factor and its score. Finally, a linear regression for association with cord blood metabolites, adjusted for relevant confounders, will complete the investigation.
Conclusion A good classification of the different maternal diets has been identified which allows for the characterisation of associations between maternal diet and cord blood metabolites.

We conclude that maternal diet modulates metabolic status of the fetus which may be relevant for fetal growth and development.

P I – 3–3 PHYSICAL ACTIVITY MAY MODIFY THE ASSOCIATION BETWEEN SATURATED FAT INTAKE AND BLOOD LIPIDS IN ADOLESCENTS

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Background/aim A detrimental role of saturated fatty acids (SFA) on blood lipids has been suggested but not confirmed in adolescents. Physical activity (PA) may influence blood lipids by altering the metabolic fate of nutrients. To understand the integrated role of these lifestyle factors we tested the association of SFA intake with blood lipids in 15-year-olds, considering interactions with different PA levels.
Methods Children from the GINIplus and LISA cohorts with data on SFA, PA and blood lipids at age 15 years were included (n=830). SFA intake (% of total kcal) was estimated from food frequency questionnaires. PA (average min/day) was measured over one week by accelerometers and classified into sedentary, lifestyle (LSPA), or moderate-to-vigorous (MVPA). Blood lipids (total cholesterol, LDL, HDL, and triglycerides) were measured in serum and those with skewed distribution were log-transformed (all except HDL). Sex-stratified associations between SFA and blood lipids were assessed by linear regression, adjusting for potential confounders. Interaction terms were included between SFA and PA levels, and for significant interactions analyses were performed stratified by tertiles of the relevant PA level.
Results No significant association was observed between dietary SFA and any of the blood lipid outcomes. Interactions were observed with time spent sedentary for the outcomes total cholesterol and HDL in females, and with time spent in LSPA for LDL and triglycerides, in males and females, respectively ($p<0.1$). Stratified analyses indicated a significant inverse association between SFA (per interquartile increase) and triglycerides in females, only in the lowest LSPA tertile (means ratio: 0.91 (95% confidence interval: 0.85; 0.98), $p=0.01$). Further, a significant positive association was observed with total cholesterol and LDL in males in the middle tertile of LSPA (1.08 (1.03; 1.14), $p=0.004$; and 1.12 (1.03; 1.21), $p=0.01$, respectively).
Conclusion Our findings do not indicate a significant association between SFA intake and blood lipids among adolescents. The role of dietary SFA on the lipid profile might vary in an activity-specific manner, although interpretation may be complicated due to non-intended noise arising from methodological limitations. For further insight, future analyses might consider other, possibly correlated nutrients.

P I – 3–4 THE EFFECT OF RADIONUCLIDE WATER POLLUTION ON THE STRUCTURE OF CHILDHOOD DISABILITY

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Background/aim The objective is to identify the impact of water pollution with radionuclides on the childhood disability structure.
Methods A total of 58 persons with disabilities under the age of 18 and 195 disabled adults living in the Valley of the Mayluusuu River passing through the uranium biogeochemical zone were subjected to examination. The examined were divided into 2 groups depending on the nature of water consumption. Group I included 46 children under the age of 18 who consumed water from the Mayluusuu River which is polluted with radionuclides. Group II comprised 12 children under the age of 18 who consumed water from the Naryn River (uranium-free zone).
Results The children were divided into 2 groups depending on the source of water supply. Group 1 included 46 children who consumed water from the Mayluusuu River. Group II – 12 children with water supply from the Naryn River. In Group I, congenital pathologies were observed in 97.8%. Of them, oligophrenia in 32.6%, mental retardation in 10.9%, Down's syndrome in 8.7%, congenital deaf mute in 8.7%. In control, the pathology requiring continuous monitoring – mental retardation was diagnosed in 8.33%, congenital deaf mute in 8.3%, cerebral palsy in 16.7%, congenital heart disorder in 16,7% and congenital dislocation of the hip joint in 16,7%. Among the 195 adults with disabilities, congenital pathologies were diagnosed in 61.02%. The structure of pathologies was similar to that of Group I.
Conclusion Thus, congenital pathologies predominate (97.8% versus 91.7% in control) among the population consuming water contaminated with radionuclides. In Group I, mental disabilities predominate, accounting for 60.9% vs 16.6% in control. The number of disabled people requiring constant care is 3.5 times higher in uranium zone than in uranium-free areas. But this question requires further studies.

P I – 3–5 GUT MICROBIOTA MODULATION OF ARSENIC SPECIES IN BREASTMILK

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Background/aim Presystemic biotransformation of metals by gut microbiota alters their bioaccessibility and toxicity in experimental studies. Humans are chronically exposed to arsenic through contaminated food and groundwater, and exposure occurs during critical periods of early-life development via transplacental and lactational transfer. We investigated if gut microbiota modulated arsenic speciation.
Methods This study was based on the Norwegian HUMIS-NoMIC birth cohort. Total arsenic (tAs) and water-soluble arsenic species (including the organic forms dimethylarsinate and arsenobetaine) were quantified in breastmilk collected at

one month postpartum. Gut microbiota was sequenced in maternal faecal samples collected 4 days postpartum using Illumina 16S rRNA amplicon analysis. We assessed associations between α-diversity (Shannon's, phylogenetic, and OTU richness), β-diversity, and taxonomic composition of gut microbiota and the profile of arsenic species in breastmilk.

Results The median (interquartile range) of tAs was 0.33 µg/kg (0.08–0.65). Both fatty and lean fish intake was strongly associated with arsenic concentrations in breastmilk. Increasing α-diversity measures were associated with decreasing tAs and also with specific arsenic species. There were no consistent associations for β-diversity. Preliminary analyses revealed associations between arsenic speciation and differential abundances of taxa.

Conclusion There were indications that maternal gut microbiota modulated the chemical forms of arsenic presenting in breastmilk, although it was not possible to establish directionality of associations in this observational study. This warrants further research as gut microbiota are amenable to interventions and may modulate the toxicity of environmental metal exposures.

P I – 3–6 LEUKAEMIA AND LYMPHOMA INCIDENCE IN CHILDREN IN BELARUS

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Background/aim Haematological malignancies are the most common cancer in people under age of 19 years. Moreover, in Belarus possible health consequences of radiation exposure among young groups of population are of special concern. The objective was to test for time trends in leukaemia and lymphoma in children and adolescents.

Methods Data on cases of acute lymphoblastic leukaemia (ALL), acute myeloid leukaemia (AML), Hodgkin lymphoma (HL), and non-Hodgkin lymphoma (NHL) diagnosed during 25 year period (1990–2014) were obtained from National Cancer Registry. Crude rates and cumulative risk were computed for lung cancer overall and by gender. Annual percent change (APC) and 95% confidence intervals (CIs) were estimated by linear regression to characterise trends in incidence rates over time for the overall population, by gender, by age group, and by age group within gender.

