

ISEE-268

MEASUREMENTS OF EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELDS (50HZ) IN PRIVATE HOMES IN GERMANY - RESULTS OF A REPRESENTATIVE SAMPLE OF N=1935

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Background: Extremely low frequency magnetic fields (ELF-EMF) are discussed as one possible risk factor for leukaemia and malignant lymphoma. Little is known, however, about the distribution of ELF EMF in the general population. In the Northern Germany Leukaemia and Lymphoma Study (NLL) we face-to-face interviewed 4471 cases (N=1430) and population controls (N=3041) using a standardized computer-assisted questionnaire. Exposure assessment comprises the individual lifelong history of all residences and workplaces.

Methods: Additionally we conducted physical measurements of 50-Hz magnetic fields in 1935 representative private households of NLL-participants, using calibrated handheld EMDEX II meters (Enertech, Campell CA, USA). Short-time measurements (30 sec) of magnetic flux density (uT) were conducted at 7 predefined spots in the homes including the living room (separate measurements for TV on/off), the kitchen (electrical household appliances turned on/off), and the bedroom. Besides these spot measurements the magnetic field at the position of the participants' head while sleeping (pillow position) was monitored for 2 hrs. Upon completion of all measurements the EMDEX meter was connected to the interviewers' notebook computer and the data were downloaded automatically by a data transfer protocol (EMCALC TM). A self-constructed, portable power consumer (0 VA 10 sec, 500 VA 10 sec, 1000 VA 10 sec) was used to test for ground currents.

Results: The geometric mean of the 2h-measurements (N=1912) was 0.026 uT (geometric standard deviation (s) =3.67). 3.2% of all 2h-measurements were <0.2 uT. If differentiated by type of home we found for apartments (N=447) a geometric mean of 0.04 uT (s=2.8) and for houses (N=1192) a geometric mean of 0.021 uT (s=3.99). Maxima of 50-Hz magnetic fields were found most often in private work rooms with a PC switched on (26.1% of 1935 homes) and in kitchens with electrical appliances turned off (14.5%).

Ground currents were detectable in 2.2% of 1742 homes. Presence of ground currents was strongly associated with one of two electrical wiring systems commonly used in Germany (TN), while it was rare in the other system (TT).

Conclusion: In Germany indoor ELF-EMF are the predominant source of exposure for the majority of the general population. Flux density varies considerably depending on type of home, electrical appliances, and wiring systems.

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VARIABILITY OF RADIOFREQUENCY POWER OUTPUT OF GSM MOBILE PHONES

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Purpose: The purpose of this study is to measure how environmental and network factors affect radiofrequency (RF) power output of a mobile phone. Variability in power output is known to occur based on engineering concepts and principals, but the parameters that affect the

variability and levels of required RF output power are not known and are likely to affect exposure in the mobile phone user. We assess variability among calls as part of an exposure assessment study designed to develop exposure metrics for future epidemiologic studies. Previous epidemiologic studies have relied on self-reported use, years as a subscriber, or billing records as exposure surrogates. While subscriber records can minimize recall bias in self-reported years or minutes of use, these methods do not capture potential significant variations in the level of RF power.

Methods : We used software-modified phones that record the RF power control (PWC) levels of mobile phones to monitor variations in RF power output in different situations. (PWC is used to optimize antenna input power in wireless systems to provide satisfactory fidelity with the lowest possible power.) Individuals were instructed to use an SMP phone in different geographic locations in specific situations that were likely to require different overall power. These situations included urban/suburban/rural; indoor/outdoor; and moving vehicles. Because all the modified phones are the same model, the effect of phone design and antenna geometry is constant. To date, base station density, which affects power output, can only be estimated indirectly, based on market penetration of GSM.

Results: The initial results show that within a geographic region, average PWC level differs between calls made from a higher floor vs. lower floor in an urban area, and calls made from inside a home and driving in a rural area. Based on initial testing, the average PWC level of cell phones was consistently higher for calls made inside a commercial building than for calls made outside.

Conclusions : Cell phone power output, and therefore potential human exposure, differs among calls made from different locations within the same geographic region, as well as among calls made from different geographic regions (e.g., rural vs. urban). These data provide guidance for making preliminary estimates of the range of exposure variability determining sample size for surveys of actual users. Additional testing will collect data for a larger number and duration of phone calls.

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ISEE-270

IMPROVING RADIOFREQUENCY EXPOSURE ASSESSMENT IN STUDIES OF MOBILE PHONE USERS: AN OVERVIEW OF RESEARCH DESIGN AND PRELIMINARY DATA

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Abstract: Our objective is to identify aspects of cell phone systems and use that can yield practical and reliable proxy measures for radiofrequency (RF) exposure in epidemiologic studies. Handset power control (PWC) can rapidly change RF power radiated from the handset over a 100-fold range. Although exposure is a function of duration and RF energy, most epidemiologic studies have concentrated on duration of use as the sole surrogate for RF exposure. Our method for estimating exposure to RF is based upon recording PWC data from GSM-based software modified phones (SMPs). In addition, we are measuring the specific absorption rate (SAR) using "mobile phantom heads" for a variety of field conditions and wireless technology factors (handset type, service provider). Our research program incorporates four major research elements: a questionnaire recall study, SMP survey, field study, and SAR modeling. Key aspects of the

four studies include:

Recall Study: We will determine the accuracy of recall of phone use over recent (1 week, 1 month) and more distant periods (1-3 years) by comparing questionnaire data to billing record data in an occupational population. Company billing records are available for 215 employees. Preliminary analysis of data for a one-year period of use indicated that on average 5 calls were made per day for an average of 15.5 minutes per day.

SMP Study: Individuals in occupational and general populations are using SMP phones and activity logbooks. Analysis will assess how technical and environmental factors affect PWC.

Field Study: SAR measurements in phantom heads fitted with phones and E-field probes will be used to assess the influence of phone type, network type and condition, and movement. The results of a pilot field study that will be used to refine the design of the Field Study and SMP survey data are also presented.

SAR Modeling Study: Organ specific SAR dependent on phone type, position at the head and anatomy is evaluated based on the dosimetric data submitted to the US FCC as well as of the exposure evaluations conducted in the IT'IS laboratory between 1994–2004 combined with simulation results.

Factors that impact PWC, and hence user RF energy exposures include 1) characteristics of the user, 2) technical characteristics of the mobile phone (e.g., design, specific cellular technology and position of the phone relative to the head or other body region), and 3) environmental factors (e.g., network [type, traffic], distance to base station, base stations density, terrain).

ISEE-271

CHALLENGES IN ESTIMATING ASSOCIATION OF PUBERTAL DEVELOPMENT RATES WITH ENVIRONMENTAL EXPOSURES, IN CROSS-SECTIONAL STUDIES

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Introduction: The purpose of this work is to discuss challenges in estimating the association between pubertal development rates and environmental exposures, in cross-sectional studies

Methods: Estimation of transition rates from each one Pubertal Developmental Stage to the next is straightforward, if subjects have been followed over time and the time of at which each person enters the next stage has been recorded. Estimation of developmental rates is less straightforward, when only cross-sectional observations are available. We review methods for estimating these transition rates from one developmental stage to the next, and how these results can be used to assess the impact of environmental exposures.

Results : The method of estimating transition rates is illustrated using data from NHANES concerning pubertal development stage, and the association with lead exposures. We characterize the key inherent assumptions with use of cross-sectional data, as well as potential biases related to violation of those assumptions.

Discussion: A number of assumptions that underlie estimation of developmental rates from cross-sectional observations of pubertal stage are vital to validity. The associated limitations when applied to studies of environmental exposures are discussed.

ISEE-272

POLYBROMINATED BIPHENYLS, BODY WEIGHT AND INCIDENCE OF TYPE 2 DIABETES MELLITUS

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Introduction: In the summer of 1973 polybrominated biphenyls (PBBs) were accidentally mixed into cattle feed instead of magnesium oxide. As a result, some Michigan residents consumed PBB-contaminated farm products for about eight months. A cohort of exposed residents was established and three surveys were conducted: 1976 (enrollment), 1991 (1st follow-up), 2001 (2nd follow-up). PBBs are thought to have endocrine disrupting activities.

Objective: To investigate the relationship between initial PBB serum concentration- measured in parts per billion (ppb), body weight, and incidence of (self-reported) type 2 diabetes mellitus using information from three surveys.

Methods: Our study population included 1,478 subjects (29.3%) from the Michigan PBB cohort. Selection criteria: no diabetes in the first survey, age greater than 20 years at enrollment, an initial PBB serum determination, and information from enrollment and at least one follow-up survey. The incidence of diabetes was modeled using person-years of follow-up (Poisson regression). Covariates include PBB exposure group (0-1, 2-3, 4-5, >5 ppb), gender, age at enrollment, body mass index (BMI), smoking, and alcohol consumption. Using generalized linear models, we estimated the incidence density ratio (IDR).

Results: Men and women in the highest BMI group (<30 kg/m²) had a significantly increased diabetes incidence: IDR=6.6 (95% CI: 3.5-12.4) for men and IDR=5.5 (95% CI: 3.2-9.5) for women. Women in the 4-5 ppb PBB group had a significantly higher diabetes incidence when compared to the reference level (0-1 ppb): IDR=2.1 (95% CI:1.2-3.6). Additionally we investigated changes in self-reported weight in the first two surveys. We found a linear decrease in weight related to the PBB exposure levels in men, but not in women. For men, the diabetes incidence was significantly higher for those who lost weight (IDR=1.7, 95% CI: 1.1-2.7) when compared to those who gained weight or remained the same.

Conclusion: BMI was strongly related to diabetes incidence in both genders. The association between diabetes and PBB exposure is not straightforward. We found a significant association with a medium-level exposure only in women. In men, our data suggests an association between PBB level and weight loss, which in turn is associated with a higher incidence of diabetes. Weight loss is known to contribute to an increase in serum concentration of lipophilic toxicants. It is possible that the increased diabetes incidence in men who lost weight is due to increased PBB serum levels. Our data is also indicative of a sexual dimorphism in response to PBB.

ISEE-273

SERUM DIOXIN CONCENTRATIONS AND AGE AT MENARCHE

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Introduction: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), a widespread environmental contaminant and known endocrine disruptor, is associated with a delay in onset of puberty in animal studies. On July 10, 1976, as a result of a chemical explosion, residents of Seveso, Italy experienced the highest levels of TCDD exposure in a human population. Twenty years later (1996-1998), the Seveso Women's Health Study (SWHS), a retrospective cohort study, was initiated to determine whether the women were at higher risk for reproductive disease.

Methods: The SWHS cohort comprises 981 women who were one month to 40 years in 1976, resided in the most contaminated areas at the time of the explosion, and had archived sera collected soon after the

explosion. We examined the association of TCDD exposure with age of menarche among the 282 SWHS women who were premenarcheal at the time of explosion. Individual serum TCDD exposure was measured by high-resolution mass spectrometry and age at menarche was collected by self-report at interview.

Among the 282 women who were premenarcheal at explosion, the adjusted Hazard Ratio (HR) associated with a 10-fold increase in TCDD was 0.95 (95 percent confidence interval: 0.83, 1.09); and the p-value for trend was $p = 0.46$. That is, there was no change in risk of onset of menarche with a 10-fold increase in TCDD (e.g., 10 to 100 ppt). When TCDD was categorized, there was also no evidence of a dose-response trend ($p = 0.65$). The conclusions were similar when the analysis was restricted to the subset of women who were less than eight at exposure ($n=158$) and thus not yet at risk for menarche or when we added back in 153 women who were in the same birth cohort as the 282 women in the analysis sample (birth years 1959 - 1976), but who had begun menstruating before the explosion date, July 10, 1976.

Discussion: In summary, individual serum TCDD measurements are not significantly related to age of menarche among women in the SWHS cohort. The women in this study experienced significant TCDD exposure during the postnatal but pre-pubertal developmental period. Animal evidence suggests in utero exposure may be the more sensitive route for the developing fetus, thus, continued follow-up of the offspring of the SWHS cohort is important.

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MENSTRUAL CYCLE FUNCTION AMONG WOMEN WITH POLYBROMINATED BIPHENYL EXPOSURE

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Introduction: The Michigan Female Health Study was conducted in 1997-1998 among women in a cohort exposed to polybrominated biphenyls (PBBs) in 1973. We investigated whether menstrual cycle function was altered among these women.

Methods: A total of 337 women, aged 24 to 56, with self-reported menstrual cycles between 20 and 35 days, were eligible for analyses. We estimated PBB levels at the time of interview by modeling the exponential decay of serum PBB levels that had been measured from 1975 to 1987 when the women were enrolled in the Michigan PBB Cohort. Linear regression models related menstrual cycle length and bleed length to estimated current PBB exposure.

Results: Higher levels of physical activity were associated with shorter bleed length, and increasing age was associated with shorter cycle length. The association of age with bleed length was J-shaped. Although no overall association was found between PBB exposure and menstrual cycle characteristics, significant interactions of PBB exposure with age and weight loss were found. Among women with weight loss, PBB exposure was associated with longer bleed length and shorter cycle length.

Discussion: These observations generate hypotheses for specific mechanisms of endocrine disruption by organohalogen compounds.

