DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON · SCHOOL OF PUBLIC HEALTH

GRADUATE STUDENT RESEARCH DAY

Wednesday, May 30, 2018
2:30 – 5:00 pm
South Campus Center 316

Program & Abstracts

http://deohs.washington.edu/student-research-day

Graduate Student Research Day

2:30 PM **Welcome**
Michael Yost, Chair

2:35 PM **Oral Presentations**
Presentations by winners of the Castner and Outstanding Student Awards.

Rachel Shaffer	2018 PhD Castner Award Winner
Erica Grant	2017 Master's Castner Award Winner
Meagan Jackson	2018 Outstanding Master's Student
Graeme Carvlin	2018 Outstanding PhD Student

3:30 – 5:00 PM **Poster Session and Reception**
See below for abstracts by graduating master's students, selected doctoral students, and senior fellows.

Oral Presentations

Poster Presentations

DEOHS Students

BEBTEH Trainees

Oral Presentations

The following abstracts are for oral presentations by winners of the Castner and Outstanding Student Awards.

2018 PhD Castner Award Winner: Rachel Shaffer

Air Pollution & Dementia

Rachel Shaffer
Environmental & Occupational Hygiene, PhD
Faculty Advisor: Lianne Sheppard

Abstract: Neurodegenerative disorders, including Alzheimer's disease (AD) and related dementias (ADRD), affect over 47 million people worldwide, and this number is anticipated to reach 131.5 million by 2050. Because no medication successfully reverses the course of disease, researchers are focusing increasing efforts on prevention by addressing potentially modifiable risk factors. Recent evidence suggests that air pollution, a ubiquitous environmental exposure, may be linked to neurodegeneration and dementia. This project aims to advance the state of the science on this topic through biologically-based epidemiological analyses. In the first aim of this project, I will evaluate the association between $PM_{2.5}$ exposure and AD-related pathologies, oxidative stress biomarkers, and cerebrovascular injury biomarkers in the cerebrospinal fluid (CSF) of diseased and cognitively normal individuals. In the second aim, I will utilize autopsy specimens to evaluate the association between $PM_{2.5}$ exposure and AD biomarkers in the temporal lobe, frontal lobe, and hippocampus of diseased and cognitively normal individuals. In the third aim, I will evaluate the association between $PM_{2.5}$ exposure and incidence of dementia (AD and all-cause). This proposed work will advance scientific understanding of the mechanisms and risk factors for dementia. Furthermore, the findings of this research could inform policies to reduce exposure to air pollution, which could decrease the burden of environmental-related dementia across the population.

2017 Master's Castner Award Winner: Erica Grant

A Comparative Analysis of Gut Microbiota on the Human-Macaque Interface in Northeast Thailand

Erica T. Grant
Environmental & Occupational Health, MPH
Faculty Advisor: Peter Rabinowitz

Authors: Erica T. Grant, Randall C. Kyes, Pensri Kyes, Janna M. Schurer, Pauline Trinh, Vickie Ramirez and Peter Rabinowitz

Background: Traditional zoonotic disease research efforts centered on detection of high profile pathogens may miss opportunities to understand broader microbial transmission dynamics between humans, animals, and the environment. The Global Assessment of Zoonotic and Environmental Risks (GAZER) platform seeks to address this knowledge gap by examining overlaps of bacterial microbiome communities between humans, animals, and environments in settings where interaction with animals is high and potential for human health impacts of this contact are greater. We present data from Maha Sarakham, Thailand, where a growing population of long-tailed macaques (Macaca fascicularis) in the Kosumpee Forest Park interface with residents of the adjacent village. In particular, community members working in or near the park experience a high level of direct and indirect contact with macaques through feeding as well as aerosols of macaque feces during cleaning.

Methods: Workers were surveyed to characterize tasks that contribute to exposure and other dietary or lifestyle factors that influence gut microbiome composition. We employed comparative microbiome analysis based on the V4 region of the 16S rRNA gene to assess the degree of similarity between gut bacterial communities and potential for pathogen transmission between macaques and workers. Fecal samples were collected from humans (exposed, n=12; control, n=6) and macaques (exposed, n=8; control, n=4) using the OMNIgene.GUT kit and sequenced on the Illumina HiSeq platform.

Results: Alpha and beta diversity analyses between humans (exposed, n=12; control, n=6) and macaques (exposed, n=8; control, n=4) shed light on compositional changes that may occur as a result of their increased level of contact. Unweighted UniFrac and Bray-Curtis distance metrics were used to assess degree of sharing based on the similarity of taxa present. Variance detected in PCoA visualizations were tested using adonis and betadisper to investigate the role of the Anna Karenina principle (AKP). This effect is signature of dysbiosis characterized by increased variation in profiles, typically as a response to environmental stressors. Exposed macaque samples exhibited significantly greater dispersion than controls ($p<0.01$). Human samples had homogenous dispersion but different spatial medians between groups ($p<0.03$), implying a shift in microbial composition.