Results During 1990–2014, 4056 incident cases were diagnosed in children and adolescents. More cases were reported in males (2305) than females (1751). During this period, the average crude rate was 6.48 per 100 000 population without significant trends (APC 1.12%; CI: −0.69÷2.97). In males, average crude rate was 7.15, in females – 5.76.

The rates for ALL, AML, HL and NHL in males were stable with no significant trends. In females were observed significant increase for ALL (APC 1.98%; CI: 0.61÷3.36) and decline for NHL (APC −3.94%; CI: −6.73÷−1.08). When age subgroups were examined, the highest upward trend was observed for ALL in female age group 0–4 years old (APC 2.9%; CI: 1.2÷4.7) with even more expressed tendency in 2005–2014 (APC 12.3%; CI: 5.8÷19.1).

Conclusion Childhood leukaemia and lymphoma rates in Belarus have remained relatively stable, except the ALL in females. Further investigations are necessary to analyse for causal factors and individual susceptibility. Analysing time trends of cancer incidence could be useful to generate some new hypotheses for etiological researches.

P I – 3–7 EVALUATING SCHOOL BUILDINGS AND INDOOR ENVIRONMENTAL QUALITY IN NIGERIAN ELEMENTARY SCHOOLS

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Background/aim Research on school indoor environmental quality (IEQ) are rare in developing countries due to the extremely low funding for research and student education. This study sought to evaluate IEQ in classrooms and the general condition of school buildings.

Methods Five primary schools, including three classrooms per school, were assessed between December 2016 and January 2017. Classroom temperature (T), relative humidity (RH), carbon dioxide (CO2) and carbon monoxide (CO) were measured with data loggers (outdoor measurements were also taken). Adenosine triphosphate (ATP) concentration was measured on students' desk tops after school hours to assess cleaning effectiveness. General condition of the buildings were assessed based on walk-throughs.

Results All schools used natural ventilation by opening windows and doors. Classroom occupancy exceeded 50 person/100 m^2 in all cases indicating overcrowding. Concentrations of CO2 remained below 1000 ppm in most classrooms: only three classrooms exceed this limit with two classrooms from the same school. Maximum indoor CO was 6ppm. Indoor T raised during the day mimicking outdoor T. ATP concentrations on desk tops were high in all schools. General building condition was low (e.g. only one school had functioning toilets).

Conclusion The use of open incinerators, which was the main source of CO, should be discouraged. Students should have access to functioning bathroom facilities and cafeteria. Improving hygiene, for example by cleaning desks and other high contact surfaces, should also be encouraged. Installing passive and/or mechanical cooling systems should be considered to improve thermal comfort.

P I – 3–9 THE BURDEN OF CARBON MONOXIDE EXPOSURE ON PUBLIC HEALTH: EVALUATING THE ROLE OF CARBOXYHAEMOGLOBIN (COHB) AS A BIOMARKER AND EXPLORING NEW APPROACHES FOR QUANTIFICATION

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Background/aim Carbon monoxide (CO) is one of the leading causes of domestic deaths. Exposure occurs in- and outdoors,

in occupational or accidental (e.g. fires) settings, or by smoking. Current biomarker COHb has poor correlation with symptoms of CO poisoning, which are unspecific. Thus, this study aims to evaluate alternative methods for estimating CO, in order to reduce the error in diagnosis of CO poisoning.

Methods We explore a new technique based on gas-chromatography coupled to mass-spectrometry (GC-MS) that measures the total CO amount in blood (TBCO). CO is released from a blood sample (100 µL) by mixing with sulphuric acid in an airtight vial and heating. It is then analysed by GC-MS. This method is then compared to an optical method (CO-oximetry). An assessment of the measurement errors deriving from an analytical perspective is performed for both approaches through monitoring of analytical factors, such as storage conditions (temperature, time, volume, freeze- and thawing cycles, tube reopening, initial concentration levels) and instrumental errors, with analysis of ~2500 bovine blood samples. Results are compared and assessed using descriptive statistics and regression models.

Results A novel approach for CO quantification in small amounts of blood was developed and validated for clinical and postmortem range. The total amount of CO present in blood at analysis time is released and analysed through airtight gas syringe (AGS)-GC-MS. Preliminary results of the monitoring study show important statistical influences by all parameters analysed but 'tube re-opening' (p-values>0.05). No linear correlation is found between COHb and TBCO, with resulting backcalculated COHb from TBCO concentrations generally higher than COHb measured optically. The approach was applied to real poisoning cases, with resulting COHb between 45%–75%, as opposed to COHb backcalculated from TBCO, which ranges between 83%–275%, suggesting the presence of a part of CO dissolved in blood and not bound to Hb

Conclusion CO levels based on optically measured COHb may lead to underestimation of CO exposure. CO not linked to Hb might be of pathophysiological relevance. The use of TBCO as more reliable biomarker of CO exposure in the clinical field requires further testing. Furthermore, the new approach presents lower cost and invasiveness. Storage guidelines can be derived for use in clinical and forensic domains.

P I – 3–10 SEASONAL CONTRASTS OF INDOOR EXPOSURE TO PM2.5 IN PERI-URBAN AND URBAN BEIJING

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Background/aim Facing high concentrations of ambient air pollution and household air pollution from biomass burning, Beijing is introducing interventions on fuel for domestic heating in its strategy package. My study aims to:

1. understand the indoor exposure to PM2.5 in peri-urban and urban Beijing during winter and summer,
2. understand the causes of seasonal and spatial differences in indoor exposure levels.

Methods The Effects of AIR pollution on cardiopuLmonary disEaSe in urban and peri-urban reSidents in Beijing (AIRLESS) study, is a collaborative research project between UK and China to understand the health effects of air pollution in peri-urban and urban Beijing. During AIRLESS winter and summer campaigns, indoor deployment sub-panels were recruited out of the AIRLESS panels in peri-urban and urban Beijing. Urban sub-panel members were selected considering the floor of residence and distance to the main road; the selection criteria of the peri-urban sub-panel were:

i. home exposure to environmental tobacco smoke (ETS),
ii. fuel used for cooking and
iii. fuel used for heating.

RTI MicroPEM V3.2 nephelometer was deployed indoor to monitor PM2.5 continuously for at least 48 hours.

Results In this project, 25 peri-urban and 25 urban subjects completed more than 48 hour PM2.5 exposure monitoring for both winter and summer campaigns. In both peri-urban and urban sub-panels, there were significantly higher ($p<0.01$) log-transformed indoor exposure levels in winter than summer. When combining the subjects in the two sites together, the difference is till significant ($p<0.01$). Currently the effects of fuel types and air purifier on indoor air quality in peri-urban and urban Beijing are being investigated.

