respiratory admissions, a significant effect of low temperatures is observed for all ages in the North-Continental cities (−2.5%; 95%CI: −3.6; −1.3) and Mediterranean cities (−1.6%; 95%CI: −2.5; −0.6) with the greatest percent change in the 75+ age group (−4.1%, 95%CI: −5.7; −2.5 and −2.7%; 95%CI: −3.3; −2.1, respectively in the North-Continental and Mediterranean cities).

Conclusions: The impact of low temperatures and hospital admissions confirm findings from the PHEWE cold-related mortality analysis with the strongest impact on respiratory admissions, especially in North-Continental cities. Results suggest that cold-related hospital admissions are an important public health problem across Europe.

ISEE-0550

The Attributed Effect of Climate Extremes, Climate Related Epidemics or Outbreaks on Health Is Largely Dependent on the Choice of Approach – A Case Study Comparing Four Approaches for Estimating Excess Hospital Admissions During a Record Warm Summer in South Sweden

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Background: One effect of global warming is an increasing number of extreme weather events, such as floods, storms and heat waves. We aim to compare approaches for the estimation of excess number of cases associated with an extreme episode, exemplifying with a case study of hospital admissions during the extremely warm summer 2006 in southern Sweden.

Method: Hospital admissions were collected for 6 hospitals in the Skåne (Scania) region of Southern Sweden, 1998–2006, from the Swedish National Board of Health and Welfare. Temperature data in the region was collected from the meteorological station in the city of Malmö.

We used four established approaches to estimate the excess numbers associated with extreme heat. Time series of daily frequencies of hospital admissions were assumed to follow a Poisson distribution. Standardized mortality ratios and generalized additive models were used to estimate the health risks attributed to the extreme heat.

Results: The four approaches yield vastly different results that are not reflected in the confidence limits of the specific estimates. The excess numbers can be largely biased if time trends are not accounted for when estimating the observed from previous years' data. Moreover, modeling the effect of temperature (including lagged effect) fails to describe the risks induced by the extreme heat, possibly due to not incorporating the duration of exposure.

Conclusion: The estimated excess frequencies may be largely dependent on the choice of approach. Estimating relative risks of temperature or other determinants of disease may fail to incorporate the specific characteristics of the particular weather event, e.g. the duration. This means such estimates may be less appropriate to use when predicting the future burden of such event on human health, and in particular the burden of future heat waves.

ISEE-0556

Heat Related Mortality among High Risk Elderly in Rome. Summer 2008

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Background and Objectivies: High temperature does not affect the entire population but specific subgroups are more susceptible to heat effects. We analysed the impact of heat waves on mortality during summer 2008 among elderly (≥65 years) residing in Rome, classified according to an indicator of susceptibility to heat.

Methods: At the beginning of summer people 65+ year old were classified in four groups at increasing risk of dying during heat waves (low, medium-low, medium-high, high). The indicator attributes a score to subjects according to age, gender, civil-status and pre-existing pathologies. People identified at medium-high and high risk were included in an active surveillance program.

Heat mortality by level of risk was evaluated using a cubic regression spline; relative and attributable risks of dying during heat wave days by risk level were computed.

Results: The maximum apparent temperature-mortality relationship show different pattern in the four risk groups, with a clear dose-response relationship only in the medium-high risk group. The RRs of dying during heat wave increase by increasing risk up to the medium-high level, while in the highest risk group the RR was lower and not significant (RR_{-low} 1.18, 95CI%: 1.10–1.27; $RR_{-medium\text{-}high}$ 1.40, 95CI%: 1.08–1.86; RR_{-high} 1.10, 95CI%: 0.88–1.37). The attributable risk ranges from 0.99 per 100,000 (95CI%: 0.83–1.16) in the low risk group to 11.39 in the medium-high (95CI%: 7.66–15.97) and declines to 4.24 in the high risk group (95CI%: 0.72–8.60).

Conclusions: Results show an effect of heat on mortality which increase according to susceptibility level. However the highest risk group showed a lower RR of dying during heat waves, and this might be due to their high overall mortality rate as well as to the effectiveness of the prevention program.

ISEE-0558

Expert Elicitation on Health Effects Related to Exposure to Ultrafine Particles: Likelihood of Causality and Causal Pathways

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Background and Objective: Exposure to fine ambient particulate matter (PM) has consistently been associated with morbidity and mortality. However, the association of health effects from exposure to ambient ultrafine particles (UFP) is still under debate. Therefore, we organized an expert elicitation workshop to assess the evidence for a causal relationship between exposure to UFP and health endpoints.

Methods: The workshop focused on: 1) the likelihood of causal relationships with key health endpoints, and 2) the likelihood of causal pathways for cardiac events. Selected through a systematic peer-nomination procedure, twelve European experts (epidemiologists, toxicologists and clinicians) attended the workshop. Individual expert

judgments in the form of ratings of the likelihood of causal relationships and pathways were obtained using a confidence scheme adapted from the Intergovernmental Panel on Climate Change.

Results: The likelihood of an independent causal relationship between increased short-term UFP exposure and increased all-cause mortality, cardiovascular and respiratory hospital admissions, aggravation of asthma symptoms and lung function decrements was rated medium to high by most experts.

The likelihood for long-term UFP exposure to be causally related to all cause mortality, cardiovascular and respiratory morbidity and lung cancer was rated slightly lower, mostly medium.

The experts rated the highest likelihood for the pathway involving respiratory inflammation and subsequent thrombotic effects; translocation of particles to the blood and subsequent effects on the autonomic nervous system and cardiac rhythm was considered the least likely pathway towards cardiac events.