ISEE-275

ANTIESTROGENIC EFFECTS OF ENVIRONMENTAL POLLUTION IN HUMAN BLOOD AND PLACENTA

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Abstract: Modulation of estrogenic activities in humans were investigated in two epidemiological studies in the Central European region. In the first study, total estrogen receptor-mediated activities of extracts from 150 male sera were determined in the breast cancer T47D.Luc cell line stably transfected with a luciferase reporter gene (ER-CALUX assay). Samples from region of Michalovce (Slovakia), heavily polluted with polychlorinated biphenyls, showed generally lower ER-mediated activity, however the decrease in estrogenic activity was not significant. 17beta-Estradiol elicited a major part of the total ER-mediated activity detected in the samples. A specific contribution of persistent organic pollutants to overall estrogenic response was measured in H2SO4/silica fractionated serum extracts. A portion of samples was inactive in the ER-CALUX assay; however, a number of samples eliciting at least a partial estrogenic activity was significantly lower in the PCB-polluted area as compared to the background control region. Moreover, a threefold increase in number of samples showing antiestrogenicity was found in the PCB-polluted area. In summary, this study suggested that antiestrogenic effects and/or suppression of estrogenicity might be associated with long-term PCB pollution.

In the second study, human placental aromatase (CYP19) and 7 ethoxyresorufin O deethylase (CYP1A) activities were investigated in 120 human placental samples collected in two Czech Republic urban regions with a different extent of pollution. A significant suppression of the aromatase activity was found in the placental samples from the industrially-polluted district of Teplice (Czech Republic), where airborne pollution is clearly the prevalent way of exposure. Association with the intrauterine growth retardation of fetus was found as well. The CYP1A activity (which is a biomarker of exposure to dioxin-like compounds leading to additional antiestrogenic effect) was elevated only marginally. The human placental aromatase activity in vivo appears to be a prospective biomarker of endocrine disruption pathway which is independent of estrogen receptor.

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ISEE-276

MATERNAL EXPOSURE TO DDE MAY INCREASE WEIGHT AND BODY-MASS IN ADULT FEMALE OFFSPRING

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Introduction: To investigate the effect of *in utero* exposure to polychlorinated biphenyls (PCBs) and dichlorodiphenylethylene (DDE) on weight, height and body mass index (BMI) in adult female offspring.

Methods: We identified 213 daughters, 20-50 year of age, of mothers with DDE and PCBs determinations from the first generation in the Michigan fish eater cohort. Of the adult female offspring 71% participated in our study ($n=151$). Maternal serum levels (DDE, PCBs) were ascertained between 1973 and 1991 in repeated investigations. We extrapolated maternal serum levels backward to the time of birth. To estimate the effect of *in utero* PCB and DDE exposure on weight, height, and BMI, we used linear regression analyses. We controlled for maternal height and weight, as well as for factors of the adult offspring such as birth weight, breastfed or not, number of pregnancies, and age of the offspring.

Results: The average age of the adult female offspring was 36.6 years; 17% had a BMI of 30 kg/m² and higher (obese) and 20.5% a BMI between 25 and >30 kg/m² (overweight). Maternal height and BMI were significant predictors of their daughters' height, weight, and BMI. Low birth weight (>2,500 g) was significantly associated with reduced adult offspring height, weight, and BMI. High birth weight (<4,000 g) significantly predicted adult offspring height, but not weight or BMI. Maternal DDE levels predicted the weight and body-mass of adult

offspring. The weight of the adult offspring, controlling their height, increased 6.08 kg per 10 microg/L increase in maternal serum DDE levels ($p=0.047$). Body-mass of the offspring increased by 2.0 kg/m² per 10 microg/L maternal DDE ($p=0.058$). Maternal PCB concentrations during pregnancy were not related to these anthropometric measures.

Discussion: *In utero* exposure to the estrogenic endocrine-disrupting chemical DDE may explain a part of the obesity epidemic in the United States. Further research is needed to better understand the relationship.

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ISEE-277

PUBERTAL DEVELOPMENT AS AN INDICATOR OF, AND CRITICAL PERIOD FOR, ENDOCRINE DISRUPTION

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Abstract: Pubertal development is a complex process involving the central nervous system, gonads and other endocrine organs. The first step in this process occurs in utero and extends into infancy. The surge in steroid hormones that occurs in infancy is sometimes referred to as “baby puberty” and may represent a critical window for the normal development of the endocrine system. Exposure to endocrine disrupting chemicals during this critical period may cause advanced or delayed puberty as well as later reproductive dysfunction. Likewise, the period of pubertal development itself is a critical period of gonadal maturation and preparation for reproduction. Exposures during this window may also have adverse consequences for reproduction, reproductive cancers and other endocrine-sensitive endpoints. We will review the endocrine events that occur during these developmental stages.

A cohort of individuals exposed to polychlorinated biphenyls (PCBs) as the result of an industrial accident provides a unique opportunity to observe the effects of exposure during these critical windows. We will present data on pubertal development and subsequent reproductive success among girls exposed in utero and through breastfeeding. Girls exposed in utero and through breastfeeding had their first menstrual period an average of one year earlier than unexposed girls (Blanck et al, 2000). We are now following these girls through the reproductive years and will present preliminary data on their reproductive success.

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ISEE-278

AIR DIOXINS AND HEAVY METALS OF THE 36 PRIMARY SCHOOLS SURROUNDING THREE MUNICIPAL WASTE INCINERATORS IN THE TAIPEI BASIN

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Introduction: In order to get a whole picture of the environmental impact of municipal waste incinerators (MWIs) on children health, we conducted an environmental survey of air dioxins and heavy metals of the 36 primary schools surrounding three MWIs in the Taipei basin.

Methods: Considering the purpose of figuring incinerator emissions, we chose the sampling sites by the distance from three incinerators. For each incinerator, we chose 4 sampling sites as the incinerator group, four primary schools within two km as the exposure group, and eight primary

schools in the distance of at least three km from the MWIs as the reference group. We underwent two environmental sampling for dioxins and particles in May and August of 2003. Finally, we compared the dioxins, PM₁, PM_{2.5}, PM₁₀, and heavy metals in PM_{2.5} among the three groups.

Results: The range of dioxins in the incinerator group was from 0.022 to 0.896 pg-TEQ(I-TEF)/m³ with median and mean values of 0.058 and 0.111 pg-TEQ(I-TEF)/m³, respectively; the range in the exposure group was from 0.011 to 0.317 pg-TEQ(I-TEF)/m³ with median and mean values of 0.036 and 0.053 pg-TEQ(I-TEF)/m³ respectively; while the range in the reference group was from 0.011 to 0.078 pg-TEQ(I-TEF)/m³ with median and mean values of 0.029 and 0.030 pg-TEQ(I-TEF)/m³, respectively. The dioxins were mainly contributed from the incinerators by the principal components analysis. We also found the same trend for heavy metals such as cadmium and chromium.

Discussion: The distance may be the most important predictor of MWI emissions in the Taipei basin. MWIs were the major source of dioxins for the 36 primary schools surrounding the incinerators.

ISEE-279

THE SEX RATIO IN THE OFFSPRING OF MUNICIPAL SOLID WASTE INCINERATOR WORKERS

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Introduction: From 1999 to 2001, the Ministry of Labour, Japan conducted medical surveillance including blood dioxins level measurement for more than 400 municipal solid waste incinerator workers. Although the results of the surveillance showed trends of blood dioxin levels to increase along with the duration engaging in specific jobs and significant difference in congener pattern between the workers and the general population, there was no significant difference in total TEQs between the two. Knowledge to date suggests that such difference in exposure to dioxin does not yield serious consequence in health, but the workers still have strong concern because of the lack of clear epidemiological evidence. Based on this situation, we have launched a large-scale cohort study focusing on risk assessment for cancer mortality and changes in the sex ratio of offspring among the workers. We will present the results of the analysis for the sex ratio in this report.

Methods: We obtained information on sex, date (year and month) of birth, job history and frequency (0: none, 1: once in 1~3 years, 2: several times per year, 3: several times per month) of cleaning/maintenance work of the inside of incinerators by self-administrated questionnaire from about 7,500 municipal waste collection/incinerator workers being in active at 31st, December 2002. We used the product of frequency of cleaning/maintenance work multiplied by period of work until one year before the birth of the first offspring as the surrogate index of cumulative exposure to dioxins. The index was stratified by tertile and the sex ratio for offspring by each category was calculated.

Results: The table shows the results of the preliminary analysis on the first offspring. The male to female ratio tended to become greater according to exposure, but it was not statistically significant.

	Cumulative Exposure Index				Total
	0	0-5.7	5.7-13.2	13.2-	
Male % (n)	50.7 (1838)	51.7 (77)	53.6 (81)	54.0 (81)	51.0 (2077)
Female % (n)	49.3 (1787)	48.3 (72)	46.4 (70)	46.0 (69)	49.0 (1998)
Male/Female Ratio	1.03	1.07	1.16	1.17	1.04

Conclusions: Contrary to previous reports, the present study showed increasing trend of male to female ratio according to exposure, though the trend was not statistically significant. Further analysis on time trend and the sex ratio for 2nd or later offspring by contrast with the general population is required.

ISEE-280

LATENT EFFECTS OF GESTATIONAL EXPOSURE TO HEPTACHLOR

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Introduction: The objective is to determine whether gestational exposure to the insecticide, heptachlor, permanently alters neurological, reproductive, or immune function. The study is based on a well characterized episode in which the commercial milk supply on the Hawaiian island of Oahu was contaminated with heptachlor epoxide (HE) during a 15 month period (1981-82), resulting in gestational exposure to offspring of women who drank cows' milk at that period.

Methods: The study has two phases. First, we conducted an island-wide survey of 20,408 high school students to identify 1,891 young adults who were born during 1981-82 and lived on Oahu for at least 15 years. Using this sampling frame, we selected 332 Oahu-born and 113 not Oahu-born participants to assess neurobehavioral function and academic achievement using standard test instruments and school records. For the study of reproductive and immune function, we are using the same sampling frame to recruit 400 Oahu-born young adults and 200 comparison participants who were not born on Oahu, matched by age and ethnicity. Indicators of reproductive function include: serum testosterone in males, estradiol and progesterone in females; and luteinizing hormone and follicle-stimulating hormone in both sexes; semen samples; and daily first morning urine specimens in females for one menstrual cycle to measure luteinizing hormone, estrone-3-glucuronide, and pregnanediol 3-alpha-glucuronide. Indicators of immune function include skin tests for standard recall antigens; antibody titer response to immunization with tetanus and pneumococcal vaccine; Th1 and Th2 type CD4+ cell subsets in peripheral blood; and susceptibility of peripheral blood T cells to activation-induced cell death using *in vitro* analysis of Fas (CD95) and its ligand (CD95L) expression. The analysis compares outcomes between the Oahu-born and comparison groups, controlling for relevant confounders. Secondary comparisons among the Oahu-born population are made based on individual estimates of gestational heptachlor epoxide exposure.

Results: For the neurobehavioral study, multivariate analyses controlling for confounding factors indicated that gestational HE was associated with lower neurobehavioral performance, especially abstract concept formation, visual perception, and motor planning, and with more reported behavioral problems. There were no strong associations for school-based performance measures, such as GPA. Data are now being analyzed for the first half of participants in the reproductive and immune function study.

Discussion: The findings indicate that gestational exposure to HE may be associated with subtle latent effects on neurobehavioral performance. It is relevant to evaluate whether gestational HE exposure is also associated with latent effects on reproductive and immune function.

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ISEE-281

STRATEGIES FOR ASSESSING PUBERTAL DEVELOPMENT IN EPIDEMIOLOGIC STUDIES

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Abstract: The question of whether endocrine disrupters, such as PCBS, PBBs and other halogenated hydrocarbons, may affect the reproductive health of humans has gained a great deal of attention in both the popular press and scientific journals. There has been speculation that perinatal exposures may have lifelong consequences and that puberty, the period between childhood and adulthood, during which sexual maturation occurs, may be particularly affected. However, gaps exist in both our knowledge of the course of normal puberty (Delemarre-van de Waal, 2002) and of the potential effects of the putative disrupters (Harrison, 2001). The National Institute of Environmental Health Sciences, acknowledging these gaps, recently has called for examinations of relationships between lifestyle behaviors, nutrition, anthropometric markers to puberty and the effects of chemical, physical, and social exposures on normal pubertal maturation (Collman, 2003).

Especially for males, for whom there is no concrete landmark of puberty comparable to the onset of menses, a wide variety of biomarkers have been suggested. External signs of development such as onset of secondary sexual characteristics (Tanner stages), changes in height velocity and fat-free mass, and even changes in voice frequency are among methods for tracking puberty. More direct measures of underlying hormonal changes include spermaturia and alterations in salivary, serum, and urinary metabolites. We are developing strategies for the use of a variety of non-invasive indicators, simultaneously, in order to examine the course of puberty in prospective epidemiologic studies. Information from this type of study is critical for identifying alterations of normal development that may be attributable to the effects of environmental factors.