Conclusion This project shows that there are significant seasonal differences in indoor exposure levels to PM2.5 in AIRLESS peri-urban and urban sub-panels. Investigations will be conducted to analyse the reasons for seasonal and spatial differences, using the fuel, behaviour and air purifier data that were collected. In future, we hope to inform fuel use interventions and behaviour changes in Beijing.

Urban environment and climate change

P II – 1–1 HEALTH IMPACT ASSESSMENT OF BARCELONAS SUPERBLOCK MODEL

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Background/aim Car-centric city designs of previous decades have resulted in sedentary lifestyles, high levels of environmental pollution (i.e. air pollution, noise and heat islands) and the disappearance of natural outdoor environments. The Barcelona 'superblock' model is a promising land-use strategy with the aim to reduce motor traffic while promoting active and public transport and recreational activities.

Methods A health impact assessment (HIA) is carried out assessing the health consequences of the implementation of the Barcelona superblock model with respect to expected changes in physical activity levels, air pollution, noise and local temperatures and the access to green spaces. Avoidable premature mortality, disability-adjusted life-years (DALYs) and economic impacts related to the Barcelona superblock model are estimated in order to assess the health benefit-risk tradeoff of this urban land-use intervention.

Results Results of this HIA demonstrate the expected net health impacts of the Barcelona superblock model. Results will be presented to the Barcelona City Council to promote and advocate for the implementation of this promising land-use strategy to reduce burdensome motor traffic in cities and associated emission levels and return public space to the citizens in order to promote social cohesion and healthy urban living.

Conclusion The Barcelona superblock model is an encouraging intervention to overcome contemporary burdensome motor traffic in cities and the associated physical inactivity crisis and environmental pollution burden. Associated health impacts are expected to make a case for the rapid implementation of this new urban model.

P II – 1–2 URBAN AND TRANSPORT PLANNING RELATED EXPOSURES AND MORTALITY: A HEALTH IMPACT ASSESSMENT FOR BRADFORD, UK

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Background/aim By 2050, almost 70% of people globally are projected to live in cities. As the environments we inhabit affect our health, urban and transport designs that promote healthy living are needed. We will estimate the number of premature deaths preventable under compliance with international exposure recommendations for physical activity, air pollution, noise, temperature and green spaces in Bradford, UK
Methods We will apply the Urban and TranspOrt Planning Health Impact Assessment (UTOPHIA) tool to Bradford. Exposure data of physical activity, air pollution, noise, temperature and access to green spaces will be available for Bradford residents≥20 years on the neighbourhood level. We will compare recommended with current exposure levels. We will quantify the associations between exposures and mortality and calculated population attributable fractions to estimate the number of premature deaths preventable. We will also model life-expectancy and economic impacts.
Results Results of HIAs of urban and transport planning related performance are important for cities to align themselves and have a better understanding of local health hazards and the associated health burden. Results of this HIA will be presented to the Bradford City Council to advise them on which environmental exposures pose the bigger health hazards and need to be targeted and acted-upon urgently with public policies in order to provide sustainable and healthy urban living.
Conclusion HIA is a useful tool to assess the intended and unintended health burden of public policies such as urban and transport planning. Its wider routine application in many cities is encouraged.

P II – 1–3 GEOMAGNETIC STORM, STRONG SOLAR WIND AND STREAM INTERACTION REGION AFFECT FOR CARDIOVASCULAR SYSTEM

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Background/aim Recent research shows that not only geomagnetic storms (GS), but also other space weather events affect human health. The main goal of this research is to evaluate GS, solar wind (SW) velocity, and flow of stream interaction regions (SIR) in the formation of influence patients for acute coronary syndromes.
Methods In research we used daily heliophysical data from 2001 till 2003 (maximum of 23 Solar cycle). The data of 1391 patients, who were hospitalised at the Hospital of Lithuanian University of Health Sciences, were used. Patient health variables were classified using binary state variables. The univariate associations between patients' characteristics and space weather variables were analysed by using $\chi 2$ test and the logistic regression. The space weather variables were used as categorical: days of the events, 1–2 days before and after event. For the assessment of the impact of environmental variables on unfavourable cardiovascular characteristics, we used the percentage increase and odds ratio with 95% confidence interval, and p-values of coefficients in the logistic regression analysis.
Results On days of fast solar wind (SW≥600 km/s), more than 50% increased risk of acute coronary syndrome (ACS) in patients with hypertension, diabetes and kidney disease. SIR events increase risk of arrhythmias more than two times. In patients, hospitalised during GS or 1–2 days after their increased the risk of hyperglycemia over 1.5-fold. GS lasted more than one day at SW≥600 km/s over 2.5 times increased of myocardial infarction with ST elevation. In patients with the metabolic syndrome the risk of ACS increased over 1.5 times during GS and on 1–2 days before and after.
Conclusion The results obtained suggest that the 1–2 days prior to GS, GS, 1–2 days after GS, the faster solar wind velocity (≥600 km/s), and SIR can be identified as independent risk factors in humans.

P II – 1–4 A TIME SERIES ANALYSIS OF ASSOCIATIONS BETWEEN CLIMATE CHANGE AND HEAT RELATED ILLNESSES AND DEVELOPMENT OF A HEAT HEALTH WARNING SYSTEM IN THAILAND

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Background/aim Thailand has no heat health warning system. However, there is an increasing number of heat-related illnesses (HRI) yearly. Thus, the objective of this work was to investigate the statistical associations between climatic variables and heat-related illnesses with an aim to set up a suitable threshold level for Heat Health Warning System in Thailand.
Methods Daily HRI of hospital admissions from the ICD10 database with diagnosis T67 (Effects of heat and light) were collected between January 2010 to December 2014 from the Bureau of Policy and Strategy, Department of Disease Control, Ministry of Public Health, Thailand. Daily temperature and humidity from the same period were obtained from Meteorological Department Ministry of Digital Economy and Society. The heat index was calculated according to the Steadman equation. Time series and Poisson regression analysis were used to find out the relationship between HRI and heat index controlling for day of the week and holiday indicator, for lag times of 1–7 days.
Results There were 6,895 HRI visits. The overall incidence was 2.14 visits per 1 00 000 persons per year. The majority of patients were female. The highest incidence was in the 80–84 years old group with an age-specific incidence rate of 7.21 per 1 00 000 persons per year. The relative risks of HRI visits in the country at 25th and 75th percentile of the mean of

heat index at lag 0 were 31.44 and 42.53, respectively. The in-country regional relative risks at the 25th percentile of the Southern, Northern, Central and Northeast regions were 5.01, 15.79, 55.37 and 26.38, respectively. Similarly, the relative risks at the 75th percentile of Southern, Northern, Central and Northeast regions were 5.56, 21.76, 79.59, and 39.75, respectively.

