

**Methods:** The relationship between particles and self-reported symptoms was studied in the Respiratory Health in Northern Europe Tartu cohort. A postal questionnaire with questions regarding respiratory complaints, cardiac disease, lifestyle as smoking habits, indoor environment, occupation, early life exposure, and sleep disorders was sent to 2460 adults. The annual concentrations of particles induced by local heating were modeled with an atmospheric dispersion model AirViro and obtained PM<sub>2.5</sub> concentrations in 200 × 200 m grid cells were linked with home addresses, using geographic information system. The relationship between the level of fine particles outside home and self-reported health problems was analyzed with logistic regression model.

**Results:** The annual average exposure to PM induced by local heating was 4.1  $\mu\text{g}^{-3}$  (max, 7.4  $\mu\text{g}^{-3}$ ). We found a significant relation with wheezing, OR = 1.10 (95% CI: 1.00–1.21); and cough, OR = 1.07 (95% CI: 1.00–1.14) per 1  $\mu\text{g}^{-3}$  increase in PM<sub>2.5</sub> exposure. The associations were slightly positive but nonsignificant for chronic bronchitis, rhinitis, shortness of breath, hypertension, and cardiac diseases.

**Conclusion:** The local heating pollution seems to induce slight respiratory symptoms such as wheezing and cough. These particles appear to be different from others, as our previous results with traffic-induced PM had shown relationship only with cardiac diseases.

#### PP-31-023

##### Estimating Commute Time and Distance for Human Subjects in Air Pollution Epidemiological Studies

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**Background/Aims:** In-transit exposures to traffic-related air pollutants are frequently high because of vehicle's proximity to traffic emissions and rapid air exchange rate. However, little is known about the affect of people's in-transit exposure on adverse health outcomes mainly due to methodological difficulties in assessing parameters of vehicle travel. In this study, we developed methods to reliably estimate people's commute time and distance based on addresses or coordinates of key locations (eg home, work, school) using widely available online trip routing services.

**Methods:** We compared the self-reported and global position systems (GPS)-based commute times based on travel diary and GPS tracking data for about 300 households in the 2000/2001 Southern California Association of Government travel survey. In addition, we derived web-based estimates of commute time and distance based on origin and destination locations. Multivariate regression models were developed to estimate actual commute time and distance by including web-based estimates and other influential factors that can be readily obtained either from questionnaire surveys (eg, season, day of the week, time of day, purpose of commute) or from publicly available data (eg, type and speed limit of roadways).

**Results:** We identified the potential and limitations of using diary or GPS-based method for examining people's commute patterns in epidemiological studies. GPS-based data frequently identify short trips not reported in diaries (eg, a GPS may reveal a subject's sequential locations as work—daycare drop-off—grocery shopping—home, whereas a diary may indicate location as work—home). We found that web-based estimates correlated better with GPS-based estimates for commute distance than commute time. Our preliminary regression models can explain 85% of the variance in GPS-based commute time.

**Conclusion:** On the basis of simple questionnaire data and trip routing tools, we can reasonably estimate subjects' commute time and distance for in-transit exposure assessment in air pollution epidemiological studies.

#### PP-31-024

##### Air Pollution and Respiratory Diseases Hospital Admissions: Sex-related Patterns in a Population Living Nearby a Steel Producing Plant in Brazil

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**Background/Aims:** Epidemiologic studies have been supplying evidence on the association between different health problems and the daily increase of air pollution levels. Studies analyzing such association considering gender as a susceptibility factor have been inconclusive. This study aimed to evaluate the air pollution effect on respiratory diseases hospital aiming to evaluate the role of age and gender as susceptibility factors.

**Methods:** Volta Redonda is a city in Southeast region of Brazil, wherein the country's largest steel producing plant is settled. This ecological time-series study used data on local daily hospital admissions for respiratory diseases (ICD-10, J00–J99) in the whole population and among those aged ≥65 years. Data were stratified by gender; PM<sub>10</sub>, and SO<sub>2</sub> average concentrations, minimum temperature, and relative humidity along January 2002–December 2006. Furthermore, hospital admissions data were analyzed using generalized additive Poisson regression, with constrained distributed lag models adjusted for long time trend, weekdays, and holidays. The quality of fit for the final model was estimated using residual deviance analysis and the Akaike criteria.