ISEE-282

ENVIRONMENTAL IODINE DEFICIENCY IN URBAN AREAS AND GOITER PREVENTIVE ASPECTS AMONG CHILDREN

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Introduction: Goiter- the endemic disease of the high mountain regions has recently become a common disease for the whole country, including the urban areas. The high prevalence of goiter among children at the age of 6-12 stressed the need to evaluate the effectiveness of goiter preventive measures in relation with the level of endemicity of the areas and preventive means, applied.

Methods: Epidemiological and ecological studies were carried out. Two urban areas were selected from the moderate endemic zones of goiter. Effectiveness of preventive measures were assessed by clinical-physical examination of children, evaluation of their intellectual ability by Raven Test (adapted to the study) and measurement of T4 and TSH hormones in biosubstrat (blood) by standard methodology (ELISA), using Swiss test-system" General Biological Corp".

Iodine salt and iodine oil capsules were used for goiter prevention purposes. Study groups were selected from children at the age of 11 because of the highest prevalence rate of goiter among them. The study groups were given iodine oil capsules while the controls were left on equalae iodine salt preventive regimen. The study and control groups were examined at the beginning of the study and were followed up during one year with quarterly check ups and appropriate screening tests.

Results: Iodine content in soil in the study areas ranged between 0.5 mg/kg - 0.79 mg/kg. The Ravenec Test results in study groups were within 9.8-10.74 before the study and within 11.0+13.09 after the study, T4 increased from 6.4+1.8 n/mol/l to 9.1+1.4 n/mol/l and TSH decreased from 5.9+1.9 μ IU/ml to 3.7+0.7 μ IU/ml. The Ravenec Test results among controls did not exceed 10.74. T4 level was within 7.4+1.8 n/mol/l and TSH - 4.9+1.9 μ IU.

Conclusion: Goiter prevention with iodine oil capsules is significantly effective than prevention with iodine salt in urban moderate endemic areas of goiter in terms of improving children's clinical-physical characteristics and intellectual ability.

We would like to express our gratitude to Ms. Nino Marinashvili, Dr. Marina Gordeladze, Dr. Marina Lashkarashvili and physicians-endocrinologists in the regions for their contributions to the study.

ISEE-283

HEAT WAVE EXPERIENCES IN THE US, CHICAGO

John Wilhelm. *Department of Public Health, City of Chicago*

Introduction: Exposure to excessive heat can cause illness, injury and death. During 1979-2000, approximately 8,316 deaths in the United States were heat-related. Approximately 400 people die each year from exposure to heat due to weather conditions, and many more die from health conditions that are exacerbated by exposure to excess heat. The City of Chicago experienced two significant heat waves during the 1990s. The record-breaking July 1995 heat wave resulted in 485 heat-related deaths and 739 excess deaths. During the 1999 Chicago heat wave, 103 heat-related deaths occurred; 80 of these were attributed to extreme heat.

Methods: This presentation will discuss the City of Chicago's experience with heat waves and will summarize the results of epidemiologic investigations into risk factors for mortality during these extreme heat events.

Results: For both the 1995 and 1999 Chicago heat waves, the risk for heat-related death increased for elderly persons and those with cardiac disease or psychiatric illness and for persons who lived alone. Reporting a working air conditioner and participating in group activities were the most important protective factors. While these two heat waves differed in duration and meteorologic characteristics, the implementation of an Extreme Weather Operations Plan by the City of Chicago probably reduced the 1999 death toll by increasing the number of daily contacts for the elderly during the heat wave.

Discussion: All heat-related illnesses and deaths are preventable. By knowing who is at risk and what prevention measures to take, heat-related illness can be prevented. The implementation of an Extreme Weather Operation Plan is a critical element in reducing future mortality from extreme heat.

ISEE-284

EXPOSURES AMONG PREGNANT WOMEN NEAR THE WORLD TRADE CENTER SITE ON 9/11

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Introduction: We have characterized exposure among 187 women who were pregnant and near or at the World Trade Center (WTC) on 9/11 and who are enrolled in a prospective cohort study of health effects.

Methods: We assessed exposures using geographic information system (GIS)-based models, interview, and biologic markers. Women recorded their locations from 9/11 until October 8, 2001 using a time-activity log.

Exposures were assessed by time spent in 5 zones around the WTC and by an exposure index (EI) based on plume reconstruction and time per day at specific street addresses within these zones. We measured selected chemicals in blood and urine specimens collected starting in February 2002, in order to determine levels of PAH-DNA adducts in blood mononuclear cells by ELISA and other biomarkers of exposure.

Results: A large proportion (<70%) of these women was within 8 blocks of the WTC at 9 a.m. on 9/11/2001, and 12 were in one of the towers. EI was highest immediately after 9/11, and became lower but highly variable over the next 4 weeks. EI was associated with recalled air quality in lower Manhattan and with time spent during site evacuation, living, and working in the WTC area. PAH-DNA adducts were higher among women whose blood was collected closer to 9/11, but no remarkable patterns of association with EI or other potential source were seen.

Discussion: This report suggests that intense bystander exposure occurred after the WTC collapse, and provides information about non-occupational exposures. Further investigations are being conducted to assess pregnancy outcomes, infant growth and development in relation to maternal exposure.

Supported by Grants from NIEHS and EPA.

ISEE-285

COMPONENTS OF SUCCESSFUL HEAT WAVE RESPONSE PLANS

Michael McGeehin. *National Center for Environmental Health, Centers for Disease Control and Prevention*

Introduction: Since 1983, heat waves have resulted in more weather-related deaths annually in the U.S. than any other natural disaster. The populations most impacted by heat waves are well known and include the elderly, chronically ill, socially isolated, and people living in urban environments. Coordinated, city-wide interventions and weather based warning systems aimed at these populations have been shown to reduce heat wave mortality. To be successful, these Heat Wave Response Plans (HRP) need to be in place and understood by all participants prior to any heat event and should include a post event evaluation and plan revision. While HRP are essential elements in the prevention of heat related illness and death, many cities do not have written plans, or have plans that are not city-specific. This is likely because heatwave related morbidity and mortality is an underestimated threat to public health.

Methods: This presentation will summarize the results of an evaluation of existing HRP in cities with known history of mortality from heat, focusing on the identification of key criteria necessary for a successful plan.

Results: We conclude that HRP should reflect local climatologic and sociocultural circumstances but should incorporate several key elements including the identification of a lead agency and participating organizations; criteria for plan activation and deactivation; pre-developed communication materials; response measures that target high-risk populations; and information collection, evaluation and plan revision.

Discussion: While extreme heat events cannot be prevented, the morbidity and mortality related to heat waves can. HRP are central elements in the public health response to heat waves and should be implemented in all regions at risk for heat-related mortality.

ISEE-286

BHOPAL'S CATASTROPHE: LEGACY AND FUTURE

Gerald V. Poje. *U.S. Chemical Safety and Hazard Investigation Board, Washington, DC*

Abstract: Uncontrolled chemical reactions have led to serious explosions, fires, and toxic emissions, that kill and injure, damage property and threaten the environment. In December 1984 a runaway reaction within a storage tank at Bhopal, India's Union Carbide pesticide plant released a toxic gas cloud that killed 6000+ and injured hundreds of thousands. Underlying systemic problems at the Bhopal facility and management system failures associated with other catastrophes are reviewed with emphasis on inherently safer design as an underutilized, primary prevention tool.

Union Carbide's catastrophe and others also initiated major policy changes that defined process safety and strengthened public oversight. Two decades of chemical safety policy developments are described, including recent work of the United States Chemical Safety and Hazard Investigation Board (CSB), an independent federal agency created by Congress to investigate chemical disasters. CSB's primary mission is to promote prevention of chemical incidents in commercial or industrial settings.

CSB has investigated the root and contributing causes of a series of reactive hazard incidents, culminating in a major study of management practices and policy. CSB examined 167 serious domestic incidents involving uncontrolled chemical reactivity over two decades. Forty-eight incidents resulted in a total of 108 fatalities, with nearly 50 incidents affecting the public. The Board's major study of recent reactive incidents and its recommendations are reviewed and opportunities for public health improvements are discussed with special emphasis on regulatory reform recommendations to OSHA and EPA.

ISEE-287

EMERGENCY ROOM VISITS FOR RESPIRATORY CONDITIONS INCREASED AFTER VOLCANIC ERUPTIONS IN QUITO, ECUADOR

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Introduction: Studies on the impact of air pollution due to volcanic activity have found an increase in childhood respiratory conditions after eruptions. Such relationships have been found following the eruption of Mt. Pinatubo (Philippines), Mt. St. Helen's (USA), Cerro Negro (Nicaragua), and Soufriere Hills (Montserrat). The volcano Pichincha, located near Quito, Ecuador, has erupted frequently in the last decade. The effects of the eruptions on the Quito population have not been determined. The aim of this pilot study was to characterize the emergency room (ER) visits for respiratory conditions following three volcano eruptions in April 11, April 16, and July 12 of 2000. The study was conducted at the Baca Ortiz Hospital for Children, Quito's largest pediatric facility.

Methods: 5055 legitimate ER records of primary respiratory conditions were abstracted for the year 2000. For each case the following information was recorded: name, date of birth, sex, address, admission date, temperature, weight, respiratory rate, and diagnosis. After determining the mean age (3.18 and 3.04 years, in girls and boys, respectively), four time series of daily counts of ER visits were compiled: for males and females under and over 3 years of age. We also compiled a binary time series to indicate the timing of volcano eruptions including one week post-eruption. To examine the relationship between the timing of the volcanic eruption and ER visits we applied a Poisson regression model adapted to time series data.

Results: The differences between daily mean ER visits during the defined periods of volcanic activity compared to the remainder of the year were the highest for children under 3 yrs: 2.23 for boys and 2.45 for girls.

Pair-wise Spearman correlations between time series were moderate ranging from 0.3 to 0.4, although significant. A substantial increase in ER visits due to respiratory conditions associated with volcanic eruptions was observed in the youngest age category; the relative risk was higher in girls [RR=1.655; 95%CI: 1.382, 1.982] than in boys [RR=1.468; 95%CI: 1.245, 1.731].

Discussion: This pilot study was the first to consider the effects of Pichincha eruptions on the young pediatric population of Quito. This study shows that children under 3 are the most susceptible to the effects of volcanic activity. The next steps of this study are to abstract ER records that will cover a longer time span to include other volcanic eruptions, to determine if higher rates are seen in malnourished children, and to better characterize and assess exposure levels.

ISEE-288

ACUTE RESPIRATORY RESPONSES TO SEPTEMBER 11: A SURVEY OF 446 NEW YORK POLICE OFFICERS

Zhengmin Qian,* Gillio Robert,† Larisa Buyantseva,* Paul Enright,‡ George Kapalka,§ Mark Young,* Arthur Roberts,|| Rosanne Pogash,* Rebecca Bascom.* *Penn State College of Medicine, PA; †Innerlink, PA; ‡NIOSH, WV; §Monmouth University, NJ; ||Living Heart Foundation, NJ

Abstract: Officers from the New York Police Department (NYPD) were deployed following the September 11 attacks and were exposed for prolonged periods to pollutant mixtures resulting from the collapse of the World Trade Center (WTC). The Living Heart Foundation conducted cardiopulmonary health screening for NYPD officers between September 28 and October 11, 2001 in lower Manhattan. Exposure information was collected simultaneously with the health survey using a questionnaire that identified the site of deployment, and the presence of smoke, odors and fumes. The objectives of this analysis were to conduct a pilot study of pulmonary health effects in NYPD officers exposed to the September 11 attacks. We randomly selected 446 NYPD officers for study from approximately 1,500 officers who were screened. We developed three exposure levels for the study subjects based on the questionnaire-derived exposure information. The definitions of these exposure levels are: lightly exposed level = officers not working at Ground Zero (GZ) or working at GZ with little exposure; moderately exposed level = officers working at GZ but not in the massive cloud of the collapse; and heavily exposed level = officers working at GZ in the massive cloud of the collapse. We observed positive relationships of exposure to the September 11 attacks with prevalence rates of cough (OR = 2.72, 95% CI = 1.40-5.28 for heavily exposed level; OR = 2.31, 95% CI = 1.19-4.47 for moderately exposed level), short of breath (OR = 2.44, 95% CI = 0.98-6.08 for heavily exposed level; OR = 1.78, 95% CI = 0.71-4.48 for moderately exposed level), and sputum (OR = 2.91, 95% CI = 0.99-8.57 for heavily exposed level; OR = 2.66, 95% CI = 0.90-7.88 for moderately exposed level). We did not observe other outcomes that were associated with an exposure-response pattern:

	Lightly exposed	Moderately exposed	Heavily exposed
FVC % predicted	90.9(14.7)	89.9(13.2)	88.1(13.0)
FEV1 % predicted	89.9(16.1)	90.3(14.3)	88.6(13.0)
FEV3 % predicted	91.4(14.9)	91.1(13.1)	89.0(12.6)

To our knowledge, this is the earliest systematic health survey data obtained following the WTC attack, and has the unique attribute of simultaneously collected exposure data and cardiopulmonary data. These results suggest that associations may exist between the NYPD officers' cardiopulmonary health outcomes and the exposure to air pollution

mixtures from the WTC collapse on 9/11. Further studies are needed to explore exposure-response relationships by including all 1,500 NYPD officers and controlling for major potential confounders.