Conclusion The level of heat index has a positive association with heat-related illnesses visits. A suitable warning threshold level of heat index for Thailand will be investigated in the next stage of the study.

P II – 1–5 EXPLORING THE IMPACT OF WEATHER ON PHYSICAL ACTIVITY IN THE FACE OF CLIMATE CHANGE: A LITERATURE REVIEW AND EXPLORATORY SURVEY

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Background/aim Although health impact of climate change (CC) has been studied, only limited research studies are available to understand related health behaviours. Extreme temperatures and rainfall variation could pose barriers to physical activity (PA), a protective factor for well-being and non-communicable diseases. This study aims to explore the relationships and identify predictors between weather and PA.

Methods A literature review was conducted to review the current published knowledge on effects of weather on PA. An exploratory cross-sectional telephone survey was conducted in an Asian sub-tropical city, two weeks after a 2017 heatwave. Ethics approval and participant's verbal consent were sought. Self-reported changes in outdoor PA, health outcomes and protective behaviours, knowledge of heat-related information, and sociodemographic variables were collected from 436 respondents. Descriptive analyses, Chi-square test, and multivariable logistic regression were conducted to assess predictors of changes in outdoor PA in a heatwave.

Results The literature review identified 33 studies on the effects of weather on PA between 2004–2017. The studies focused largely on overall or leisure PA, and varied in study design and methodology. Overall, PA had mixed findings with temperature, negative association with precipitation, wind speed and humidity, and positive association with day length. In the exploratory study, 35.2% of respondents reported a decrease in outdoor PA in the two weeks after a heatwave warning was announced, while 55.6% reported no change, and 9.2% reported an increase. Socio-demographic and behavioural predictors associated with changes in PA were identified by multivariable logistic regression.

Conclusion Weather has a demonstrated effect on outdoor PA, which may have implications for health with the more frequent occurrence of extreme weather events. This review and exploratory study provide preliminary evidence of the current state of knowledge on weather and PA. Further studies are needed to quantify the extent of this relationship and investigate adaptation measures to enhance sustainable PA.

P II – 1–6 A CRITICAL ANALYSIS OF THE DRIVERS OF HUMAN MIGRATION PATTERNS IN THE PRESENCE OF CONTEMPORARY CLIMATE CHANGE: PRESENTATION OF A NEW CONCEPTUAL MODEL

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Background/aim Climate change can both directly and indirectly drive human migration. Despite this, strong understanding of the system of determinants of migration and their interactions, remains a knowledge gap resulting in large uncertainties and ill-informed interventions.

Objectives To create a new conceptual model for the identification of drivers of migration in the context of climate change.

Methods A critical analysis of existing theoretical and quantitative literature was performed in order to synthesise a new conceptual model for identifying the migration determinants system.

Results Quantitative studies fail to homogenously apply a theoretical model for the drivers of migration and the variety of migration outcomes that occur. This in turn results in a poor evidence-base for interventions in areas where this is critical, including public health, land planning and immigration policies. Existing theoretical models are insufficiently transferable and fail to capture the full range of migration determinants. A new migration typology and conceptual model of migration is constructed based on an upstream, holistic approach to migration. The model overcomes current shortcomings by capturing temporality and driver dynamics as well as being a plastic model that may be transferred into any context.

Conclusion From the homogenous application of such a conceptual framework, quantitative models may also be able to more accurately quantify the extent to which contemporary and future climate change influences migration. Such models are therefore informative tools for decision-making concerning strategies for migration policy and public health planning.

P II – 1–7 SPATIO-TEMPORAL ANALYSIS OF THE RELATIONSHIP BETWEEN METEOROLOGICAL FACTORS AND HAND-FOOT-MOUTH DISEASE IN BEIJING, CHINA

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Background/aim Hand-foot-mouth disease (HFMD) is a common infectious disease in China and occurs mostly in infants and children. Beijing is a densely populated megacity, in which HFMD has been increasing in the last decade. The aim of this study was to quantify spatio-temporal characteristics of HFMD and the relationship between meteorological factors and HFMD incidence in Beijing, China.

Methods Daily counts of HFMD cases from January 2010 to December 2012 were obtained from the Beijing Centre for Disease Prevention and Control (CDC). Seasonal trend decomposition with Loess smoothing was used to explore seasonal patterns and temporal trends of HFMD. Bayesian spatiotemporal Poisson regression models were used to quantify

spatiotemporal patterns of HFMD incidence and associations with meteorological factors.
Results There were 114,777 HFMD cases reported to Beijing CDC from 1 January 2010 to 31 December 2012 and the raw incidence was 568.6 per 1 00 000 people. May to July was the peak period of HFMD incidence each year. Low-incidence townships were clustered in central, northeast and southwest regions of Beijing. Mean temperature, relative humidity, wind velocity and sunshine hours were all positively associated with HFMD. The effect of wind velocity was significant with a RR of 3.30 (95% CI: 2.37 to 4.60) per metre per second increase, as was sunshine hours with a RR of 1.20 (95% CI: 1.02 to 1.40) per one hour increase.
Conclusion The distribution of HFMD in Beijing was spatiotemporally heterogeneous, and was associated with meteorological factors. Meteorological monitoring could be incorporated into prediction and surveillance of HFMD in Beijing.

P II – 1–8 DEVELOPMENT OF LAND-USE REGRESSION MODELS FOR AIR TEMPERATURE AND RELATIVE HUMIDITY IN AUGSBURG, GERMANY

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Background/aim Epidemiological studies show that changes in air temperature affect mortality and morbidity. So far these changes have been observed mainly on a temporal scale while spatial changes have rarely been considered. We used land-use regression (LUR) models to predict the spatial variability of temperature and relative humidity and to detect urban heat islands in the Augsburg region, Germany.
Methods We measured temperature and relative humidity at more than 80 sites between December 2012 and October 2017 in the city centre of Augsburg and the two surrounding counties. Seasonal averages were calculated for monitors with at least 14 days of measurements. Discontinuous measurements were adjusted using data from a reference station. We compiled a large set of predictors, which will be offered as potential explanatory variables to separately model the spatial variation of temperature and relative humidity. As geographic predictors we will offer traffic and land use variables, altitude, population, building density and sky view factor. As remote sensing predictors we will offer albedo, normalised difference vegetation index and. K-fold cross-validation will be used to validate our models.
Results For each season, we could include five rounds of measurements ranging from 29 to 73 available monitors. The seasonal averages of the monitors ranged between 13°C and 23.2°C for the summers and between −2.4°C and 7.1°C for the winters. For the springs they ranged between 5.2°C and 14°C, while between 2°C and 19.3°C during autumns. The final LUR models are intended to reflect the spatial distribution of temperature and relative humidity in the study area for the different seasons and will be presented at the conference. Air temperature values are expected to increase within the city centre where building density and traffic rates are higher. Instead, values of relative humidity are supposed to decrease with scarce presence of water bodies and vegetation.
Conclusion We are developing spatial models to predict seasonal mean temperature and relative humidity for a typical city of Southern Germany. On the basis of these models, we aim to investigate potential health effects in subsequent epidemiological analyses as we will apply the final LUR models to the residential addresses of our KORA (Cooperative Health Research in the Augsburg Region) participants.