Discussion: Alterations in gut microbiota of exposed worker and macaque populations and highlight the potential for increased susceptibility to other diseases. By characterizing these exposures and associated gut microbial community shifts, we can inform development of protective measures and training recommendations to reduce occupational hazards. This information can also be used to mitigate negative aspects of contact between humans and macaques in order to optimize the health of both populations.

2018 Outstanding Master's Student: Meagan Jackson

Field Effectiveness of Ultraviolet Disinfection Units: Technical and Organizational Determinants of Reliable Onsite Wastewater Treatment

Meagan Jackson
Environmental Health, MS
Faculty Advisor: Tania Busch Isaksen

Authors: Meagan Jackson, Tania Busch Isaksen, Scott Meschke, Jeremy Simmons

Abstract: In areas where conventional onsite sewage systems are inadequate to treat wastewater, ultraviolet disinfection (UVD) units provide essential advanced treatment. This is especially important in the Puget Sound region, where soils are often course-grained, water tables are high, and coastal contamination can have widespread effects on the shellfish industry and public health. Although UVD units meet treatment standards under testing conditions, their field effectiveness is not well understood. This study aimed to evaluate the field performance of UVD units installed in Western Washington as well as identify potential risk factors for malfunction. A mixed-methods approach was used to test the hypothesis that 25-50% of inspected UVD units would have malfunctioning UV bulbs and that effluent from these units would have higher fecal coliform levels than the effluent from fully-operational UVD units. The research methods included a field survey of 97 UVD units, environmental sampling to determine effluent quality, and analysis of retrospective compliance sampling results. The results from this data were complimented with qualitative research and surveys to examine stakeholders' perspectives on operation and maintenance of UVD units. The study found that when properly installed and maintained, fully-functioning UVD units discharge effluent that meets treatment standards. However, 25% of UVD units in this region have UV bulbs that are off and not providing disinfection. Compared to units with well-functioning bulbs, the odds of exceeding treatment standards were 7.5 times greater in units with malfunctioning bulbs, after adjusting for other deficiencies in the OSS (95% CI: 4.0-13.9, $p<0.001$). Biofilm buildup and electrical issues were identified as potential risk factors for UV bulb malfunction, and a strong pattern was observed between county-level operation and maintenance programs and UVD unit malfunctions. The study's results provide recommendations to increase UVD unit reliability and minimize public health risks. Manufacturers can improve unit designs to protect against electrical damage and biofilm buildup; local health jurisdictions can ensure correct installation and adequate maintenance with intensive management plans; and homeowners and maintenance providers can collaborate to provide ongoing oversight and maintenance of UVD units.

2018 Outstanding PhD Student: Graeme Carvlin

Measuring Particulate Matter in Imperial County, CA

Graeme Carvlin
Environmental & Occupational Hygiene, PhD
Faculty Advisor: Edmund Seto

Abstract: The Imperial Project is an effort by academics, government, and community leaders to address the high levels of air pollution in Imperial County, CA. To this end a 40-monitor air quality network was created, calibrated, and the data used for land use regression and back trajectory analyses. Types of land use and meteorology associated with high PM were investigated and a 2D air pollution surface created. Locations and potential sources contributing to high PM were identified.

Poster Presentations

The following abstracts are for the poster presentations by 2nd year Master of Science and Master of Public Health degree students.

A comparison of antibiotic resistance trends of E. coli among bovine and human isolates in Washington State

Lauren Frisbie
MPH in Environmental & Occupational Health
Faculty Advisor: Peter Rabinowitz

Authors: Lauren Frisbie, Scott Weissman, Cheryl Adler, Vickie Ramirez, Marisa D'Angeli, Peter Rabinowitz

Abstract: Antibiotic resistant genes and bacteria pass readily between animals, humans, and their shared environments, and therefore represent a classic zoonotic disease threat. There is a need for improved stewardship of antibiotics in human medicine, animal medicine, as well as agriculture and aquaculture. Despite this, our traditional methods of tracking the emergence of antibiotic resistant strains of bacteria have been fragmented between human and animal sectors, and generally non-existent in the environmental realm. We report on the efforts of the Washington State One Health Steering Committee to assemble an ongoing database of antibiotic resistance in humans, animals and the environment. The Washington Integrated Surveillance for Antibiotic Resistance (WISAR) database includes human and animal data from hospitals, laboratories, and clinics in Washington State, as well as human and animal data from the US National Antibiotic Resistance Monitoring System. Looking at multiple year trend data from the WISAR database creates an opportunity for a collaborative effort to discuss the next stages for local efforts in antimicrobial stewardship across human, animal and environmental sectors. We used the WISAR database to study the patterns of resistance to five classes of antibiotic of E. coli from bovine and human isolates in Washington State from 2002 – 2017. This comparative analysis allows for an understanding of: 1) what conclusions can be made between data sets? 2) how valid are these conclusions 3) what data is needed to make this type of comparison in resistance across sectors?