We are grateful to brave NYPD officers who were the "Heroes" working to find survivors and providing other services to victims of 9/11 disaster at the WTC. We are also grateful to over 200 volunteers who were the "Angels" conducting this health screening program for our heroes between two and four weeks after 9/11. Special thanks to Dr. Arthur Roberts who assembled the volunteer team within two weeks of 9/11. We also appreciate support from many anonymous contributors.

ISEE-289

PREDICTORS OF LONG-TERM PSYCHOLOGICAL HEALTH AMONG INDIVIDUALS AFFECTED BY THE CHERNOBYL ACCIDENT

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Abstract: While there is no strong evidence that the Chernobyl nuclear accident in 1986 has led to serious physical health effects other than childhood thyroid cancer, there is considerable concern about psychological health problems associated with this event. We conducted a comprehensive psychological health assessment among individuals who have previously participated in a case-control study of childhood leukemia in the Gomel and Mogilev regions of Belarus. The Gomel region was by far the most contaminated area in the former Soviet Union, but parts of the Mogilev region were also affected by high radionuclide contamination. Participants include 416 individuals from these regions who, in addition to contamination status of their residence, also differed with respect to having a family member with childhood leukemia. All participants completed an interviewer-administered questionnaire, which included information on demographics, life stressors, life style factors and economics. General and psychological functioning was assessed using the Russian language version of the SF-36 Health Survey and the 53-item Brief Symptom Inventory (BSI). We observed striking differences in general and psychological health between participants from the Gomel and Mogilev regions. Compared to Mogilev residents, participants from the Gomel region had significantly ($p > .05$) lower scores (i.e., poorer functioning) on all but one (bodily pain) subscales of the SF-36. We also observed significantly ($p > .05$) greater reported symptoms among Gomel residents on all subscales of the BSI, as well as the global BSI score ($p > .001$). These differences between regions were still apparent when females and males were examined separately. Contrary to expectations, SF-36 and BSI scores were similar for participants with and without a family member with childhood leukemia. Results from linear regression analyses indicated that, while factors such as residence ($R^2=0.02$) and concern about adverse Chernobyl-related health effects in children ($R^2=0.02$) were significantly predictive of psychological health (measured as the global BSI score), number of reported daily hassles was by far the strongest predictor of psychological health in this population ($R^2=0.22$). Our results indicate that, while there are substantial differences in psychological functioning between residents of the Gomel and Mogilev regions in Belarus, 'current life-stressors are much more predictive of psychological health than measures related to the Chernobyl accident.

ISEE-290

HUMAN EXPOSURE TO ORGANOPHOSPHATES AND PYRETHROIDS DURING AERIAL AND TRUCK-MOUNTED SPRAYING AFTER HURRICANE ISABEL

Zandra Duprey. *Centers for Disease Control and Prevention, National Center for Environmental Health*

Introduction: In 2003, the number of human and animal cases of West Nile Virus and Eastern Equine Encephalitis in Virginia was greater than in previous years. The risk of these mosquito-borne diseases was further exacerbated after September 18, 2003, when Hurricane Isabel made landfall in coastal North Carolina and continued to Virginia. Data collected from prior hurricanes indicate that affected areas experience a 500%-1000% surge in mosquito populations. Such increases heighten concerns of increased transmission of mosquito-borne disease, as well as nuisance from such mosquito population surges. As a result of Hurricane Isabel, government-sponsored large-scale mosquito control activities (LSMC) were instituted in affected areas of Virginia. These activities included aerial spraying of naled (an organophosphate adulticide) and truck-mounted spraying of d-phenothrin (a pyrethroid adulticide) on the Tidewater Peninsula of Virginia. Limited information is known about human exposure to LSMC. We conducted this study to assess exposure to these LSMC pesticides in urban residents of the Tidewater Peninsula in Virginia.

Methods: Pre- and post-spray questionnaires were administered to 95 randomly selected residents in medium- to high-density areas of the Tidewater Peninsula in Virginia. These questionnaires were designed to assess household and occupational exposure to pesticides. Each participant also contributed pre- and post-spray urine samples to quantify exposure to naled and d-phenothrin. Generalized estimating equations were used to detect differences pre- and post spray urine metabolites in dimethylphosphate (DMP), a metabolite suggestive of naled exposure, and differences in 3-phenoxybenzoic acid (3-pba) which is suggestive of exposure to d-phenothrin.

Results: We detected no significant difference between the number of people with increases and the number of people with decreases in DMP or 3-pba at $p>0.05$. No association with increased levels of metabolites and self-reported behaviors was found at $p>0.05$.

Discussion: These findings suggest that community exposure to naled and d-phenothrin in LSMC did not lead to a significantly greater proportion of people that had increased urine levels of pesticide metabolites. However, because this study contributes to a small body of knowledge regarding LSMC, more studies should be performed to further evaluate human exposure in LSMC. Our study findings may serve to increase awareness of pesticide exposure in LSMC, particularly as an important component of disaster response.

ISEE-291

PATTERNS OF LONG-TERM PHYSICAL SYMPTOMS AFTER DISASTER WORK

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Purpose: In 1992 a Boeing 747 cargo aircraft crashed into two apartment buildings in a densely populated suburb. Forty-three people were killed and many more were injured. In the following years rumours and questions arose about the cause of the accident, the contents of the cargo and possible acute and future health risks. Meanwhile, people affected by this air disaster expressed health complaints. In 2000, a controlled epidemiological study set out to investigate long-term health complaints

and indicators of exposure among occupationally involved subjects. As part of this study, the present paper addresses patterns of health complaints. The main hypothesis is that occupational involvement and exposure to a variety of potentially toxic materials during this stressful event, combined with public debate and extensive media-coverage, may have led to a pattern of medically unexplained symptoms that differs from that reported in non-involved colleagues.

Methods: In this cohort study a comparison is made between fire fighters (n=334), police officers (n=834) and accident and investigation workers (n=399) who were occupationally involved in this air disaster and reference groups of colleagues who were not involved in this air disaster (n=194, n=634, and n=104, respectively). The overall response rate was 70%. Data collection took place from January 2000 to March 2002, and included questionnaires on occupational involvement, various types of current health complaints and health-related background information.

Results: Preliminary results indicate that occupationally involved workers report considerably more health complaints of various kinds than the respective reference groups. Further analyses on symptom patterns will be presented at the conference.

ISEE-292

RISK FACTORS OF MORTALITY DURING THE HEAT WAVE OF AUGUST 2003 IN FRANCE'S NURSING HOMES

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Introduction: An unprecedented heat wave came about in France during the month of August 2003, causing an excess mortality of nearly 15,000 deaths, including 5,000 among people living in nursing homes. The purpose of this study is to research risk factors of mortality within the elderly population living in nursing homes during the heat wave: individual risk factors (autonomy/handicap, medical condition, drug consumption) and environmental risk factors (number and quality of personnel available; facility size and characteristics; prevention plans and therapeutic protocols).

Methods: This survey is made of two parts: a "facility case-control study" and an "individual case-control study". The target facilities are retirement homes and hospital units for the long term care of the elderly in the areas characterized by a high level of heat wave-related mortality. The selection of facilities was done on the basis of a rapid postal survey conducted in August 2003. The facilities with the higher level of mortality are the "cases" in the "facility case-control study". They are paired to controls on criteria of geographical proximity and mean level of autonomy of the residents. 200 cases and 200 controls are investigated. Within each of the "cases facilities", two "individual cases" are randomly selected among the persons deceased between 5 and 15 of August 2003 (excluding non heat-related causes). Each individual case is paired with the person who was still alive on the first of September, and whose age is the closest to the case. The data on cases and controls are gathered through a questionnaire administered during face-to-face interviews with the administrative and health care personnel. Analysis is done using SAS and STATA. Matched pairs analysis is used to estimate odds ratios and confidence intervals for each potential risk factor. All potential risk factors derived from questionnaire are tested in univariate analysis. The final multivariate model will use a conditional, stepwise logistic regression model.

Results: The results will be available in April 2004 and will be presented during the conference.

Discussion: At this stage, it is too early to draw conclusions. The study is on schedule and without any major problem so far. The major interest of this study is to investigate the heat-related mortality in an institutional environment: previous investigations of risk factors of mortality during

heat waves have previously been done among people living in private dwellings.

ISEE-293

PHYSICAL AND MENTAL HEALTH OF NEW YORK CITY POLICE OFFICERS 18 MONTHS AFTER THE WORLD TRADE CENTER ATTACKS

George Kapalka,* Georae Letizia,* Rebecca Bascom,† Zhengmin Qian,† Larisa Buyantseva,† Mark Young,† Arthur Roberts.‡ **Monmouth University, NJ*; †*Penn State College of Medicine, PA*; ‡*Living Heart Foundation, NJ*

Abstract: New York City police officers were contacted by telephone to perform health and mental health screening and referral. Originally, the Living Heart Foundation conducted health screening of over 1500 police officers immediately following the attacks, and those still listed in the data base as of Spring of 2003 were contacted for follow-up. After accounting for subjects that were deceased or otherwise unavailable (less than 1%), retired or moved (22%), unable to contact (32%) or those who rejected to participate (4%), the final response rate (N=573) was about 40 percent. The unusually high rate of officer's relocation or retirement is notable. The officers were administered a health questionnaire, the Global Assessment of Functioning (GAF) Scale, and the Brief Psychiatric Rating Scale (BPRS). Where appropriate, the officers were given a DSM-IV psychiatric diagnosis. Preliminary review of randomly-selected 221 responders revealed that 80 percent of those officers were males between the ages of 35 and 45. With regard to health symptoms, 36 percent reported problems with chronic cough, 35 percent reported symptoms of chest pain, 32 percent reported shortness of breath, 40 percent reported ear, nose or throat symptoms, and 50 percent reported a confirmed diagnosis of Gastro-Esophageal Reflux Disease (GERD). With regard to mental health symptoms, 34 percent revealed a GAF Scale rating between 70 and 80 (indicating moderate-level mental health symptoms), and 8 percent revealed GAF Scale ratings below 70 (indicating more severe symptoms that significantly affect the person ability to work, attend to daily tasks, etc.). Twenty six percent reported their work life as "somewhat worse" after 9/11/2001, and 35 percent reported their work life as "much worse" after 9/11/2001. Twenty nine percent were given one DSM-IV diagnosis (indicating the presence of one psychiatric disorder), and 4 percent were diagnosed with two or more psychiatric disorders. Of those disorders, two-thirds were diagnosed with an anxiety disorder (for example, Post Traumatic Stress Disorder), and one-third were diagnosed with clinical depression. These results suggest that a high number of police officers continue to exhibit health and mental health problems 18 months after the attacks. Further studies are needed to explore the specific nature of these problems.

We are grateful to brave NYPD officers who were the "Heroes" working to find survivors and providing other services to victims of 9/11 disaster at the WTC. We are also grateful to over 200 volunteers who were the "Angels" conducting this health screening program for our heroes between two and four weeks after 9/11. Special thanks to Dr. Arthur Roberts who assembled the volunteer team within two weeks of 9/11. We also appreciate support from many anonymous contributors.

ISEE-294

HEALTH EFFECTS AMONG WORKERS INVOLVED IN THE CLEAN UP AND RECOVERY EFFORT AT THE WORLD TRADE CENTER (WTC) DISASTER SITE: THE WTC CLEAN UP AND RECOVERY WORKERS HEALTH STUDY

Alison Geyh,* Xuguang (Grant) Tao,* Raz Gross,† Jennifer Massa,‡ Leslie Ashwell,* Patricia Zybent,† Daniel Herman,† Alan Langlieb,*

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Abstract: The research to be presented is a continuation of work conducted in response to the events of September 11, 2001 by the Johns Hopkins Bloomberg School of Public Health, in collaboration with the Columbia University Mailman School of Public Health. The "World Trade Center Clean Up and Recovery Worker Health Assessment" was designed to assess WTC worker health status post involvement with the disaster site. This effort involved a mail survey sent between March and July 2003 to 4546 workers from three local unions and the New York City Department of Sanitation who were identified as having worked at the WTC site or the Fresh Kills land fill as part of the clean-up effort ("exposed") and 2103 workers from a subset of these organization who did not work at the WTC site or landfill ("unexposed"). Survey questions focused on exposures on and off site, historical health, current respiratory, and mental health. Response rates among exposed contact groups ranged from 22% - 35%. Response rates among unexposed contact groups ranged from 11% - 13%. Key objectives of the data analysis are: 1) to determine if workers who were involved in the WTC clean-up effort are experiencing rates of chronic respiratory symptoms that are different from workers holding similar jobs who were not involved in the WTC clean up controlling for demographic characteristics, smoking and disease history; 2) to determine if a relationship exists between current respiratory symptoms and exposure during the WTC clean-up effort, where exposure is characterized by duration, timing, use of personal protective devices, and job title; 3) to describe differences between the exposed and unexposed groups in different sociodemographics, frequencies of symptoms and disorders, functioning, self-reported previous mental health services, and referrals to mental health professionals; 4) to examine the relationship between exposure variable and post traumatic stress disorder; and 5) to lay the ground for a follow up study of a cohort of exposed and non-exposed workers established through this survey. Preliminary analysis indicates that approximately 75% of respondents from the exposed group report symptoms consistent with probable anxiety, depression, or posttraumatic stress disorder.