Air pollution II

P II – 2–2 AIR POLLUTION AND PARKINSON'S DISEASE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background/aim Recent epidemiological research investigates associations between exposure to air pollution and neurodegenerative disease, while part of the literature suggests effects on the onset or aggravation of Parkinson's disease (PD). The goal of this study is to assess the association between exposure to air pollution (NO_2, NO_x, $PM_{2.5}$, PM_{10}) and PD through a systematic review and meta-analysis.
Methods We searched studies, published in English, until September 2017 through PubMed, Google Scholar and conference abstracts. References of identified studies were further searched for relevant literature. We initially identified 92 studies, from which 16 were included in the meta-analyses as they provided relevant effect estimates. We extracted descriptive and quantitative information from each study. We applied random-effects models to combine risk estimates and investigated the presence of heterogeneity between studies. We assessed publication bias through funnel plots and the Egger test.
Results We identified 7 articles investigating associations with long term exposure to $PM_{2.5}$, 5 studies for PM_{10}, 6 for NO_x and NO_2, while 2 reported associations for short term exposure to $PM_{2.5}$. The analysis suggested that PD was positively related to long term exposure to nitrogen oxides with relative risk 1.03% (95% CI: 0.99, 1.07%) per 10 µg/m3 increase. Particles' exposure also displayed weak positive but non-significant associations. There was high heterogeneity between studies for all analyses
Conclusion We found weak evidence for an association between air pollution and onset of PD. Although meta-analysis increases power to detect small associations in rare outcomes further research would elaborate our indicative associations, as these may be of public health significance considering the increasing trend in the ageing of the population in developed countries.

P II – 2–3 AMBIENT AIR POLLUTION AND OUTPATIENT VISITS FOR ECZEMA IN BEIJING: A TIME-STRATIFIED CASE-CROSSOVER ANALYSIS

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Background/aim This study provides further evidence that short-term changes in air pollution increase the exacerbation of eczema and the effect of NO_2 may be more robust than other pollutants.
Methods We used a time-stratified case-crossover design. Daily diagnosed visits were collected from Air Force General Hospital from April 2012 through April 2014. Daily air pollution including concentrations of fine particulates ($PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and daily meteorological data were also obtained. By using conditional logistic regression models, we estimated odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) for eczema visits associated with per interquartile-range (IQR) increase in each pollutant, adjusting for daily ambient temperature and relative humidity.
Results $PM_{2.5}$, NO_2 and SO_2 were found to be significantly associated with increased outpatient visits for eczema. The ORs were 1.03 (95% CI: 1.02 to 1.04) and 1.03 (95% CI: 1.02 to 1.05) for an IQR increase in $PM_{2.5}$ for lags 2 and 7 days and this association persisted in 2-pollutants and 3-pollutants models. The ORs were 1.01 (95% CI: 1.00 to 1.02), 1.03 (95% CI: 1.02 to 1.04), 1.01 (95% CI: 1.00 to 1.02) and 1.01 (95% CI: 1.00 to 1.03) for an IOR increase in NO_2 for the current day and for lags 2, 5 and 7 days and this association persisted in 3-pollutants models. The ORs for an IQR increase in SO_2 for the current day and for lags 5 and 7 days were 1.03 (95% CI: 1.01 to 1.04), 1.01 (95% CI: 1.00 to 1.03) and 1.02 (95% CI: 1.01 to 1.04), but only association for lags 5 day was significant in 3-pollutants models.
Conclusion Eczema is a common chronic inflammatory skin disease that place a large burden. An association between air pollution and skin problems has been suggested. However, epidemiological researches on the effects of air pollutants on ezema are still limited. We aim to evaluate the associations between short-term changes in air pollution and the outpatient visits for eczema in Beijing.

P II – 2–5 WOOD BURNING AIR POLLUTION AND PREECLAMPSIA IN TEMUCO – CHILE: A CASE STUDY

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Background/aim In Latin America and Caribe, the most common cause of mortality is hypertensive disorders in pregnancy (HDP). Some researchers found that air pollution increase the risk of HDP. However, the evidence regarding to preeclampsia has not been conclusive. In Temuco, PM2.5 exceeds daily and annual standards due to the use of wood as fuel. We aimed to estimate associations between preeclampsia and PM2.5.
Methods Temuco and Padre Las Casas are located in the south of Chile (39.7°E; 73.0°S). During the colds months increase the use of residential heating. PM2.5 was collected from 2009 to 2014 from Las Encinas air pollution monitoring station. Meteorological data (temperature (°C), wind speed (kn), relative humidity (%)) were obtained from the Chilean Meteorological Office. Reproductive data from pregnant women attending the Hospital were obtained from the databases compiled by the Obstetric Service. Data were descriptively analysed according to their distribution using mean, median, percentiles and their respective dispersion measure, depending on the variable distribution. We performed bivariate and multivariate analysis. We used STATA (version 13) to perform all the statistical analyses.
Results The prevalence of preeclampsia is 3.8%. Around 63.5% of cases are 20–34 years-old, 53.1% obese at last prenatal control, 6.7% has gestational or pregestational diabetes. We found differences between educational level, nutritional status, presence of maternal morbidities, multiple pregnancies ($p<0.05$). The mean concentration is 40.9 $\mu g/m^3$. Exists differences in the seasonal time by hour of the day. From 6 pm to 4 am, the PM2.5 concentrations increase during the winter. The same is found during weekday or weekend (I am currently working on teh development of multivariate analysis).
Conclusion The results indicate that the prevalence of preeclampsia is high. Temuco has high PM2.5 concentrations, over the national standards, attributable to wood burning.

P II – 2–6 AMBIENT AIR POLLUTION PM_{10} AND $PM_{2,5}$ DUE TO COAL TPP

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Background/aim Due to lack of PM monitoring process in Ukraine the aim of this work was to obtain information on the actual concentrations of PM_{10} and $PM_{2,5}$ in one of the Ukrainian cities with the population under coal power plant exposure.
Methods Definition of air pollution by PM_{10} and $PM_{2.5}$ was conducted in the seven points located in operation zone of the TPP which were selected according to the algorithm including relief, infrastructure, meteo data.