Green Space Exposure and Cognition: The Multi-Ethnic Study of Atherosclerosis

Demitris Haldeos
Occupational & Environmental Medicine, MPH
Faculty Advisor: Sverre Vedal

Authors: Demitris Haldeos, Sverre Vedal, Howard Frumkin, Payam Dadvand, Robyn McLelland, Teresa Seeman

Abstract: The population is aging, and increasingly urban, and or increasingly disconnected from nature. Alzheimer's disease is common (in the elderly) and becoming more prevalent, and is associated with great medical expense. There is increasing evidence that contact with nature (green space) has positive health benefits. Thus, we utilize the robust MESA study database (which focused on an older population), and its collection of individualized Cognitive Abilities Screening Instrument (CASI) scores, and analyzed for association with individualized, proxy residential based green space exposure, using NDVI (Normalized Data Vegetative Index - satellite imagery of earth surface green space converted to a numerical index). Pre-analysis uncovered strong confounders which were controlled for in a linear regression. Preliminary findings depict a positive association for CASI scores based on NDVI, which remained while controlling for confounders. However, income shows to be an incredibly strong driver. We also have access to ApoE4 allele polymorphisms for each individual, and will inspect whether its presence modifies any found association.

Risks associated with exposure to Cryptosporidium and Giardia parasites in North Seattle recreational waters

Joanna Harrison
Environmental Health, MS
Faculty Advisor: Scott Meschke

Authors: Joanna Harrison, Scott Meschke

Abstract: Cryptosporidium (Crypto) and Giardia are diarrhea-causing microscopic parasites transmitted through ingestion of fecally-contaminated water. Both parasites can have a significant impact on the health and financial burden of communities. In King County, WA, annual reported cases of Crypto during 2012-15 ranged from 18-25 and reached 43 cases in 2016. Reported Giardia cases during 2012-15 ranged from 170-219 and in 2016 reached 253 cases. Seattle, the most populated city in King County, uses protected water sources and heavily treats drinking water before distribution, resulting in negligible parasite prevalence, suggesting sources other than drinking water may cause infection. So far no studies assess risk associated with the levels present in natural recreational water of Seattle. My research adapts a Bag-Mediated Filtration System (BMFS) to use Envirochek HV filters and processing using Environmental Protection Agency (EPA) 1623.1 methodology to detect and enumerate (oo)cysts. Quantitative PCR (qPCR) was also used to identify the source of (oo)cysts. Twelve-liter water samples from 6 recreational beaches in N. Seattle were taken between July 2017 and January 2018 and filtered on-site using the BMFS. Filters were eluted, eluates re-concentrated, purified and analyzed by immunofluorescent microscopy. The (oo)cysts were scraped from the slide and underwent DNA extraction and qPCR for species-typing following established methods. Preliminary results show 2/6 locations and 14% of all samples were positive for Crypto during summer months, with levels ranging from 1-2 oocysts. Giardia was detected in 4/6 locations and 31% of all samples during summer, ranging from 1-5 cysts. Both fell to 0 (oo)cysts in fall. Samples collected before and after a New Years "Polar Bear Plunge" resulted in an increase from 0 to 4 Crypto oocysts and 0 to 27 Giardia cysts. Further study using Quantitative Microbial Risk Assessment will characterize the risk based on the source of contamination.

Piloting a Health and Safety Clinic Model to Address Precarious Worker Concerns

Manaola Hewett
Occupational & Environmental Exposure Sciences, MS
Faculty Advisor: Noah Seixas