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ISEE-295

PSYCHO-SOCIAL IMPACTS AMONGST A NEGLECTED POPULATION: THE RESIDENTIAL COMMUNITY OF LOWER MANHATTAN AFTER THE WTC DISASTER

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Abstract: Given the dimensions of the World Trade Center disaster, it is not surprising that considerable attention has been given to victims associated directly with the twin towers: the office workers, emergency responders and clean up workers. As this paper documents, there has been a significant neglect in post-disaster attention, testing, mitigation, compensation and precaution for Lower Manhattan residents against other victims groups. This inattention is evident, for example, in the shaping of epidemiological studies and policies catering to specific constituencies after the disaster. In reality, the residents were subject to significant disruption, potential environmental exposure, and relatively minimal guidance and assistance in regaining their homes. For most residents of the neighborhoods surrounding the World Trade Center, September 11 and the immediate aftermath was a period of horror and evacuation, uncertainty about a return, and uncertainty after coming home. Changes in the pattern of activities were necessitated by the physical changes to the neighborhood, the need for various precautions, and the social disruption

that occurred. Changes in the basic understanding of life also occurred. Residents feared exposure to a contaminated environment that might affect their health. The control that they had felt over their lives was now heavily compromised. Their environment was now redefined as hazardous. Their homes were no longer secure. And their trust of government and of people in general was tested in various ways. Residents' emotional states were also impacted, as were their family and other relationships, the nature of their community, and often the nature of their livelihood. Some of these impacts were short term, others persist, and still others rise to the surface only when called by current events. It is argued that a comprehensive understanding of the broad impacts to health and to quality of life in lower Manhattan is necessary if programs and policies are to be developed that adequately meet resident's needs. In particular, the paper identifies three gaps that must be closed: 1. The gap in attention to residents against other affected victims groups; 2. The gap in understanding and addressing threats to the residential community; and 3. The gap between efforts to measure mental health impacts and those based on physical exposures to contaminants for this population.

ISEE-296

TERROR, DEMOCIDE, MASS VIOLENCE: EPIDEMIOLOGIC APPROACHES TO CAUSATION, EARLY WARNING SYSTEMS AND PREVENTION

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Objectives: (1) Review role of epidemiology in distinguishing between terror and war. (2) Examine role of epidemiologic tools for defining and assessing causes, risks, and impacts and developing interventions for prevention. (3) Examine temporal associations and time lines for exposure to official incitement and deaths from political violence. (4) Examine interrelationships between environmental crises, poverty and terror. (5) Examine role of epidemiology in implementing recent recommendations for Early Warning Systems (Stockholm 2004 Intl Conference on Prevention of Genocide)

Background: Previous ISEE sessions have assessed the environmental and public health impacts of war and violence, (e.g., Air Pollution in Kuwait, effects of Nerve Gas warfare and Depleted Uranium in Iraq, bombing in Serbia,) but not their social and environmental determinants. These discussions have raised questions as to the benefits and risks of scenarios of intervention vs. non-intervention, and the ethical responsibilities of public health workers.

Methods: Five scenarios will be examined: (1) the genocides in Rwanda and former Yugoslavia; (2) the pre-war, war and post-war situations in Iraq; (3) the deaths from starvation and political repression in North Korea; (4) the relationships between poverty, terror and violence in several states in India; and (5) the Israeli-Palestinian Conflict before and after September 2000 in the light of standard UN definitions of terror and genocide. We use literature and web-based reviews, ecological studies, and timelines developed from available data.

Results: The age-sex pattern of the victims enables us to distinguish between war vs. genocide and terror. Mass killing and violence usually occurs without severe Malthusian population pressures (Yugoslavia, Kashmir), but may sometimes serve to aggravate tensions. (Rwanda). Suppression and repression biases are effective in concealing mass killing and adverse public health impacts (infant mortality) in authoritarian regimes during so-called quiet periods, (North Korea) but are less effective in concealing immediate and post war impacts. (Iraq). Political terror is more apt to lead to poverty than vice versa. (India). Incitement is a highly predictive indicator of mass violence and mass killing. (Everywhere)

Conclusions: Use of epidemiologic tools and concepts such as timelines and response time, suppression and repression bias, cross sectional and longitudinal comparison of public health indicators before, during and after episodes of mass violence, add strength to efforts to evaluate the benefits and costs of reporting, detection, and response to war, mass violence, terror and genocide.

ISEE-297

HEAT WAVE 2003 IN FRANCE: RISK FACTORS FOR DEATH FOR ELDERLY LIVING AT HOME

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Background: The August heat wave occurred in France was far worse than any seen since 1873 in terms of minimal, maximum and average temperatures and in terms of duration. The heat wave deaths toll rose more than 15,000 from August 1st to 20th. The first descriptive studies conducted by the National Institute of Public Health Surveillance have shown that heat-related deaths mainly concerned elderly people and that a high percentage of them used to live at home. The aim of this study is to identify individual risk factors (way of life, medical history, self sufficiency) and environmental factors (housing) in elderly people living at home.

Methods: We conducted a case control survey in Paris, Val de Marne, Tours and Orleans These sites were selected because they are urban area which were affected by the heat wave and because they present different social and architectural patterns. Cases were defined as people aged 65 and over deceased between August 8th to 13th living at home with death certificate not mentioning accident, suicide or surgical complications. Controls were matched with cases on age (+/-5years), gender and place of residence (area of 100 000 residents). A questionnaire was administered face to face or by phone to the next to kin for cases and to controls themselves or next of kin if necessary. Size of sampling was evaluated at 300 cases and 300 controls. Data were collected using satellite pictures to assess the heat island profile of the home places. Data analysis is currently in progress, using SAS. We use matched pairs analysis to estimate odds ratios and confidence intervals for each potential risk factor. In univariate analysis of data, we use all potential risk factors derived from questionnaire. The final multivariate model will entered into a conditional, stepwise logistic regression model.

Results will be presented during the conference.

ISEE-298

EXCESS DEATHS DURING THE 2003 HEAT WAVE IN FRANCE: WHICH CONTRIBUTION OF AIR POLLUTION?

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Introduction: Hot temperatures that occurred during the summer 2003 in Europe were associated to an excess of thousands deaths. It was estimated that about 15 000 excess deaths occurred during the August 1–20 heat wave in France. Simultaneously, air pollution levels, particularly ozone, were dramatically elevated all over the country. Indeed, patterns of air pollution and meteorological conditions are very closely related. Thus, some of the deaths attributed to the heat wave may have been caused by

photochemical and particulate air pollution. A study was designed to examine the temperature - air pollution - mortality relationships, especially in extreme pollution and weather conditions. This approach presents innovative features: two explanatory variables taken into account and focus on exceptional exposure conditions.

Methods: Time series design is used to analyze the short-term effects of temperature and air pollution on mortality. Daily values of temperature and ozone concentrations (8 hours daily mean - suburban stations) are collected in the nine biggest French cities for a multi-year period including 2003. Mortality daily counts include all causes of deaths (ICD10 A000-Y98) for all the cities. Statisticians from each city perform Poisson's time-series regression with their air pollution, temperature and mortality own data. Autoregressive Generalized linear models allowing for overdispersion are fitted to data. Short-term confounding factors as influenza outbreaks (national registry), public holidays, school holidays, day of the week and humidity are included in the model. Besides these short-term confounders, we control long term trends and seasons. Smoothing functions (penalized splines) are used to account for non-linear relationships between mortality and confounders. In contrast with previous analyses, temperature is included as an explanatory and not as a confounding variable. Possible interactions between same day of O₃ and temperature are taken into account with an interaction term. As part of the diagnostic testing of the models, we test the residuals for autocorrelation, apply Akaike's information criteria and plot the residuals. Quality control by the coordination center ensures homogeneity of the modeling processes. In order to obtain a quantitative summary of the findings across the nine cities, we use a hierarchical approach giving a pooled regression coefficient corresponding to a weighted mean of the city-specific regression coefficients. The relative contribution of air pollution and weather conditions to the excess deaths observed during the 2003 heat wave in those nine cities will be presented at the ISEE conference.

ISEE-299

HEALTH IMPACTS OF FLOODING: A GLOBAL SYSTEMATIC REVIEW

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Introduction: Floods are the most common natural disaster in both developed and developing countries. Coastal and riverine flooding may increase in frequency with global climate change. In order to make recommendations about public health responses to flooding, as well as address the health relevant impacts of and adaptation to climate change, we have undertaken the first systematic global review of epidemiological research on the health impacts and health-related responses relating to flood events.

Methods: Systematic review of bibliographic databases (including Medline and Pubmed), using key terms and search criteria. The search strategy was based on key terms for 'exposure' (e.g., 'flood', 'coastal flood', 'inland flood', 'waterlogging') and 'health outcome' (e.g., 'death', 'drowning', 'injury', 'infection', 'public health' and specific diseases). Combinations of terms were searched in 'title', 'abstract' and 'keyword'. Databases of unpublished material, as well as NGO and governmental sources of information were also searched. After removal of duplicates, papers were initially reviewed by abstract before final assessment.

Results: Approximately 100 studies with epidemiological data were found. Based on the published evidence, the greatest burden of disease due to flooding in developed countries appears to be due to the longer-term mental health sequelae, with implications for mortality and use of health services. Controlled epidemiological studies of flood events in the South are few but indicate considerable burden of disease due to diarrhoeal diseases and mental health outcomes. Outbreaks of mosquito

borne infections often follow flooding but are associated with limited health burdens, with the exception of malaria. The disruption of water supply and sanitation systems, and the destruction of hospitals and clinics represent important health problems in poorer countries although quantitative evidence of health impacts are sparse. Individual risk factors for drowning, infectious disease and poor mental health consequence include age, social contacts and level of household income.

Discussion: We aim to quantify the full impact of flooding on health, i.e. the intermediate and longer-term health impacts in addition to deaths by drowning. The burden of ill health depends on both the severity of flooding (measured as depth, flow and persistence), and the setting (developed versus developing countries). Proving clear cause-effect pathways from hazard to health outcome raised many methodological difficulties, which will be discussed.

This systematic review formed part of the project 'Health and flood risk: A strategic assessment of adaptation processes and policies', which is funded by the Tyndall Centre for Climate Change Research, UK.

ISEE-300

THE IMPACT OF THE 2003 HEAT WAVE ON MORTALITY AND HOSPITAL ADMISSIONS IN ENGLAND

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Introduction: During August 2003 England, along with the rest of Europe, experienced sustained high temperatures. From the 4th to the 13th August 2003 daytime maximum temperatures across much of England were above 30°C and in many areas temperature records were broken. Ozone exposure was also in excess of normal levels. This paper provides the first preliminary quantitative estimates of the impact of the heat wave on mortality and hospital admissions in England, by region and by selected age groups.

Methods: The episode was defined as the 4th to the 13th of August based on the pattern of observed sustained increase in daily Central England Temperatures (CET) above average levels for the period 1971–2000. Information on the daily number of deaths and hospital admissions was collected for Government Office Regions and for selected age groups. The number of deaths and hospital admissions, attributable to the heat wave, were calculated by comparing observed 2003 data with a baseline of the five previous years over the same period.

Results: During the episode there were an estimated 2,045 more deaths in England and Wales than for the same period between 1998 and 2002. Most of the excess deaths were concentrated in the south east of England, particularly in London. Increased mortality was seen in all age groups, but most notably in the over 75s. However, hospital admissions in London showed no increase for those under the age of 75. The greatest increase in mortality above expected levels was found for regions with prolonged anomalous temperatures. High ozone levels in these regions may also have contributed to increased mortality.

Discussion: In terms of the impact on human health, the summer of 2003 ranks alongside those of 1995 and 1976. This paper is unique in providing a quick response to the summer 2003 heat wave, and bringing together information from a variety of different sources. The results have implications in terms of more sophisticated future analyses, public health policies and the development of heat-health watch warning systems.

ISEE-301

EFFECTS OF THE ASIAN DUST EVENTS ON MORTALITY IN THE SPRING OF 2002, SEOUL, KOREA

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Introduction: The Korean peninsula has a long history of spring time dust clouds or storm blown from the arid deserts of Mongolia and China, and these are called Asian dust events. During the spring of 2002, we experienced an unprecedented 2 Asian Dust events in Seoul. In those days, PM₁₀ was surprisingly increased. Daily average of PM₁₀ was over 600 µg/m³ on March 21 and exceeded 700 µg/m³ on April 8. Accordingly public concern about the possible adverse health effects of these dust events has increased, because the dust arrives in Korea after having flown over heavily industrialized eastern China. We investigated the effects of the Asian dust events on mortality in the spring of 2002, Seoul, Korea.

Methods: The numbers of total nonaccidental deaths per day occurring in the spring of 2002 Seoul were extracted from the mortality records supplied by National Statistical Office. We constructed 2 Asian dust weeks (March 17~March 23, April 7~April 13) and 6 control weeks during the study period of 56 days (March 3~April 27) considering the day of the week. We analyzed daily average of deaths between Asian dust weeks and control weeks adjusting for temperature, humidity, barometric pressure.