The study was conducted throughout the 2015 as a result it was managed to get the average annual concentration. Measurements of $PM_{2,5}$ and PM_{10} concentration levels in the ambient air carried out using portable handheld analyzers Con.Tec Personal Dust Monitor PM_{10}-$PM_{2.5}$-PM_1 (Italy).

Measurements were carried out at the height of 1.2 to 1.8 metres from the ground in the human breathing area. Gathered measurements in real-time mode were conducted within one hour with an average of 1 min for 3 sequences per day.
Results As a result of the research, it has been established that:

- concentrations of PM_{10} were determined in the range of 11 to 67 $\mu g/m^3$, $PM_{2.5}$ – from 4 to 47 $\mu g/m^3$. In this case, the excess of the recommended by the WHO levels of averaged concentrations PM10 and PM2.5 in the ambient air observed in 43% of measurements especially in the autumn–winter heating period;
- every 10 μg of concentration above normative increases the death rate by 0.6%. Accordingly, in the worst scenario with a concentration of 67 $\mu g/m^3$ the mortality rate may increase by 2.82%.

Conclusion Based on the foregoing, conclusions can be drawn on the need for implementation and expansion of monitoring programs measurements of particulate matter (PM_{10} and $PM_{2,5}$) in the ambient air of Ukraine settlements. Mandatory review and approval of hygienic standards for PM10 and PM2.5, in accordance with Directives 2008/50/EU, 2001/80/EU, recommendations and requirements of WHO.

P II – 2–7 NO_2 BUT NOT $PM_{2.5}$ AT THE HOME ADDRESS IS ASSOCIATED WITH CONCERN OVER HEALTH EFFECTS OF AIR POLLUTION

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Background/aim People living in urban areas in Europe are exposed to elevated concentrations of air pollution. The lower the air pollution levels, the better for your health; so people exposed to higher concentrations should be worried more about air pollution. The aim of this analysis was to examine associations between concern over health effects of air pollution and personal and environmental factors.

Methods In 7 European cities, >12 000 participants over 18 years were recruited to complete an online questionnaire on travel and physical activity behaviour, perceptions and attitudes, and sociodemographics. The following question was assessed on a 5-point scale: 'Are you worried that air pollution in the neighbourhood of either your home or work can lead to health problems?' Mixed effects logistic regression was used to model concern over health effects of air pollution (worried (level 4–5) versus not-worried (level 1–3); city as random effect). Air pollution at the home address was determined using the West-European $PM_{2.5}$ and NO_2 land use regression models from de Hoogh et al. (2016). Potential confounding variables were chosen based on previous studies, and most variables were self-reported.

Results 57% of participants were worried over health effects of air pollution with large differences across cities (Antwerp 77%; Barcelona 81%; London 64%; Oerebro 12%; Rome 72%; Vienna 43%; Zurich 34%). Linking mean modelled air pollution to mean level of concern per city, gave a good correlation for NO_2 (r^2=0.75) and a lower correlation for $PM_{2.5}$ (r^2=0.49). In bivariate analyses, city, sex, education level, self-reported health, having children in the household, distance to the nearest major road, physical activity level, and NO_2 and $PM_{2.5}$ at home were significantly linked to concern over health effects of air pollution. In the mixed effects logistic regression model sex, self-reported health, having children in the household, physical activity level, and NO_2 at home remained significant.

Conclusion Being male, having a worse self-reported health, having children in the household, being more physically active, and higher NO_2 at the home address were associated with higher concern over health effects of air pollution.

P II – 2–9 EFFECTS OF AMBIENT AIR POLLUTION ON RESPIRATORY HEALTH OF CHILDREN IN BELARUS

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Background/aim Exposure to certain ambient pollutants negatively affects public health. Air pollution is particularly important in the development of respiratory diseases among children. The aim of our study was to analyse the level of air pollution in the major regional cities of the Republic of Belarus and its impact on the respiratory morbidity in children.

Methods Data on air pollution levels in the major regional cities in 2002–2014 (source: Republican Centre of Radiation Control and Environmental Monitoring (Ministry of Natural Resources and Environmental Protection of the Republic of Belarus) and data on respiratory diseases cases (according to ICD-10) in adult and children (0–14) in these cities (in 2002–2014), source: Republican Scientific-Practical Centre of Hygiene) were analysed by methods of descriptive statistics, morbidity rates comparatives and correlation analysis (air pollution – morbidity of children respiratory diseases).

Results The peak concentrations of particulate matter, carbon monoxide, sulfur dioxide and nitrogen were typical for spring and summer, for phenol – in autumn and winter. In average daily maximum allowable concentrations were not exceeded. Data show the general trend for decreases in air pollutant emissions, with the exception of nitrogen dioxide and formaldehyde. A number of positive correlations were revealed between children morbidity rates and the concentration of certain pollutants in the air. The rise in overall respiratory morbidity, chronic diseases of tonsils and adenoids was connected with the increase in the concentration of nitrogen dioxide and carbon monoxide. High rates of overall respiratory morbidity and pollinosis were associated with increased formaldehyde concentration.

Conclusion Study shows a significant correlation between exposure to air pollution and the frequency of respiratory diseases in children of regional cities of the Republic of Belarus. Revealed correlation coefficients between the morbidity and air pollutant concentrations can be used as a basis for further research to assess the impact of air pollutants on public health.

Big data, bio allergens and metal exposure and its health effects

P II – 3–1 OCCURRENCE OF AIRBORNE FUNGAL SPORES DIVERSITY AND ALLERGENICITY IN TWO SOUTHWESTERN STATES OF NIGERIA

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Background/aim Airborne microorganisms have been shown to vary throughout the day and season depending on various environmental factors such as: type of vegetation, air pollution human activities meteorological and seasonal climatic factors.

Methods Sedimentation plate technique using Dichloran Glycerol −18 agar and Potato Dextrose Agar (culture dependent) was employed. Identification and characterisation of fungal species was carried out by amplification of internal transcribed spacer 1 and 4 gene followed by quantification of allergenic gene by reverse transcriptase quantitative polymerase chain reaction in the most abundant fungal isolates. Furthermore, the extracts obtained were analysed using SDS-PAGE to separate the fungal antigenic proteins. Molecular markers were

scored manually for presence or absence of each band in the SDS-PAGE analysis. Data obtained were analysed (ANOVA) using SAS (version 9.1). Means were separated using the Duncan Multiple Range Test at p≤0.05. Linear regression analysis was done by PAST software.