Abstract: Precarious work, work that differs from the typical model of standard full-time, year-round employment, exposes its workers to adverse occupational health and safety outcomes such as increased occupational injury rates, higher hazardous exposures, and inadequate safety training and resources. Industries such as agriculture, custodial, food-service, housekeeping, and warehouse work are connected to precarious work. Minorities, migrant workers, and small-business owners make up a large proportion of precarious workers and minimal research has been done to minimize the occupational risks this population face. Building off an existing state-funded grant to educate low-wage workers about workplace safety hazards, this project developed, implemented, and evaluated a series of health and safety problem-solving clinics for vulnerable precarious workers. Transfer of health and safety knowledge and resources occurred during three 2-hour clinics. The clinics provided professional support to precarious workers as they identify their primary health and safety problems. The goal was for workers to empower one another through collaboration to address their concerns and professional advice given by health and safety experts ensures workers receive proper resources from a trusted source. To test the effectiveness of this model, process evaluation of the clinic model was done through follow-up interviews with clinic participants. to determine the utility of the information and resources provided and its impact it may have had at a worker's jobsite. Worker concerns such as occupational injury, filing a worker's compensation claim, workplace conflict, and harassment were commonplace despite the many different occupations at each clinic. Worker's stated that the clinics were helpful in getting their voice heard on the issues they face and that they now have the resources needed to address their problems. By bringing the health and safety experts to the workers, the clinics provide an opportunity to minimize the adverse occupational health and safety outcomes precarious workers face.

PILOT STUDY: Environmental Microbiomes of Dairy Farms- A One Health Approach

Ara Jo
Occupational & Environmental Exposure Sciences, MS
Faculty Advisor: Peter Rabinowitz

Abstract: The "One Health" paradigm embraces the importance of interdisciplinary collaboration between multiple fields of study for a more comprehensive approach to the complex issues of human, animal and environmental health. This paper will be exploring the environmental side of the Healthy Dairy Worker pilot study that is being conducted through the Center for One Health Research at the University of Washington's Department of Environmental and Occupational Health Sciences. Microbiomes within dairy farms have seldom been investigated and can hold some answers to human and animal health on the farm. A recent dairy study found that endotoxin (a key component of the outer membrane of Gram-negative bacteria and thought to be a major source of respiratory disease) concentrations are higher in the settled dust of homes in close proximity to industrial-scale dairy operations. (Williams et al. 2016). In light of this study, there has been a rise in local community health concerns as well as a growing fear and hesitation among dairy farmers to participate in further dairy research projects. Fortunately, we found two farms willing to participate in our One Health Healthy Dairy Worker pilot study. We hope to be able to characterize the environmental microbiomes within the dairy farms at 4 different locations within each farm. Methods include using the wet cotton swab to collect our environmental samples on each farm, sending samples to the lab for microbial DNA extraction and analyzing microbial data for characterization. These results, integrated with the dairy cow manure samples and dairy worker health interviews, should produce enough preliminary data to analyze the microbial environment shared on dairy farms and eventually explore possible health impacts on both the dairy farm workers and dairy cows. This study is currently still in the beginning stages of data collection and does not have any raw data or analysis to present at this time.

Resource: Williams, D. A. L., McCormack, M. C., Matsui, E. C., Diette, G. B., McKenzie, S. E., Geyh, A. S., & Breysse, P. N. (2016). Cow allergen (Bos d2) and endotoxin concentrations are higher in the settled dust of homes proximate to industrial-scale dairy operations. Journal of Exposure Science & Environmental Epidemiology, 26(1), 42–47; http://doi.org/10.1038/jes.2014.57

Exploring Mental Health Care During Period of Rapid Urban Environmental Change in Seattle, King Co.

Katherine Ly
Environmental & Occupational Health, MPH
Faculty Advisors: William Daniell and Michele Andrasik

Abstract: Gentrification is happening at an unprecedented scale in the City of Seattle. The influx of wealth and investments in historically disinvested areas quickly alters the urban built environment and disproportionately puts low income and communities of color at risk. While the built environment has been linked to conditions such as cardiovascular disease, hypertension, and mental health, less is known on the influence of built environment changes on health care access. This research attempts to fill that gap by evaluating the impact of a quickly evolving urban environment on mental health care using a cross-sectional phenomenological qualitative design. Through semi-structured interviews with caregivers of youth referred to a community mental health clinic, this project explores the experience of attending mental health services during this timely period of rapid urban environmental change from the perspective of families of the Odessa Brown Children's Clinic (OBCC). Essences of families' experiences will help shed light on the complex reality of gentrification and its perceived environmental pressures, including housing and work stress, among a clinic population. Characterizing the impact of environmental stress identifies needs, barriers and facilitators to mental health care access among families and informs recommendations for OBCC mental health services as the clinic responds and adapts to needs within the shifting urban environment.