Results: Daily average of PM₁₀ in Asian dust weeks was 295.2 µg/m³, and it was significantly higher than control weeks ($P < 0.001$). Daily average of deaths for all causes in Asian dust weeks was 109.9, 65.6 for aged 65 years and older, 6.7 for respiratory causes (J00-J99), and 25.6 for cardiovascular causes (I00-I99). We found the estimated percentage increase in the rate of deaths was increased 9.3% (95% C.I. -4.6~25.4) for all causes, 12.2% (95% C.I. -6.0~34.0) for deaths of persons aged 65 years and older, 50.9% (95% C.I. -14.9~167.4) for respiratory causes, but 10.4% (95% C.I. -32.2~18.4) was decreased for cardiovascular causes.

Discussion: We found that Asian dust events are weakly associated with risk of death from all causes. However, the association between dust events and for deaths of persons aged 65 years and older deaths, and for respiratory causes was stronger. It suggests that persons aged or with advanced respiratory disease may be susceptible to Asian dust events.

This study was supported by the Ministry of Environment, Republic of Korea (Eco-technopia 2003).

ISEE-302

THE EPIDEMIOLOGY OF EXTREME EVENTS: HEALTH AND SAFETY IMPACTS OF CASCADING INFRASTRUCTURE FAILURES

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Introduction: Extreme events in the form of environmental disasters arising from accidents, natural hazards, terrorism are almost commonplace. The frequency, area impacted, and cost of damages seems to be increasing, supporting the existence of an epidemic of extreme events and their health and safety consequences. A subset of extreme events, acting through our critical infrastructure, often escalates the magnitude of health and injury consequences because impacts cascade from the point of origin. One generic type of event involves the juxtaposition of unrelated infrastructure components, where damage to one damages others. One example is a gas line embedded in a roadbed or bridge that ruptures and ignites. Secondary consequences are damages to

transportation arteries, with vehicular accident injuries as tertiary events connected to transportation damage. Another set of secondary effects is damages to overhead electric transmission lines from heat, with tertiary injuries from falling power lines and outages. Short-term and long-term health and safety risks can occur from smoke and chemical inhalation and physical injury. The key challenge is to capture health and safety effects from these chains of events. This research hypothesizes that there are common patterns and trigger points in what appears as unique combinations. The research reported here is diagnostic and inductive in contrast to but supporting theoretical modeling such as fault-event tree construction. Actual data are analyzed to identify sensitive points that pose the most risk to human health and life.

Methodology: This work is a statistical analysis of coded, extreme events data targeted to multiple infrastructure systems incorporating primary, secondary or tertiary health and safety effects where system components rupture from a catastrophic event. The database is a set of about several dozen extreme events obtained from search engine compilations that already report such events. Each event is coded by infrastructure component with an initiating event, first, second, and third order effects, and threats to health and safety.

Results: Preliminary evaluations indicate that cascading failures: (1) are relatively high and are increasing in frequency; (2) result from either functional interdependency or physical proximity of infrastructure components; (3) have identifiable sensitive trigger points with health and safety implications; and (4) have widespread health and injury effects when all levels of effects beyond just primary ones are analyzed.

Discussion: This work links extreme events involving critical infrastructure with health and safety, whereas previous work emphasizes physical, economic and non-health related social disruptions. It is also unique in identifying commonalities in what others view as relatively unique combinations of circumstances defying generalization and prediction. This work contributes to a growing literature on the epidemiology of extreme events critical to policy and planning decisions to configure physical environments to reduce health and safety risks to the human population.

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ISEE-303

UPPER RESPIRATORY SYMPTOMS AND OTHER HEALTH EFFECTS AMONG THE RESIDENTS LIVING NEAR THE FORMER WORLD TRADE CENTER AFTER THE SEPTEMBER 11 DISASTER

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Introduction: We compared residents of the area near the former World Trade Center (WTC) to those in a comparison area to determine whether there were increases in the incidence of new-onset upper respiratory symptoms, unplanned medical visits or medication use due to respiratory symptoms, and new diagnoses of asthma after 9/11. We also investigated the prevalence of symptom exacerbation among residents with pre-existing asthma.

Methods: The study population included about 9,200 residences within 1.5 kilometers of the former WTC (affected area), and about 1,000 residences in upper Manhattan more than nine kilometers from the site (control area). Self-administered questionnaires were delivered to these residences. This survey obtained information on the presence and

persistence of respiratory symptoms, unplanned medical visits, medication use, medical diagnoses, and socio-demographics.

Results: Residents in the affected area reported significantly more new-onset upper respiratory symptoms after 9/11 than those in the comparison area (Cumulative Incidence Ratio: 2.21, 95% CI: 1.87, 2.61). Persistence of these symptoms one year after 9/11 was also significantly increased in the affected area. Indicators of respiratory functional limitation, such as shortness of breath while walking uphill or on level ground, were similar in the two areas before 9/11, but had increased among affected area residents after 9/11. Also, more residents in the affected area complained of regular or constant breathing trouble. Previously healthy residents of the affected area had significantly more unplanned medical visits for respiratory symptoms and were more likely to have started using respiratory medication after 9/11. New diagnoses of asthma and increased use of respiratory medication were also elevated in this group, although the increase was not statistically significant. Among pre-existing asthmatics, the prevalence of symptom exacerbation after 9/11 was 2.4-times higher in the affected area than in the comparison area.

Discussion: This is one of the largest among the few studies to investigate respiratory health among the residents of lower Manhattan after 9/11. We conclude that residents of the area near the WTC site reported significantly more upper respiratory symptoms, unplanned medical visits, medication use, asthma exacerbation and respiratory functional limitation after 9/11 than the comparison group. These increased risks persisted one year after 9/11 in the affected area.

ISEE-304

THE ASIAN DUST EVENTS AND EMERGENCY DEPARTMENT VISITS WITH RESPIRATORY AND CARDIOVASCULAR DISEASE IN SEOUL, KOREA

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Introduction: The Korean peninsula has a long history of spring time dust clouds or storm blown from the arid deserts of Mongolia and China, and these are called Asian dust events. During the episode in 2002, daily average of PM₁₀ in Seoul exceeded 600 µg/m³. Accordingly public concern about the possible adverse health effects of these dust events has increased, because the dust arrives in Korea after having flown over heavily industrialized eastern China. We investigated the association between the episodes of the Asian dust events and emergency department visits with respiratory and cardiovascular disease in Seoul, Korea.

Methods: We obtained 163,260 emergency department visits due to respiratory disease (ICD-10 codes J00-J99) and 50032 visits due to cardiovascular disease (ICD-10 codes I00-I99) from National Health Insurance database in Seoul during the spring period of 2000 through 2002.

We used a case-crossover analysis to assess the risk of emergency department visits during a brief hazard period after exposure in Asian dust events. For each subject, the case period was matched to 2 control periods exactly 1 week before and after emergency department visit.

Results: We found OR of 0.96 (95% CI 0.94-0.97) in respiratory disease and 0.94 (95% CI 0.91-0.97) in cardiovascular disease with Asian dust events exposure controlling for time trends, temperature, humidity, and barometric pressure. We found that OR had decreased pattern with the same day through 4-day lag, but OR of 0.99 (95% CI 0.98-1.01) in respiratory disease and 1.14 (95% CI 1.11-1.18) in cardiovascular disease with 5-day lag.

Discussion: We found that the emergency department visits were decreased in the same day of Asian dust events. However after 5 days, the visits were increased significantly in cardiovascular disease. Furthermore we plan to investigate the extended lag effect and analyze the effect modifier, e.g., age, gender, and SES in specific disease (asthma or ischemic heart disease).

This study was supported by the Ministry of Environment, Republic of Korea (Eco-technopia 2003).

ISEE-305

DOES GENDER MATTER - THE IMPACT OF MAN MADE DISASTER ON MENTAL HEALTH

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Background: The number of people living as refugees has grown over the past several decades. Man-made disaster have a severe impact on health across man and women and across cultures. The impact of violence on human health is an important areas of epidemiological research.

Objective: To assess the prevalence of morbidity of Kosovar refugees living in Germany and to analyse gender differences in symptom levels. To unmask differences in morbidity between men and women by assessing caefully symptoms.

Methods: Cross-sectional cluster sample survey was conducted among refugees living in Germany. Main outcome measure were posttraumatic stress disorder (PTSD) symptoms, depressivity and anxiety. All refugees were face-to-face interviewed using the Harvard –Trauma-Questionnaire (HTQ) and the “Hopkins-symptom-checklist 25” (HSCL-25). Main biographical data was collected.

Results: Men and women were exposed to high levels of adversity, most commonly reported events were forced expulsion and deprivation from water, food and shelter. The rates of PTSD, depressivity and anxiety were extremely high. No differences in symptom levels between men and women were found.

Conclusion: High level of impairment are likely to occur in populations affected by mass violence. Posttraumatic stress disorder seems to be as likely in females as in males after exposure to disasters of “human design”. Modelling PTSD as a unidimensional constuct seems to mask symptom differences between men and women. Further research is needed to get to know better the impact of man-made disaster on health of men and women.

ISEE-306

INCORPORATING RACE/ETHNICITY AND SOCIAL AND ECONOMIC STATUS INTO MEASURES FOR TRACKING CHILDREN'S ENVIRONMENTAL HEALTH

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Abstract: Tracking environmentally-mediated diseases is an important part of environmental health tracking, and can be used to monitor progress and identify opportunities for interventions or policy changes. Racial and economic disparities in adverse health outcomes have been well documented, with people of color and the poor often having higher incidence or prevalence of adverse health outcomes. For this reason, incorporating information by race/ethnicity and social and economic status (SES) in the different illness measures is an important component of environmental health tracking and helps identify populations at risk. As part of our work on developing measures for tracking children's environmental health, we have included race/ethnicity and SES information whenever available. Specific illustrations of how race/ethnicity and SES are addressed will be provided for measures of childhood

illnesses that are relevant to environmental health, including: asthma and other respiratory diseases, cancers, and neurodevelopmental disorders. Data on childhood illnesses come mostly from survey data, which can constrain what information is available. For example, most survey data record race and ethnicity, but information related to SES is often lacking. In addition, there may be insufficient sample size to include all race/ethnicity categories of interest. We developed measures for childhood illnesses that included, wherever possible, breakdowns in incidence and prevalence for five race/ethnicity categories (White non-Hispanic, Black non-Hispanic, Hispanic, Asian or Pacific Islander, or American Indian/Alaska Native) and three family income categories as a measure of SES (below poverty, 100–200% of the poverty level greater than 200% of the poverty level). This talk will present the advantages and limitations of the various available data sources for measuring health status by race/ethnicity and SES and discuss how these were incorporated into measures of childhood illness. For all three illness categories, race/ethnicity information was available, though usually just for three race/ethnicity categories (White non-Hispanic, Black non-Hispanic, and Hispanic). For some measures of asthma and other respiratory diseases and neurodevelopmental disorders, both race/ethnicity and family income were available. Results will be presented for these measures. While there is some information available to evaluate race/ethnicity and SES for tracking environmentally-mediated diseases, it may often not provide a complete picture. Views presented are those of the authors and not necessarily of US EPA or other organizations. See www.epa.gov/children/indicators.

ISEE-307

ACUTE HAZARDOUS SUBSTANCES RELEASES AND INJURIES ASSOCIATED WITH AERIAL AGRICULTURAL CHEMICAL APPLICATION

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Introduction: Unplanned chemical releases from aerial applications may pose an important public health threat. The Hazardous Substances Emergency Events Surveillance (HSEES) system was utilized for the analysis of adverse public health effects associated with acute releases of agricultural chemicals during aerial application. The analysis was conducted to make recommendations to reduce injuries.

Methods: Data on releases during aerial application in the HSEES system during 1995–2001 were analyzed for number, type, location of occurrence, substances released and injuries sustained. Data on aerial application accidents from the National Transportation Safety Board were also reviewed.

Results: Of 45,076 events in the HSEES system for 1995–2001, 84 were identified as aerial application events. The yearly number of events was relatively constant for the analysis period, with a slight decrease in 2001. The most commonly released substance was malathion, released in 20 events. There were 44 injured persons in all aerial application events of which 12 died and 28 required treatment at a hospital. The most common injury was trauma (n=31), followed by eye irritation (n=11). A higher percentage of aerial applicator HSEES events involved injury and death than other HSEES transportation events, likely due to trauma sustained during aircraft crashes.

Discussion: The relatively high number of trauma and non-trauma injuries and fatalities underscores the need for safety precautions, such as monitoring and limiting the pilot's exposure to pesticides, providing appropriate personal protective equipment, and providing decontamination equipment for emergency use. Emergency responders should be educated about the hazards associated with chemicals at aerial applicator crash sites.

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ISEE-308

SURVEILLANCE OF PESTICIDE RELATED ILL-HEALTH IN THE UK – DEVELOPMENT OF A PRIMARY HEALTH CARE SCHEME

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Introduction: Pesticides are widely used in agricultural and urban environments and provide important economic, agricultural and public health benefits. Because of their inherent biological activity, pesticides also have the potential to cause ill health. Cases of ill health due to pesticides in the UK identified from National Poisons, Accident Surveillance and Hospital Admission reporting schemes tend to be acute illness from high levels of exposure. There is no surveillance of cases identified or treated in primary health care.