Results A total of 44 fungal species were isolated from all locations sampled, *Aspergillus*, *Penicillium* and *Fusarium* were the most abundant and frequently surveyed fungal species in the environments while *Absidia*, *Curvularia* and *Mucor* had the least values of spore count in all locations. The mean relative gene expression values ranged from 18.95–31.28 for Actin, 17.38–26.77 for β tubulin and 19.74–30.63 for *P. oxalicum* and 30.22–37.56 for *P. citrinum* genes. SDS-PAGE analysis revealed a total of 25 protein bands with molecular weight between 5 and 100 kDa. *A. favus* had the maximum number of protein band while *P. citirinum* had least.It was observed that spore count in the dry season was significantly less than that of the wet season. Farm settlement had higher fungal load than other place

Conclusion This study has confirmed that production of fungal spores is indicative of weather parameters. Environmental conditions such as relative humidity (RH), temperature and wind velocity exert a significant effect on the type of population and the amount of microorganisms in the air therefore airborne microbial quantity and quality can vary with time of the day, year and location.

P II – 3–2 INTEGRATING GOOGLE MAPS INFORMATION ON NEIGHBOURHOOD ENVIRONMENT INTO DIABETES RISK FACTOR SURVEILLANCE: A FEASIBILITY STUDY FROM GERMANY

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Background/aim Because type 2 diabetes and obesity are more prevalent in deprived areas, it is crucial to consider environmental features related to healthy lifestyles and health care structures. The aim of our study is to develop technical and methodological algorithms to use Google Maps to extract and discover relevant information on the built environment.

Methods First, we identified neighbourhood characteristics associated with obesity, physical inactivity and health care according to the literature. Second, we assessed relevant environmental factors through geocoding services like Google Maps. We derived and refined intelligent extraction, data cleaning and discovery algorithms that allow processing big data files and identifying pathways and patterns. For three representative sub-areas, we validated the results by comparison with the actual built environment. Finally, we created detailed maps for these characteristics which can be used to monitor spatial and temporal patterns.

Results First results of literature research point to the fact that geocoding services like Google Maps have been shown to provide valid, reliable and low-cost data for the study purpose. This could be further confirmed through real life site inspection for three representative sub-areas.

Conclusion Methods to describe different components of obesogenic environments and health care structures could be potentially integrated in diabetes surveillance programs to improve risk-prediction and to tailor prevention strategies.

P II – 3–3 A SYSTEMATIC REVIEW OF HEALTH IMPACT ASSESSMENTS IN LOW-AND-MIDDLE INCOME COUNTRIES: METHODOLOGICAL ISSUES AND IMPLICATIONS

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10.1136/oemed-2018-ISEEabstracts.111

Background/aim With rapid urbanisation, the need for HIAs to expand to lower and middle-income countries is increasing. By 2050, an estimated 2.5 billion people will have moved to cities, 90% of which concentrated in Asia and Africa. There is scattered evidence on the parameters, the strength and limitations of HIA methodologies exploring how exposure pathways affect morbidity and mortality in these regions.

Methods The systematic review is performed to take note of visions, methods and experiences in the field of HIA in LMICs. Systematic database searches of Medline, Scopus and Web of Science are performed and yield peer-reviewed studies, case studies, evaluation studies, reviews and opinion papers. As a complement, the database searches are augmented by bibliographic review, grey literature web search and expert consultation for identifying all relevant studies since December 2002.

Results Results of this systematic review identify health impact assessments that have been conducted in LMICs and critically appraise them. The theoretical and practical underpinning for specific methods are presented and categorised across sectors relevant to population and environmental health. Particular attention is paid to the use of qualitative and quantitative methods in different scenarios and conditions. The approaches and experiences described in the papers build an evidence-based knowledge that will help assess the value and practicability of HIA processes across tropical regions.

Conclusion Despite the current application of different HIA methodologies worldwide, their relevance is dependent on geographical context and local socio-economic realities. The areas that afford more methodological robustness show potential to increase local human and technical capacity to integrate HIA as a regulatory mechanism in LMICs.

P II – 3–4 THE PROBLEMS OF TYPHOID FEVER AND BRUCELLOSIS IN URANIUM ZONE OF THE KYRGYZ REPUBLIC

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Background/aim The aim is to study the problems of typhoid fever (TF) among the population living in uranium zone and in the Valley of the Mayluusuu River passing through this zone.

Methods A total of 2158 patients who contracted TF during the period of 2001–2016 in the Kyrgyz Republic were subjected to analysis. Of them, 964 lived in uranium zone and in the Valley of the Mayluusuu River, 1174 patients were from the other areas of Kyrgyzstan. The incidence of TF in Mayluusuu (400 cases) and Tash-Kumyr (202 cases) during the period from 2007 to 2016 was studied. Epidemiological methods were used.

Results Of the 2158 TF patients, 964 (44.7%) lived in uranium zone. TF cases have been registered even in cold season

since 2006 in this area. Direct economic losses from TF for Kyrgyzstan due to inpatient treatment of TF patients from uranium zone amounted to more than 1.5 million US dollars.

The incidence rate of TF among the patients directly living in uranium biogeochemical zone was M=144.36±35.723 vs 0.6±0.14 for the Republic per 100 000 population (p<0.01).

The incidence rate of brucellosis in Mayluusuu over the past 10 years was M=177.25±33.97 per 100 000 population versus 56.16±42.63 reported in Tash-Kumyr (uranium free area).

Conclusion Thus, the incidence rate of TF and brucellosis among the population living in uranium zone is more than 240.0 and 3 times higher than that in the other areas. But this issue requires a more detailed study.

P II – 3–6 EXPOSURE TO ENVIRONMENTAL POLLUTANTS AND FRAILTY IN OLDER ADULTS

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Background/aim Frailty is an age-related syndrome characterised by reductions in strength, endurance, and physiologic function that increase an individual's vulnerability for developing dependence or death. Extensive research is being conducted to determine preventable risk factors and mechanistic pathways of this syndrome, whose prevalence in Europe and the US is around 10%–15% of the community-dwelling elderly.

Methods

Four studies were conducted The first was a review of the scientific literature on the association between environmental pollutants, limitations in physical functioning, and frailty among older adults. The other 3 were observational studies aimed to evaluate:

1. the association between secondhand tobacco smoke and the frailty syndrome in the nonsmoking community-dwelling US elderly population (n=2509);
2. the association between biomarkers of lead and cadmium exposure and the frailty syndrome among US adults aged ≥60 years (n=5272); and
3. the association between biomarkers of cadmium exposure and walking speed among US adults aged ≥50 years (n=3226).