Linking Human and Animal Notifiable Zoonotic Disease Data in Washington State

Kate McConnell
Environmental & Occupational Health, MPH
Faculty Advisor: Peter Rabinowitz

Authors: Kate McConnell, Minden Buswell, Hanna Oltean, Marguerite Pappaioanou, Peter Rabinowitz

Abstract: Zoonotic diseases pose an increasing risk to human and animal health around the world. Although the 'One Health' initiative has spurred calls for integrated zoonotic disease surveillance, most human and animal disease surveillance systems continue to operate independently, including those in Washington (WA) State. Because there are no laws detailing notifiable zoonotic disease data sharing between the Washington State Department of Agriculture (WSDA) and the Washington State Department of Health (DOH), zoonoses surveillance data from these agencies rarely have been analyzed jointly. The objective of this project is to compare trends in the number, incidence, and type of zoonotic diseases reported in humans and in animals (both companion and food producing) over time in WA State. We abstracted notifiable animal zoonoses data reported to WSDA from 1993 to present from paper records, and abstracted notifiable human zoonoses data reported to DOH over the same time frame from publicly available online reports. We focused our analyses on leptospirosis and psittacosis incidence because these were two of the most commonly reported zoonotic animal diseases from 1993 to present that also are notifiable in humans, and because both diseases have associated public and/or veterinary health actions. We will present the results of these comparisons, as well as the identification of possible disease clusters, and the results of exploratory analyses of the relationships between environmental variables such as rainfall and temperature and zoonotic disease cases in both humans and animals. This project identifies barriers to implementing integrated surveillance, including the lack of a common data tracking, analysis, reporting, dissemination, and communication platform, in addition to the lack of a standardized system of disease nomenclature. It also explores the challenges of correlating climate data with human and animal cases of weather-sensitive zoonoses, such as leptospirosis. Data sharing and other communications between human and animal health agencies may be essential to improving integrated zoonotic disease surveillance and response. Integrated disease surveillance is an important step toward better understanding of zoonotic disease outbreaks in both animal and human populations (including occupational risk in animal workers), improved prevention, and more timely zoonotic disease outbreak detection and effective response. Furthermore, there may be sentinel value in animal health agency awareness of zoonoses in humans (i.e. humans as sentinels for animal disease risk), and vice versa.

Occupational exposure to metals and impact on dementia incidence

Priya Motz
Occupational & Environmental Medicine, MPH
Faculty Advisor: Lianne Sheppard

Abstract: Environmental exposures to certain metals have been implicated as a potential etiology for dementia, more specifically Alzheimer's disease. With the growing population and people living longer, the incidence and cost for health management of this disease will increase. With this study, we will explore occupational exposures to copper and aluminum and separately assess their association of incidence of Alzheimer's disease and all-cause dementia. By examining occupational exposures, a better understanding of the potential implications of Alzheimer's disease can be transferred to environmental exposures as occupational exposures are expected to be higher than environmental. Furthermore, this study will allow improved knowledge on a potentially modifiable risk factor for Alzheimer's disease.

Maternal Urinary Phthalates, Gestational Diabetes, and Glucose Intolerance During Pregnancy

Rachel M. Shaffer
Environmental & Occupational Health, MPH
Faculty Advisors: Sheela Sathyanarayana and Lianne Sheppard

Authors: Rachel M. Shaffer, Lianne Sheppard, Kelly K. Ferguson, Sheela Sathyanarayana

Background/Aim: Recent studies have linked phthalates with type 2 diabetes. However, limited research exists on the potential association between phthalates and gestational diabetes (GDM), impaired glucose tolerance (IGT), defined as a failed glucose challenge test but normal glucose tolerance test, and continuous glucose tolerance measures during pregnancy. Methods: We evaluated 11 urinary phthalate metabolites from the first (T1) and third (T3) trimesters of pregnancy and medical record abstraction data in 705 women from The Infant Development and Environment Study (TIDES). We used logistic regression to examine the associations between log-transformed and specific gravidity adjusted T1-only and average phthalate metabolite concentrations across pregnancy (mean of T1 and T3) with GDM and IGT, and linear regression to examine the associations of T1 and pregnancy average phthalates with continuous glucose tolerance data. We adjusted for maternal age, maternal body mass index, study center, race/ethnicity, and parity. In sensitivity analyses, we examined potential nonlinear dose-response relationships using phthalate quartiles, as well as race-specific associations. Results: We observed 60 cases of GDM and 69 cases of IGT within the cohort. Average mono-ethyl phthalate (MEP) across pregnancy was associated with increased odds of GDM (OR: 1.88; CI: 1.14, 3.10). Increased levels of monocarboxyoctyl phthalate (MCOP) were associated with increased continuous glucose tolerance measures (T1: 6.19, CI: 0.75, 11.63), T1T3: 6.98, CI: 0.13, 13.82). Sensitivity analyses suggested race-specific associations, particularly among Asians, and the presence of non-monotonic dose response relationships for selected phthalates. Conclusions: Average MEP across pregnancy was associated with increased odds of GDM, and this result supports findings in the published literature. Increased levels of MCOP were associated with continuous glucose concentrations. Sensitivity analyses suggested elevated risks for Asians. Future studies should confirm these findings in larger cohorts of pregnant women, particularly those who may be at higher risk for GDM and IGT.