Conclusion: Overall the results of the expert elicitation indicated that there is medium to high likelihood of health effects associated to UFP exposure, most likely through respiratory inflammation and subsequent thrombotic effects. The results stresses the importance of considering UFP in future Health Impact Assessments of (transport-related) air pollution, and the need for further research on health effects of UFP exposure.

ISEE-0562

Effect of Air Pollution Control on Mortality in County Cork, Ireland

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Background and Objective: Previously, we reported reductions in black smoke concentration (-36 $\mu g/m^3$) and 6–16% reductions in total non-trauma, cardiovascular, and respiratory mortality rates following a 1990 ban on the marketing, sale, and distribution of coal in Dublin, Ireland. We have now evaluated changes in mortality rates in County Cork following a similar coal ban in 1995, where a similar 16.5 $\mu g/m^3$ reduction in black smoke concentration was observed.

Methods: Using Poisson regression, we regressed weekly age/gender standardized mortality rates against an indicator of the post- versus pre-ban period (before and after October 1, 1995) adjusting for influenza epidemics, weekly mean temperature, and the Irish standardized mortality rates in the areas not affected by the 1990, 1995, 1998, or 2000 local bans on coal sales.

Results: Compared to the pre-ban period, we found a significant reduction in the total, non-trauma mortality rate (-6% 95% CI = -9%, -5%) with larger reductions in the younger (<75 yrs) subjects (-14%; 95% CI = -16%, -11%), compared to those 75+ yrs (-5%; 95% CI = -7%, -3%). In analyses of broad ICD9 categories, we found significant reductions in the cardiovascular (-13%), respiratory (-8%), and 'other cause' (-7%) mortality rates. We also found significant 7–25% reductions in specific cardio-respiratory mortality rates including ischemic heart disease, ischemic stroke, pneumonia, COPD, and lung cancer.

Conclusion: These reductions in cardio-respiratory mortality rates were similar in size to those seen in Dublin following the 1990 ban.

ISEE-0564

Extrapolation of Land-Use Regression Models in Time

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Background and Objective: Land-use regression (LUR) modelling has become a popular method to assess exposure levels for individual study subjects in large epidemiological studies. Stochastic modelling is used to determine which predictor variables best explain the pollution concentrations measured at a number of network locations. Because of the lack of spatially sufficiently resolved data, epidemiological studies often use recent air pollution exposure data and link those to health data collected before the exposure data. This is only valid if spatial contrasts are stable over a long period of time. We tested the stability of measured and modelled spatial contrasts across the Netherlands over an approximately 10-year period.

Methods: The TRAPCA study conducted NO_2 measurements at 40 locations in the Netherlands in 1999–2000. A land-use regression model was developed to estimate individual exposures for a cohort of 4146 children. A new land-use regression model was constructed around NO_2 measurements taking place in 144 locations respectively in 2007, of which 35 locations were the same as in 1999–2000. This enabled us to compare both measurements and model predictions between the both years.

Results: Results from NO_2 measurements conducted in 2007 correlated well with NO_2 measurements taken in 1999–2000 ($R^2 = 0.86$). When both 1999–2000 and 2007 land-use regression models were applied to predict concentrations for the measuring sites using leave-one-out validation, these also agreed very well ($R^2 = 0.81$). Interestingly, our 2007 land-use regression model was able to explain 66% of spatial variability in 1999–2000 measurements and the 1999–2000 model explained 80% of variability as measured in 2007.

Conclusion: Our study found that the spatial contrasts which applied in 1999–2000, still applied to a large extent in 2007. Apart from that, we found convincing evidence that it is acceptable to use recent models to estimate exposure variability for correlation with historical health outcomes.

ISEE-0566

$PM_{2.5}$ and Heavy Metals Outdoor Concentrations at a School Near to an Industrial Zone in Cali, Colombia

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Background and Objective: High levels of particulate matter (PM) were previously found in northern Cali. The area limits with an industrial zone with main emissions coming from metals smelting and batteries production factories. As part of the exposure assessment in a prevalence study of respiratory symptoms in children, we determined outdoors levels of $PM_{2.5}$ and heavy metals in a school located 2.5 km down-wind of the industrial zone.

Methods: Twenty-four hours samples of $PM_{2.5}$ were collected from January-March 2009 with a low-volume sampler on Teflon filters. Samples were gravimetrically analyzed for mass concentration and via EDXRF to determine presence and mass concentration of heavy metals (Cu, Cr, As, Cd, Pb). Pair wise correlation coefficients were estimated for $PM_{2.5}$ and metals, and also between all metals. Additionally, linear regression analysis was performed for $PM_{2.5}$ and Pb.

Results: Mean concentration of $PM_{2.5}$ was 43.38 ug/m^3. Among all samples 73% were found with Cr at a mean concentration of 0.005 ug/m^3; 31% with As at 0,010 ug/m^3; 82% with Cd at 0,057 ug/m^3; 71% with Cu at 0,024 ug/m^3; and 100% with Pb at 0.814 ug/m^3. We only found a significant correlation between Pb and As levels ($r = 0.90$, $P < 0.001$). Regression analysis demonstrated a statistically significant association between Pb and $PM_{2.5}$ ($P = 0.05$) although it only explained 8% of the PM variation.

Conclusion: Although levels of $PM_{2.5}$ did not exceed daily limits, there was a trend to exceed annual limits. Heavy metals concentrations, mainly Pb, represent a threat for human health, and the correlation observed between Pb and as suggests that main potential sources are local factories.