**Results:** An increase of 10  $\mu\text{g}/\text{m}^3$  in PM<sub>10</sub> concentration was associated with a highest risks—1.06 (95% CI: 1.003–1.111)—of hospital admissions in elderly women, and according to similar increased levels of SO<sub>2</sub> concentration, a risk of 1.04 (95% CI: 0.924–1.178) was observed. For elderly men, the increased risks of hospital admission were 1.02 (95% CI: 0.961–1.076) and 1.02 (95% CI: 0.897–1.162).

**Conclusion:** This study showed an association between PM<sub>10</sub> and SO<sub>2</sub> air concentrations and increased risks of hospital admissions for respiratory diseases, being higher among elderly women. Therefore, age and gender act as factors of susceptibility to hospital admissions for respiratory diseases.

#### PP-31-025

##### An Update on the Multiethnic Study of Atherosclerosis and Air Pollution

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**Background/Aims:** “MESA Air” (Multi-Ethnic Study of Atherosclerosis and Air Pollution) is a multicenter prospective cohort study of air pollution and cardiovascular disease (CVD) launched in 2004, combining state-of-the-art cardiovascular outcome measurements with individual-level exposure assessment. The central hypothesis is that long-term exposure to airborne fine particulate matter is associated with accelerated atherosclerosis and risk of clinical cardiovascular events.

**Methods:** MESA Air builds on the framework of the National Heart, Lung, and Blood Institute multiethnic study of atherosclerosis (MESA). MESA studies risk factors (and evidence of pre-clinical processes) that predict development of clinical CVD among individuals without known CVD, in a population-based sample from 6 major metropolitan areas. MESA Air adds to MESA individual-level exposure estimates that integrate spatio-temporal modeling of outdoor air concentrations, participant-specific predictions of residential pollutant infiltration efficiency, and time-location patterns. MESA Air supports a follow-up measurement of intima-medial thickness of the carotid artery and coronary artery calcification (CT scan) in 3600 participants in an examination now underway. Annual follow-up of each participant (n > 6000) is followed by medical record review. Individual exposure estimates will be combined with each participant's cardiovascular status to understand the influence of air pollution exposure on progression of CVD.

**Results:** MESA Air is halfway through its 10-year project period; analysis of primary study outcomes will not proceed until 2012. However, progress to date is notable: Advances in exposure modeling approaches will be reviewed. Initial epidemiologic analyses demonstrate associations between predicted outdoor air pollutant concentrations at participants' homes and extent of emphysema (CT scan), microvascular phenomena (retinal photography), and left ventricular mass (MRI).

**Conclusion:** MESA Air is a comprehensive epidemiologic study of long-term air pollution exposures and CVD. This research will provide refined estimates of risks associated with exposure to air pollution and stimulate hypotheses regarding biologic mechanisms. The presentation will provide analysis updates and opportunities for collaboration.

#### PP-31-026

##### Increased Mortality in Diabetics Exposed to Ozone

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**Background/Aims:** Associations between ozone exposure and mortality have been established. However, the relationship between ozone exposure and diabetes mellitus mortality, 1 of the top 10 leading causes of death in the world, remains unclear. In this study, we aim to explore the relationship between ozone exposure and mortality from diabetes.

**Methods:** Between 2006 and 2008, death of diabetic (ICD-9, 250; N = 5767) patients more than 50 years of age taken from National Mortality Registry in metropolitan Taipei, Taiwan, were included for analysis. Average levels of ozone each day were calculated from 15 monitoring stations of Taiwan Environmental Protection Agency in this area. Case-crossover design was applied to examine the odds ratio between the risk and reference periods, whereas daily moving average from zero day (the day of death) to seventh day was used, and 4 reference days were chosen by every 7 days before the day of death for 1 month. Temperature and relative humidity were included in the 1-pollutant model, and PM<sub>10</sub> or PM<sub>2.5</sub> was further adjusted in 2-pollutant model separately after calculating the correlation of air pollutants.