Use of Low-Cost Air Sensors in Community-Engaged Research on Wood Smoke in the Lower Yakima Valley

Orly Stampfer
Environmental & Occupational Health, MPH
Faculty Advisor: Catherine Karr

Authors: Orly Stampfer, Victoria Breckwich Vásquez, Elena Austin, Catherine Karr

Abstract: Rural lower Yakima Valley, WA is home to communities including Latinx farmworker families, the Confederated Tribes and Bands of the Yakama Nation, and Native Americans of other tribes. Episodic poor air quality impacts this region, reflecting sources of particulate matter (PM) that include residential wood smoke and agricultural biomass burning. University of Washington partnered with the Yakama Nation Environmental Management Program and local institutions, Heritage University and White Swan High School, to develop community-engaged research on wood smoke. The aim of this thesis was to address the feasibility of community-based use of low-cost sensors to examine wood smoke emissions. This study assessed (1) perspectives on trust, equity and culturally informed processes, and community involvement in research of the project's new community-academic partnership and (2) if particulate matter size distributions from the low-cost sensor could be used to predict wood smoke emissions. Aim (1) used semi-structured interviews with each member of the UW team (n=6) and most of the community partners (n=6). Responses were coded and analyzed using a grounded theory approach. We found that Funding, Dialogue, and Formal roles and processes surfaced as structures that provided context for the following themes as practices: Community partner capacity building, Academic presence in community, Recognition of community strengths, Understanding the significance of historical and current community dynamics and culture, and Transparency in the research process. Each of the practices related to outcomes of two or three of the overarching research questions: trust, equity and culturally informed processes, and community involvement in research. We made recommendations for our community-academic partnership based on our findings. Aim (2) used data collected at a tribal air monitoring site in Winter 2018 with a laser based, low-cost, 5-bin particle counter and a 5-wavelength aethalometer (MA200 Aethlabs). We used a biomass burning indicator: Delta-C, the absorbance difference at 375nm-880nm. Low-cost sensor $PM_{2.5}$ calibration used regression parameters from an 8-day co-location with a tribal beta-attenuation monitor. The 80^{th} percentile of the hourly Delta-C: sensor $PM_{2.5}$ ratio was used to signify high wood smoke-enriched hours. The low-cost sensor particle size distributions during these high wood smoke-enriched hours were compared to those below 50^{th} percentile of the hourly Delta-C:$PM_{2.5}$ ratio. Daily $PM_{2.5}$ mean was 6.9 µg/m3 (SD 4.8 µg/m3, range 1.3-20.3 µg/m3). Mean proportions of particle size bin counts did not differ meaningfully for high wood smoke-enriched hours. The correlation between Delta-C and $PM_{2.5}$ was higher during wood smoke-enriched hours (0.84) vs. not (-0.69). This suggests that while the low-cost sensor captures wood smoke emissions, further analysis exploring other methods to isolate high wood smoke episodes are needed. Through evaluation of community engagement and assessment of the performance of low-cost sensors, this thesis contributes to knowledge of best practices in conducting community-engaged research on air quality and provides information on the potential use of low-cost sensors in identifying wood smoke in a rural US setting. These results may facilitate future studies of rural air quality in communities historically underserved in air quality research.

A Taste of Freedom: The meanings & experiences of work among formerly incarcerated Asian Pacific Islander individuals

Jamie Wong
Environmental & Occupational Health, MPH
Faculty Advisor: William Daniell

Abstract: Asian Pacific Islander populations in the US are impacted by mass incarceration. Though statistics have not been widely tracked, current data shows that API incarceration the last ten years has quadrupled (Bedi, 2003). Culturally relevant discussions of post- release transitions have not been addressed or discussed. Wage work is an important component of an individual's transition process from prison to mainstream society. Previous findings have revealed that employment offers financial stability and a new sense of identity for formerly incarcerated individuals. At the same time, formerly incarcerated individuals encounter several barriers in their job search. Utilizing interviews and qualitative research with formerly incarcerated Asian Pacific Islander individuals, this thesis intends to explore work as a contradictory process serving a dual function to discipline and reintegrate formerly incarcerated individuals into the market economy as well as the formation of new post-release identities.. This disciplining sometimes relies on narratives of an individual's brokenness and need for rehabilitation, and an individualization of the causes of incarceration. On another level, work also serves to further independence and consolidate new, potentially liberatory identities for formerly incarcerated individuals that is part of the post-incarceration healing process.