Objectives: To investigate the nature and extent of pesticide-related illness presenting to General Practitioners (GPs) and assess the potential for setting up a routine surveillance scheme.

Method: GPs are being recruited from the MRC General Practice Research Framework, an organisation of over 1,000 UK general practices involved in research. Around 70 practices are being selected to be representative geographically, demographically and by agricultural practices. Low level exposure to pesticides could cause a wide range of symptoms, many of which present commonly in primary care. A screening checklist for GPs has been developed to identify patients if: (i) exposure is specifically mentioned by patients; (ii) there are serious acute symptoms such as blurring of vision, vertigo, respiratory compromise; and (iii) the patient has any flu type, respiratory, gastrointestinal, skin, eye or acute neurological symptoms, occurring within the last 3-4 days, that are unusual for the patient and have no other specific pathology. These patients are invited for a detailed interview using a structured questionnaire about their symptoms and possible exposure to pesticides, occupationally, domestically and environmentally. The methodology is being piloted for 3 months in 10 practices.

Results: A preliminary pilot of the screening checklist in 3 practices indicated that 30–35% of consulters were eligible for referral for interview. Of 700 patients, pesticide exposure was a specific reason for attendance in only 2. Of those symptomatic patients, 15% presented with potential pesticide related symptoms unusual for the patient.

Discussion: There is considerable controversy over the extent of the occurrence of chronic and minor ill-health caused by low level pesticide exposure. Current knowledge comes from epidemiological studies and laboratory experiments rather than surveillance schemes. This project addresses this gap. However, the wide range of pesticides and related symptoms presents considerable methodological challenges. These will be discussed together with results from the pilot study. The effectiveness, practicality and cost of a permanent primary care surveillance scheme monitoring environmentally and occupationally related ill health will also be evaluated.

Funding from the Health and Safety Executive.

ISEE-309

HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE (HSEES) – PREVENTION OUTREACH ACTIVITIES IN URBAN AREAS

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Introduction: The Agency for Toxic Substances and Disease Registry (ATSDR) maintains the Hazardous Substances Emergency Events Surveillance (HSEES) system to track public health consequences associated with acute hazardous substance release events in 15 states. The goal of this surveillance system is to reduce the morbidity and mortality from hazardous substance events. This presentation will describe how state HSEES data have been used for prevention activities.

Methods: The North Carolina Department of Health and Human Services, Texas Department of Health, and Washington State Department of Health have presented county specific data to local emergency planning committees in urban areas within each state.

Results: The Texas Department of Health HSEES staff prepared information for the counties that make up both the Dallas and Houston metropolitan areas. The Dallas metropolitan area comprises Dallas, Denton, and Tarrant counties, and is the second largest metropolitan area in Texas. The Dallas area medical community requested information to help guide the placement of their hazmat teams and decontamination units to better control and respond to hazardous substance spill events. The Houston area, including Harris County, is the largest metropolitan area in Texas. It also is a highly industrialized area in Texas and has a large number of transportation-related hazardous substance events.

HSEES staff of the North Carolina Department of Health and Human Services is assisting the local emergency planning committees of Wake, Guilford, and Mecklenburg counties, which include the metropolitan areas of Raleigh, Greensboro, and Charlotte. In each instance, the counties evaluated the HSEES information to see where they should target their outreach efforts to prevent future releases. Prevention outreach activities in Thurston, Clark, and Snohomish Counties have benefited from HSEES data provided by the Washington State Department of Health. These counties comprise the Olympia, Vancouver, Edmonds, Lynnwood, Marysville and Everett areas. Local emergency planning groups requested HSEES data and assistance in planning for hazardous events intervention and prevention activities.

Discussion: The HSEES information from each of these state agencies included county specific data about the most common types of spills, locations of events, contributing factors, chemicals, industries, and victims involved in hazardous event.

National, state, and county specific HSEES data are available to all 15 states participating in the HSEES system, and can help reduce the morbidity and mortality associated with acute releases of hazardous substances. HSEES data are used on a local level to help guide decision making processes in the allocation of resources and development of prevention strategies.

ISEE-310

A STATISTICAL MODEL TO PREDICT EPISODES OF ROSS RIVER VIRUS INFECTION IN NORTHERN NEW SOUTH WALES, AUSTRALIA

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Abstract: Ross River Virus (RRV) infection is the most prevalent mosquito-borne disease in Australia. RRV is active in northern New South Wales (NSW), Australia, and causes significant morbidity with over 50% of those contracting the virus having symptoms persisting beyond six months. Our study of the Northern Rivers Area (NRA) of NSW from 1992 to 2001 describes trends and cyclical variations in monthly counts of

RRV, monthly mosquito numbers, and various environmental factors. We used time series analysis, taking account of overdispersion and serial correlation, to investigate associations between monthly counts of RRV and environmental factors. We developed statistical models based on temperature, rainfall (or the Southern Oscillation Index) and the previous patterns of RRV to predict RRV incidence in the NRA. Our models effectively predicted the regular seasonal peaks in RRV in the NRA, as well as the extreme episodes in 1996, 1999 and 2001. We validated our short term and long term predictive models prospectively against a further 2 years of data and effectively predicted RRV patterns in the NRA over this period. Our long term predictive model can be used to estimate RRV episodes up to 6 months in advance. Our analysis suggests that predictive models can be developed for arboviral diseases, based on environmental factors. These models can be used to predict extreme episodes of disease and to target limited public health resources. They might also be used to investigate the impact of climate change on disease prevalence.

ISEE-311

SELECTION AND DEVELOPMENT OF INDICATORS IN AMERICA'S CHILDREN AND THE ENVIRONMENT

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Abstract: Children's environmental health indicators present quantitative information that can be used to monitor trends in environmental factors important to children's health and adverse health outcomes thought to be caused at least in part by such environmental factors. Monitoring, or tracking, of relevant health outcomes and environmental factors can be used to identify opportunities and needs for interventions or policy. Selection of indicators must consider both scientific information and the needs of the decision making process. We have developed and the U.S. Environmental Protection Agency (U.S. EPA) has published a set of key national measures that reflect the environmental contaminants and diseases most relevant for children's environmental health. The measures reflect levels of contaminants in the environment, body burdens, and incidence or prevalence of disease. The importance to the health of children was used to select the topics addressed in the measures. Criteria used to select data sources were: 1) availability of data for much or all of the United States; and 2) sufficient quality of data to generate a reliable measure. In many cases, data are not available for important topics, and surrogate measures are needed. Specific methods for data selection and indicator construction will be discussed. Indicators for environmental contaminants reflect potential exposures of children to outdoor and indoor air pollution, drinking water contaminants, pesticides, mercury in fish, and land contaminants. Indicators for body burdens represent lead and cotinine measured in children's blood, and mercury measured in blood of women of childbearing age. Indicators for childhood disease reflect adverse health outcomes potentially influenced by exposure to environmental contaminants and include asthma and other respiratory diseases, childhood cancer, and neurodevelopmental disorders. Overall, while many children's environmental health indicators show improvements, some percentage of children remain at elevated risk. Key findings include: mean concentrations of children's blood lead continued to decrease through the late 1990s, though over 4% of children still have levels of concern; children's exposures to excessive levels of air pollution has decreased, though a high percentage of children are exposed to significant ozone and particulate matter concentrations; and many children are prenatally exposed to elevated mercury concentrations, as about 8% of women of childbearing age have blood mercury concentrations of potential concern. These measures are quantifiable and useful for monitoring trends relevant

to the environment and children in the US. Views presented are those of the authors and not necessarily of US EPA or other organizations. See www.epa.gov/children/indicators

ISEE-312

METHODS FOR LINKING ASTHMA DATA FROM A POPULATION-BASED SURVEY WITH OZONE DATA FROM AMBIENT MONITORS AT THE ZIP CODE LEVEL: LESSONS LEARNED

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Introduction: Health outcome information is often only available at the zip code level due to privacy protection. However, zip codes vary greatly in size, shape, and population distribution. We examined multiple methods to link California Health Interview Survey data related to the control of asthma at the zip code level with ambient ozone measurements collected at monitoring stations operated by the South Coast Air Quality Management District in Los Angeles.

Methods: The methods evaluated include: 1) assigning zip codes to the nearest monitoring station based on distance only; 2) selecting only zip codes for which 60% of the area fell within a 4-mile radius of a monitoring station; 3) selecting only zip codes for which at least 60% of the zip code population lived within a 4-mile radius of the station; and 4) assigning zip codes to stations based on distance, geography (e.g., hills), and meteorology (e.g., prevailing wind direction). We compared these methods to assignments based on residential cross-street locations and examined the impact on the respective effect estimates for asthma outcomes due to variations in sample size and exposure misclassification.

Results: Using cross-street assignments, we observed a positive association between uncontrolled asthma and average annual ambient ozone level. Odds ratios for uncontrolled asthma were similar for: 1) selected zip codes where at least 60% of the population lived within a 4-mile radius of a station; and 2) zip codes assigned to stations based on distance, geography and meteorology. The other two methods did not show an association between ozone and uncontrolled asthma.

Discussion: These results suggest that methods of exposure assignment incorporating distance, population concentration, geography, and/or meteorology may be more valid than simpler methods. The findings of this study provide crucial information for national environmental public health tracking efforts.

The project is part of the UC Berkeley Center of Excellence for Environmental Public Health Tracking funded by CDC.

ISEE-313

ESTIMATING THE NUMBER OF CHEMICAL INCIDENTS: METHODOLOGICAL APPROACHES, NEEDS AND DIFFICULTIES

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Background: A major problem in planning for chemical incidents is that there are few sources of information on their nature, frequency and impact on health. There has been a series of initiatives at local, regional and national level in the UK to develop surveillance and tracking systems for environmental hazards. These systems are currently being reviewed and updated. The aim of this study was to estimate the number of chemical incidents that occur in England using routinely collected data.

Method: Records about chemical incidents occurring during 2001 in a rural county and in an industrialized county were compared with records

from regional and national databases. Capture-recapture was used to estimate the 'real' number of incidents that occurred during this time period at both local and national level.

Results: Findings from the study indicate that the 'real' number of chemical incidents occurring is between 3 and 18 times greater than the number of incidents reported to regional and national agencies. The number of chemical incidents recorded by one national organization in 2001 was 1333. This analysis estimates that the 'real' number of incidents maybe between 4,000 and 23,000. There are difficulties with the capture-recapture methods, which are likely to under estimate the total number of incidents as the sources of information available may be inter-dependant. This is compounded by some differences between data collection methods across the different databases.

Conclusion: It seems likely that many more chemical incidents occur than has been fully appreciated. The difficulties with existing estimates indicate a need to undertake further research. However, these results provide our best estimates of the 'real' number of chemical incidents in England. They, therefore, indicate the need for further resources in surveillance and control of such hazards.

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ISEE-314

APPLICATION OF THE WISCONSIN ENVIRONMENTAL PUBLIC HEALTH TRACKING NETWORK TO CHILDHOOD CANCERS

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Abstract: The possible relationships between environmental factors and childhood diseases is a significant public concern. One specific area of interest is childhood cancers and how they may be linked to various environmental exposures. Approximately 250 cases of childhood cancer are reported to the Wisconsin Cancer Registry each year. As yet, it has been difficult to conduct systematic and comprehensive analyses linking these cases with probable exposures. Wisconsin is utilizing its Public Health Tracking Network (PHIN) to address this issue. The PHIN integrates the Health Alert Network (HAN) and the National Electronic Disease Surveillance System (NEDSS) and serves as the platform for all Wisconsin public health surveillance. The program area module (PAM) for childhood cancer surveillance includes the following functions: rapid case ascertainment via automated exchange of cancer case data between the public health division and hospitals; supplemental web data entry for environmental exposure confirmation and hypothesis testing; automated data analysis, visualization, and exposure-outcome record linkage; personnel directories for controlling access to sensitive surveillance information; information dissemination and alerting; and IT security. This functionality is divided into two utilization tracks. Track 1 is for hypothesis generation such that cancer cases are messaged and populate the integrated data repository (IDR). The environmental data are merged and visualized using GIS tools for ecologic exposure risk assessment. Track 2 is for hypothesis testing. Follow-back interviews are completed for exposure, parental employment, and residential histories. The PAM framework and these functions allow for the near real-time state-level assessment of linkages for childhood cancer cases and environmental factors. This PAM provides the basis for a modern, comprehensive system to assess potential environmental cancer etiology.