Results Very few studies have previously evaluated the association between environmental pollutants and frailty or its components. Lead, cadmium and secondhand smoke, are among the pollutants for which we have found evidence that they may be associated with the frailty syndrome. In our studies, the adjusted odds ratios (95% CI) of frailty comparing the second, third, and fourth quartiles of serum cotinine to the lowest were, respectively, 1.44 (0.67–3.06), 1.46 (0.75–2.85), and 2.51 (1.06–5.95), p value for trend 0.04. The corresponding OR for lead tertiles were, respectively, 1.40 (0.96–2.04) and 1.75 (1.33–2.31), p value for trend <0.01. Finally, the highest (vs. lowest) quintile of blood cadmium was associated with a 0.18 (95% CI: 0.10 to 0.25) ft/sec reduction in walking speed, p value for trend <0.001.

Conclusion There is a need for more studies to assess the effects of environmental pollution on frailty.Environmental and geriatric epidemiologists should work together to address important research challenges.

P II – 3–7 OCCUPATIONAL HEALTH OF WORKERS IN THE POTASH INDUSTRY: A RETROSPECTIVE STUDY

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Background/aim The previous works on health of mine workers were mainly related to the respiratory issues due to work with dust. A higher prevalence in cough, dyspnea and chronic bronchitis was observed, but better pulmonary function among high/low exposed potash workers. The aim of this study was to observe Odds ratios for several groups of diseases in potash industry workers vs farmers from the same region.

Methods A retrospective epidemiological study of two cohorts was used to calculate prevalent rates for studies populations and Odds ratios for some diseases (covered period of observation 1984–1995).

Results The industrial workers had higher prevalence rates in all observed diseases types (respiratory system, mental health, musculoskeletal, ocular and hearing organs systems). On average, ORs for the observed period were as the following ones:

1. Respiratory diseases (5.8);
2. Hearing organs system (4.7);
3. diseases of ocular system (4.3);
4. mental health (4.1), and
5. muscuoskeletal diseases (1.8).

The dynamics of ORs was stable except of ocular system and mental health, where the slight increase have been observed after the year 1991 that could be related to synergetic mechanisms with other environmental effects due to the consequences of the Chernobyl accident.

Conclusion Although in those years the protective measures for workers of the potash industry were successfully implemented, some occupational health problems were still observed. Other improvements with regards to the health of the industrial workers are recommended, including preventive or rehabilitation measures; as well as behavioural interventions.

P II – 3–8 BENEFITS OF PARTICIPATION CITIZEN SCIENCE IN RECOVERY PROGRAMS (POST-NUCLEAR ACCIDENTS)

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Background/aim Nowadays citizen-science are volunteers that are involved in research with purposes of their own benefits for volunteers themselves (education) or for the benefit of the project, sometimes with effects on potential changes in a society. The aim of SHAMISEN SINGS project is to explore more benefits and practical uses for and of such volunteers in post-accidental period after nuclear disasters.

Methods An analytical review of peer-reviewed publications on a topic citizen-science in general and specifically related to

radiation, nuclear disasters and dosimetry; as well as main lessons learnt from practical experiences on post-accidental recovery programs after the Chernobyl and Fukushima nuclear accidents (output from the SHAMISEN project – Nuclear Emergency Situations: Improvement of dosimetry, Medical and Health Surveillance).

Results The results of peer reviewed publications show a small proportion (0.02%) related to radiation topic with citizen-science approach: 18 publications were detected by PubMed search with key words 'citizen-science' or 'citizen science' and 'radiation', 5 inputs with 'nuclear disasters' and 2 for 'dosimetry'. After checking the abstracts for their context, it was found the only relevant publication by Brown et al. (2016) concerning to the tool and program 'Safecast: successful citizen-science for radiation measurement and communication after Fukushima'. However, the lessons learnt from the SHAMISEN project highlight the importance of public involvement in the practical post-accidental recovery that make them more sufficient in their daily life to prevent their health and improve well-being.

Conclusion Citizen-science is a useful approach in post-accidental recovery. It can provide information to affected populations – about exposure (dynamics) and health – and can also contribute to the environmental monitoring (complementary to experts), decision-making processes, and, monitoring of health and support of affected publications to take control of their own radiological protection.

P II – 3–9 POLITICAL ECONOMY AND CONTEXTUAL CORRELATES OF HEALTH VARIATIONS IN URBAN NIGERIA

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Background/aim This study investigates the spatial variation in health outcomes in urban Nigeria as a function of this interrelationship as measured by environmental habitat quality in different residential neighbourhoods, the population's levels of social wellbeing and the distribution of urban service infrastructures in the neighbourhoods.

Methods The study employed primary data to rank the neighbourhoods and measure their levels of social wellbeing and secondary data on the location of healthcare facilities in the study area and clinically-diagnosed cases of malaria as a corollary of health outcomes. The data was analysed using a combination of Principal Component Analysis, Hierarchical Cluster technique, One-Way Analysis of Variance, and Correlation analyses,

Results The study established a bias in the distribution of health facilities against high density residential neighbourhoods populated mostly by the urban poor. Health outcomes were also poorest in these neighbourhoods.

Conclusion Urban planning strategies to address the spatial inequalities in habitat quality and service provision are recommended as these will ultimately address health inequalities in the study area

P II – 3–10 ASSOCIATIONS BETWEEN RESIDENTIAL SURROUNDING GREENNESS, CITY PARK USE AND PRESCHOOL CHILDREN HEALTH

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Background/aim There is some evidence that physical activity and nature contact is associated with positive impact on health; however, the research in young children is sparse. The aim of this study was to determine the association between of city park use, residential surrounding greenness level and preschool children health.

Methods This nested case-control study included 1,489 4–6 years children residents of Kaunas city, Lithuania. Responses to the questionnaires completed by the parents were used to identify children's health. We assigned individual exposure to greenness levels as GIS assessed the average of satellite-derived Normalised Difference Vegetation Index (NDVI) within a 100 m buffer of each participant address. Using multivariate logistic regression analysis, we estimated the associations of residential greenness in 100 m buffers by median and time spent in nearest city park (more than 5 h/week vs less than 5 h/week) with children health outcome as adjusted odds ratios (aOR) with 95% confidence intervals (CI).

Results Poor health was reported in 14.0% of children aged 4 to 6 years. Preschool children who spent shorter than 5 h/week in city park had statistically significant by 48% higher risk (OR 1.48 95% CI: 1.10–2.02) of poor health than those who spent longer than 5 hours per week. With reference to the group of higher level of residential greenness exposure (NDVI >median and time spent in city park >5 h/week), lower level of greenness exposure and shorter time spent in city park were associated with statistically significant higher adjusted odds ratios for poor health in 4–6 year-old children (aOR 2.35; 95% CI: 1.45 to 3.81).

Conclusion The findings of this study suggest a beneficial impact of use of city parks on poor health amongst 4–6 year-old children and demonstrate the important role that increased residential greenness can play a beneficial role in reducing the risk of young children's poor health.

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