BEBTEH Trainee Poster Presentations

Biostatistics, Epidemiologic and Bioinformatics Training in Environmental Health

The following abstracts are from PhD students whose research are funded by the BEBTEH training grant. The National Institute of Environmental Health Sciences federal training grant (ES015459) supports pre-doctoral and postdoctoral trainees from the Department of Biostatistics, Environmental and Occupational Health Sciences, Epidemiology, and Genome Sciences who are pursuing quantitative training with environmental health science applications.

Selecting Predictable Principal Components for Multipollutant Pollution Exposures Using Penalized Regression

Maitreyee Bose
Biostatistics, Post doctorate
Faculty Advisor: Adam Szpiro

Authors: Maitreyee Bose, Adam A. Szpiro

Abstract: Air pollution monitoring locations are typically spatially misaligned with locations of participants in a cohort study, so to analyze pollution-health associations, exposures must be predicted at subject locations. For a pollution measure like PM2.5 (fine particulate matter) comprised of multiple chemical components, the predictive principal component analysis (PCA) algorithm derives low-dimensional representation of component profiles for use in health analyses. Geographic covariates help determine the principal component loadings of the pollution data to give improved prediction accuracy of the principal component scores. While predictive PCA can accommodate pollution data of arbitrary dimension, it is currently limited to a small number of pre-selected geographic covariates. We propose a penalized predictive PCA algorithm, which applies penalized regression methods to select geographic covariates that are most informative in choosing the principal component directions in the pollutant space. This method also incorporates spatial dependence in the pollution exposure model by merging kriging with the regression model and expressing it as a linear mixed model. The penalized predictive PCA will improve the accuracy of multi-pollutant exposure predictions at subject locations, ultimately leading to more precise quantification of multi-pollutant health effects.

Incorporating Mobile Monitoring Data in Spatio-temporal Air Pollution Modeling

Mei Tessum
Environmental & Occupational Health, Post doctorate
Faculty Advisor: Sverre Vedal

Authors: Mei Tessum, Lianne Sheppard, Sverre Vedal

Abstract: Air pollution measurements from mobile platforms could potentially increase the accuracy of pollutant exposure prediction models. However, it can be challenging to separate spatial and temporal variability when including mobile measurements in exposure prediction models. This study investigates whether using mobile monitoring data in a spatio-temporal air pollution model can improve the performance of an exposure model in predicting NO2 and NOx concentrations compared to a model created using only routine monitoring data. Three model scenarios were tested using a unified spatiotemporal modeling approach for the Los Angeles region from 2005 – 2014: 1) a model using two-week averaged AQS and the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air) fixed site data only, 2) a model using those AQS and MESA Air fixed site data plus two-week averaged mobile monitoring data, and 3) a model using AQS and MESA Air fixed site data plus two-week averaged passive sampler data (concurrent and collocated with mobile monitoring). Additional measurements from MESA Air home sites were used for model validation. Models with either mobile monitoring data or passive sampler data improved model performance in home site predictions for both NOx and NO2 compared to models developed from routine measurements only. Models using passive sampler data performed better than models created using mobile monitoring data. Results indicate that additional spatial information from mobile monitoring data can improve the spatio-temporal model performance, but passive sampler measurements may be preferable if available.

Phthalate Exposure and Pediatric Asthma Exacerbation: Reviewing Evidence of an Association and Future Directions

Ryan S. Babadi
Environmental Toxicology, PhD
Faculty Advisor: Catherine Karr

Authors: Ryan S. Babadi, Sheela Sathyanarayana, Catherine Karr

Abstract: Phthalates are a class of high-production volume chemicals used widely in manufacturing of plastics – especially polyvinyl chloride (PVC) – including applications in consumer and personal care products, building materials, and medical devices. Phthalates migrate from polymers in these products, and in the U.S. appear in indoor dust at higher concentrations than any other consumer product chemical. Their prevalence in home, daycare, and school environments poses a high risk of exposure for children through ingestion, inhalation, and dermal absorption; over 90% of children in the U.S. have detectable concentrations of phthalate metabolites in their urine. Emerging evidence suggests these exposures may promote complex pathological mechanisms in the airway which ultimately lead to common pathways of cellular inflammation, enhanced bronchial responsiveness, and greater obstruction of airflow – the hallmarks of asthma. Most investigations of the association between phthalate exposure and pediatric asthma focus on developmental effects by examining gestational exposure, early-life exposure, or both, and childhood presence or absence of disease. Fewer studies attempt to elucidate the potential for phthalate exposure to serve as an environmental trigger of pediatric asthma exacerbation among individuals who have developed the disease. Asthma triggers are generally characterized in relation to a non-allergic irritant pathway, allergic IgE-mediated pathway, or adjuvant pathway. Thus, we summarize recent literature regarding the relationship between phthalate exposure and pediatric asthma exacerbation, with an emphasis on pathway-specific information. Experimental evidence is conducted primarily in mouse models and overall supports phthalates acting as adjuvants of allergic asthma airway responses. The epidemiological evidence is mixed, and necessitates additional longitudinal studies in children. Future studies should aim to clarify the effect of cumulative exposure to multiple phthalates at non-occupational levels, the temporal relationships between exposures and outcomes, and the underlying molecular mechanisms mediating observed adjuvant effects. The Home Air in Agriculture Pediatric Intervention (HAPI) Trial aims to generate unprecedented data in this area.