ISEE-315

INTEGRATING INDIVIDUAL- AND COMMUNITY-LEVEL SES DATA IN ENVIRONMENTAL HEALTH TRACKING: THEORETICAL AND METHODOLOGICAL CONSIDERATIONS

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Abstract: Studies in the environmental health and sociology literature suggest that communities of color and the poor bear a disproportionate burden of exposure to environmental hazards such as proximity to industrial facilities, toxic waste sites, exposure to ambient air pollution, and their associated health risks. These studies raise the question of how much persistent health disparities among communities may be partially explained by disparities in exposures to environmental hazards. The use of SES data for understanding health disparities has become an important area of study, but has only recently been incorporated into environmental health research due to policy concerns about environmental inequalities. The development of an Environmental and Public Health Tracking (EPHT) system provides an unprecedented opportunity to integrate demographic and SES data to identify disparities in environmental exposures and health outcomes over time and over a large geographic scale. This presentation will examine methods and data sources for measuring individual- and community-level SES data that have potential for use in an EPHT network. Specifically, we show how SES data can be integrated with environmental exposure and toxicity information to identify demographic disparities in exposures and estimated health risks among diverse populations.

ISEE-316

THE DEMOGRAPHIC AND GEOGRAPHIC DISTRIBUTION OF ADULT ASTHMA HOSPITALIZATION RATES INDICATE A SIGNIFICANT CONTRIBUTION OF SOCIOECONOMIC FACTORS RELATED TO INCOME

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Introduction: The environmental factors that influence the prevalence adult asthma hospitalizations are uncertain. To be consistent with the Centers for Disease Control's (CDC's) goal to improve asthma surveillance, we utilized a source of local hospital discharge data to assess the seasonal frequency, rates, and geographic distribution of adult asthma hospitalizations for a post-industrial, urban county in the United States.

Methods: Hospital discharge data was obtained from the State Department of Health which is mandated by a 1994 state law to collect all hospital discharge data. The population of interest was adults 19–64 years of age that had been hospitalized for asthma from 1999–2001. Seasonal frequencies were assessed for a relationship to the Air Quality Index that is published by the Environmental Protection Agency (EPA). This index reflects the ambient air concentration of the 6 criterion pollutants listed by the EPA. Age-adjusted and age-specific rates for asthma hospitalization were assessed for county of interest and compared to the adult asthma hospitalization rates that were most recently published by the CDC. Included in these calculations were those specific for the subgroups which are documented to be at a higher risk for hospitalization due to asthma (i.e., women, minorities). For each of the 72 zip codes in this county, age-specific asthma hospitalization rates were calculated and compared to those for the county. These geo-specific assessments were also performed for the aforementioned "at-risk" subgroups using ARC-VIEW GIS software. The measure of comparison used was the Standardized Incidence Ratio (SIR) and a corresponding confidence interval.

Results: Seasonal analysis demonstrated higher frequencies of hospitalizations during the winter months compared with summer months suggesting a contribution of indoor environments rather than outdoor air quality to adult asthma hospitalizations. Hospitalization rates for the county and the respective "at risk" subgroups were comparable to those published by the CDC. However, when comparing the geo-specific rates in each of the 72 zip codes in the county, 12 zip codes had SIRs that were significantly higher. Additionally, a gender and age-related disparity of hospitalizations for females was observed when compared to males. For the 12 zip codes that had higher SIRs, higher measures of socioeconomic depression are reported and are located predominantly in the Southeastern quadrant of this county.

Discussion: We find that for this post-industrial, urban county, there is a geographic-specific risk of adult asthma hospitalization which is significantly influenced by a disparate distribution of socioeconomic factors related to income.

ISEE-317

GEOSPATIAL MONITORING OF ASTHMA IN ALAMEDA COUNTY, CALIFORNIA

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Introduction: Asthma is the leading cause of chronic disability among children in the United States, and concern is increasing regarding both the role of environmental factors and prominent demographic disparities in the disease. As part of a demonstration project in Environmental Public Health Tracking (EPHT), we investigated the uses of public and private health utilization data in conjunction with Geographic Information Systems (GIS) techniques to visualize disparities in asthma burden and suggest environmental factors that may play a role in its etiology.

Methods: By combining health utilization records from the Kaiser Permanente of Northern California HMO and the state Medicaid program for Alameda County during 2001, we constructed a dataset covering 7.3 million person-months. Data representativeness was assessed through comparison with US Census information at the census tract level. Following the method of Rushton and Lolonis (1996; Stat. Med. 15:717-26), we calculated localized rates of asthma-related events in localized areas spaced at regular intervals. Statistical significance was calculated through the use of Monte Carlo simulations.

Results: The dataset was broadly representative of the socioeconomic spectrum of County residents, and described a total of 1,077 hospitalizations due to asthma, 3,919 emergency room visits, 54,814 outpatient visits, and 262,621 prescription fills for asthma medications. We produced high-resolution maps to display statistically significant geographic patterns in asthma outcomes.

Discussion: These data enabled visualization and analysis of small-area variations in asthma burden to inform stakeholders about asthma "hot spots" and suggest environmental factors that may play a role in asthma epidemiology.

ISEE-318

A COMMUNITY-BASED PARTICIPATORY SURVEY OF PUBLIC HOUSING CONDITIONS AND ASSOCIATIONS BETWEEN RENOVATIONS AND POSSIBLE BUILDING RELATED SYMPTOMS

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Abstract: We report analysis of survey data from two public housing developments in Boston, Massachusetts (USA) that house low-income inner-city residents. The two developments differ in that one has had substantial renovations to walls, roofs, piping, heating and water systems while the other has not. In 2002 we collected a combined 238 surveys from the two developments using a questionnaire that recorded self-reports of housing conditions (pest infestation, water leaks, etc.), chronic health conditions and symptoms in the preceding month. Because heating and domestic water replacement at the more renovated development occurred between the 2002 survey and a pilot survey we conducted in 1998, we were also able to assess changes in responses over time. Crude and adjusted odds ratios showed that residents reported worse environmental conditions at the unrenovated development. Only the crude OR for skin rashes was statistically significant and only the adjusted OR for ear infection, skin rashes and sneezing exceeded 2.0. The longitudinal component of the study also showed changes in environmental factors after renovation, but the evidence was more mixed with both negative and positive trends. Only the crude OR for sneezing was statistically significant and only the adjusted OR for nosebleeds, sneezing and burning/itching eyes exceeded 2.0. We conclude that our analysis supports the contention that renovations improve housing conditions and that such improvements may be associated with health improvements, but that further research is needed to firmly document any health benefits.

ISEE-319

AIR POLLUTION EFFECTS ON ASTHMA ACCORDING TO SOCIOECONOMIC POSITION IN A CASE-CROSSOVER STUDY

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Introduction: Recent epidemiological literatures have observed that health effects of air pollution vary from one socioeconomic position to another. In regard of the differences in health related to social contexts, asthma attacks are disproportionate across regions representing socioeconomic positions. The relationship between air pollution and health effects is well-estimated by a case-crossover approach. This study examined the associations between air pollution and hospital visits due to asthma in children under age of five modified by region, using a case-crossover design.

Methods: Relative risks (RR) of the asthma-related hospital visiting of children under age of five for outdoor air pollution concentrations were estimated in a conditional logistic model using a case-crossover design across 25 districts of Seoul on November and December in 2000. Average premium of self-employed in the National health insurance was selected to represent socioeconomic position in each district. We calculated Pearson correlation coefficients to investigate the relationship between asthma risk from air pollution and the mean of premium of self-employed in national health insurance across regions. Air pollution effect on hospital visits due to asthma from the eight districts with the highest average premium and the effect from the eight lowest districts were compared.

Results: We observed negative trends between the RR's of asthma hospital visiting from air pollution and average premiums of self-employed in national health insurance ($r = -0.245$ for PM10 and $r = -0.150$ for ozone). RR of asthma for PM10 was 1.136 (95% CI=1.101, 1.172) in the eight districts paying the highest premium, but 2.016 (95% CI=1.949, 2.085) in the eight lowest payment districts. RR for ozone was 0.521 (0.504, 0.538) from the eight rich regions and 1.030 (1.007, 1.053) from the eight poor regions. The RR's are associated with

inter-quartile range changes (49 micro-gram per cubic meter and 14 ppb for PM10 and for ozone).

Discussion: RR's of asthma hospital visit in children for PM10 and O3 were observed to decrease as average premiums of self-employed in the National health insurance increase across the regions. Our study indicates that living in poor area may cause more asthma episode in children.

This study was supported by the Eco-Tech project from Korean government.

ISEE-320

PROVIDING THE TRANSPARENCY OF ARGUMENT AND CONCLUSIONS REQUIRED BY PRECAUTIONARY STRATEGIES

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Introduction: The Wingspread formulation of precautionary strategies emphasizes stakeholder involvement and the willingness to explore alternative courses of action even when the degree of certainty about a possible hazardous activity is not yet "virtually certain". To accommodate these strategies requires the risk assessor to format conclusions as a "degree of certainty" and not as a dichotomy between "virtually certain" or not. To make the reasoning behind the conclusions transparent to all stakeholders, the risk assessor must not only reveal the evidentiary grounds of his/her argument but also the evidentiary "tests" applied and the criteria used to evaluate the results of those tests so as to "warrant" the claims made about hazardousness. Many arguments about "degree of certainty claims" are really arguments about the unrevealed criteria used to "warrant" the claims.

Methods and Results: After discussing the concepts of "degree of certainty claims", "evidentiary grounds", "evidentiary tests" and criteria or "warrants", I will show how these concepts were actually applied in a recent risk evaluation of low frequency electric and magnetic fields (EMFs). The policy question about EMFs (or any environmental potential hazard) could be formulated as: "How certain must one be of how much disease before one moves from inaction to cheap or expensive protective actions?" I will describe how stakeholders with different ethical frameworks recommended different styles of precautionary action when we presented our "degree of certainty claim" about EMFs.

Discussion: Since the regulatory agency which commissioned the risk evaluation of EMFs has not reopened hearings on the topic, it is not yet clear whether this format for epidemiological claims and their justification when combined with the precautionary policy analysis we carried out will facilitate precautionary policies. I believe that society could agree on some criteria that would trigger precautionary alternative policy analysis and a transparent risk evaluation of the sort described above. Because of the variety of stakeholder interests and ethical frameworks I do not believe that society will ever agree to one style of precautionary action for all suspected hazards.

ISEE-321

ENVIRONMENTAL BURDENS OF LOW INCOME AND MINORITY POPULATIONS AND HEALTH DISPARITIES: IMPLICATIONS FOR ENVIRONMENTAL PUBLIC HEALTH TRACKING

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Abstract: Health tracking is a scientific movement towards improving the quality and comprehensiveness of measures of health processes and progress. One application of health tracking is to reduce disparities in health, as minority and economically disadvantaged populations appear to bear a disproportionate share of the health risks related to environmental hazards. The purpose of this presentation is to review linkages between

environmental burden and health disparities. We discuss how environmental health tracking should attend to the social processes that shape communities as well as the traditional measures of environmental factors known to impact health. These social processes include neighborhood deprivation (e.g. poverty and income inequality), relational resources (e.g. social cohesion), and social inequality (e.g. residential segregation) and community stressors (e.g. violence). Based on review of social science, environmental justice research and environmental health sciences literature we describe several key environmental health issues facing racial/ ethnic minority and low-income populations, including ambient air pollution, indoor air quality, drinking and ambient water quality, pesticides, hazardous waste and land contaminants and body burden measurements. We review several of these factors from a multi-level perspective and provide suggestions for the refinement and conceptualization of health indicators relevant to health disparities.

ISEE-322

CASA DE SALUD: A MODEL FOR ENGAGING COMMUNITY

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Purpose: Casa de Salud is a community-based participatory research project conducted in an urban industrial community in the United States with a large immigrant population that is now more than 70% Latino. Poverty is widespread and severe, ranking the city among the twenty-five poorest in the United States with an average per capita income of less than \$10,000. Environmental health threats are significant. Decayed housing, dense population, abandoned factories, contaminated properties, waste disposal facilities and eight out-of-compliance auto body shops per square mile contribute to lead levels in children that are nearly three times the state rate and pediatric asthma rates that are the highest in the region. Yet, Latino residents have been largely uninvolved in efforts to address the significant environmental health issues that affect residents.

Research Objectives: Casa de Salud (Health House) is designed to engage residents of highly stressed neighborhoods in activities to mitigate the health impacts of environmental exposures. Research objectives include: 1. Gathering data regarding residents health concerns and knowledge of environmental health issues; 2. Gathering data on residents' involvement in initiatives to address high lead and asthma rates; and 3. Assessing the effectiveness of culturally appropriate interventions to engage the community.

Methods: Using a culturally integrated community education and organizing model conducted in Spanish, project partners developed educational materials written and translated for a lay audience, trained residents to become neighborhood "Casa" leaders and educators, and conducted mutual education and intervention planning among residents, health care providers, and environmental health scientists. Casa Leaders open their homes for monthly charlas (meetings) that serve as the primary sites for interaction in a highly accessible setting where residents outnumber "experts" and neighborhood culture is dominant.

Results: In the first three years of the program Casa Leaders held charlas for 628 residents. 60% reported that they had never before attended a meeting to learn about environmental health even though 77% reported concern about environmental health issues. 92% reported that they felt comfortable participating in the charlas and 95% reported that they gained knowledge about environmental health issues from attending. The project's success can be attributed to a mutual respect and understanding developed among Casa Leaders, health care providers, and environmental health scientists that focused the project on issues identified by the community that validated their concerns, respected their level of knowledge, and was considerate of cultural learning styles.