**Results:** In 2-pollutant model with PM<sub>2.5</sub> adjusted, the trend of accumulative effect of ozone was observed. Diabetic patients were at risk (OR = 1.09, 1.01–1.17) for deaths in an interquartile increase of ozone (11.6 ppb) within 5 days exposure. In ozone-associated deaths from diabetes, male was at higher risk (OR = 1.14, 1.03–1.26), and younger age group (50–65: OR = 1.19, 1.01–1.40) was at elevated risk than older groups. Similar results were also observed when PM<sub>10</sub> was controlled in 2-pollutant model.

**Conclusion:** Mortality from diabetes is associated with increased ozone exposure, and the risk is higher for males and those aged 50–65. The specific causes of diabetes mellitus death need further investigation.

#### PP-31-028

##### Time-activity Patterns: A Case of South Durban, South Africa

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**Background/Aims:** Exposure modeling in the developing world is constrained by a lack of population specific time-activity patterns data. The application of data from the developed world in exposure modeling in the developing world is fraught with uncertainties, concerning among others the exposure setting characteristics, the amount of time spent in various microenvironments, and the drivers for time spent in various microenvironments. The objective of this study was to determine time-

activity patterns for an adult population in south Durban, South Africa, to inform air pollution exposure modeling. A questionnaire was administered to a sample of the adult population between January and June 2007.

**Methods:** The data were analyzed using STATA 10. Descriptive statistics were calculated for the amount of time spent in various microenvironments. Linear regression modeling was used to determine factors that influence the amount of time spent in these locations by the study population.

**Results:** Results indicated that time spent indoors, outdoor, and on transportation activities by the Durban adults differed to that reported for the developed world adult populations by approximately 12%–16%, 44%–55%, and 50%, respectively. Statistically significant drivers for mean time indoors were age, season, and temperature ( $P < 0.05$ ). Mean indoor time at home was dependant on age ( $P < 0.05$ ), and employment status and weekend versus weekday ( $P < 0.001$ ). Mean time outdoor was dependant on age and temperature ( $P < 0.05$ ). None of the factors evaluated were statistically significant drivers for mean time spent on transportation activities. Overall gender, education, and precipitation were not statistically significant drivers of time spent in different microenvironments ( $P > 0.05$ ).

**Conclusion:** The results suggested that time-activity patterns for the developed and developing world differ. Therefore, exposure modeling in the developing world needs to be informed by population specific time-activity patterns.

#### PP-31-029

##### Exposure to Highway-related Ultrafine Particles and Cardiovascular Markers: The CAFEH Project

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**Background/Aims:** A significant portion of urban air pollution derives from motor vehicle exhaust on highways and busy streets. Recent studies have shown that the near-highway environment contains elevated concentrations of ultrafine particles (UFP; diameter  $<0.1$  micrometer), which is a concern, because UFP is generally more toxic than larger particles. We are involved in a 5-year, observational, cross-sectional, community-based participatory research study (titled Community Assessment of Freeway Exposure and Health [CAFEH]) of exposure and cardiovascular health outcomes in neighborhoods immediately adjacent to major highways in the Boston, Massachusetts, area.

**Methods:** We are conducting environmental monitoring of particle number concentration and other air pollutants in Somerville (just north of Boston) near Interstate-93 ( $>1.5 \times 10^5$  vehicles/d), using a mobile monitoring platform and 2 fixed sites. The residents aged  $\geq 40$  living  $<100$ , 100–400, and 1000 m have been selected for participation. Participants complete a survey of demographics, time-activity, cardiovascular diagnoses, and potential confounders. A subset of these participants agreed to have blood pressure measurements taken and to donate blood samples for C-reactive protein (CRP), lipids, and fibrinogen analysis.

**Results:** Data collection is ongoing, and we have preliminary results for the first set of participants. The cohort is predominately female and white, with a mean age of 58 years. Prevalence of hypertension and pre-hypertension based on measurement is 36% and 78%, respectively. The mean levels of CRP and fibrinogen are 1.9 and 455 mg/dL, respectively. Mean systolic and diastolic blood pressure in the left arm is 135 and 77 mm Hg, respectively. There are weak correlations between systolic blood pressure and both hypertension and cardiovascular diagnosis. In addition, there is a weak association between distance-to-highway and CRP.