Addressing Spatial Misalignment in Air Pollution Health Effects Modeling through Reweighted Universal Kriging

David Clausen
Biostatistics, PhD
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Abstract: Measuring individual air pollution exposures is prohibitively expensive in large cohort studies. For this reason, inference on air pollution health effects from cohort study data typically proceeds in two stages, first a regression using air pollution monitor data to predict exposures at study participant locations, and second a regression of health outcomes on air pollution exposures predicted from the first step. However, under spatial misalignment (i.e., when air pollution monitors and study participants are differently distributed in space) the resulting estimates of the effect of air pollution on health outcomes may be substantially biased. We present three kriging procedures in which observed air pollution levels are weighted to reduce measurement error in predicted air pollution exposures and thereby ameliorate bias. We compare these procedures to unweighted universal kriging on a dataset from the National Institute of Environmental Health Sciences' Sister Study.

Exposure to traffic-related air pollution and its associations with blood pressure in pregnancy and risk of preeclampsia

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Introduction: It is well-established that traffic-related air pollution (TRAP) is associated with increased blood pressure (BP) and adverse cardiovascular outcomes in adults. However, less is known about the relationship between TRAP and hypertensive disorders during pregnancy. We evaluated associations between TRAP (nitrogen dioxide [NO2], particulate matter diameter <2.5 micrometers [PM 2.5], particulate matter diameter <10 micrometers (PM10)] and blood pressure during each trimester of pregnancy and risk of preeclampsia. Additionally, we tested whether these associations differed by pre-pregnancy overweight/obesity status.

Methods: Participants (n=733) were recruited in 1996-2008 for the Omega Study, a pregnancy cohort study in Washington State. Residence (at time of enrollment)-specific TRAP exposure during pregnancy was estimated using land-use regression models. We conducted multivariable linear regression models to assess the relationships between TRAP and trimester-specific blood pressure (systolic blood pressure [SBP], diastolic blood pressure [DBP], and mean arterial pressure [MAP]) during pregnancy. In addition, multivariable logistic regression was used to assess the association between TRAP and odds of preeclampsia. Stratified analyses and models with interaction terms were used to assess effect modification by pre-pregnancy overweight/obesity status.

Results: Median(IQR) exposure to PM 2.5, PM10 , and NO2 was 9.0(8.3, 9.7) µg/m3, 17(15, 19) µg/m3, and 17(16, 20) ppb, respectively. PM2.5 was not significantly associated with blood pressure in any of the three trimesters of pregnancy. A 10 µg/m3 increase in PM10 was associated with significantly higher SBP during the third trimester and DBP and MAP during all three trimesters. The greatest differences were in SBP [2.7 mmHg (95% CI: 1.0, 4.4)], and MAP [2.5 mmHg (95% CI:1.1 ,3.8)] in the third trimester. A 10 ppb increase in NO2 was not significantly associated with blood pressure during the first trimester, but was associated with significantly higher SBP, DBP, and MAP in the second and third trimesters, with greatest differences in SBP during the third trimester [2.5 mmHg (95% CI: 0.36, 4.6)]. In the associations with second trimester BP, there was a significant interaction with PM10 (p=0.03) and NO2 (p=0.02) and pre-pregnancy overweight/obesity status. In stratified analyses, 10 unit increases in PM10 and NO2 were associated with higher second trimester SBP among women with normal pre-pregnancy BMI, but not in those with overweight/obese pre-pregnancy BMI. There were 20 (2.7%) preeclampsia cases in this cohort. In adjusted models, exposure to NO2, PM 2.5, or PM10 was not significantly associated with odds of preeclampsia, and none of the associations varied by pre-pregnancy BMI. Conclusions: These findings suggest that PM10 and NO2 may be linked to increases in blood pressure among pregnant women. These associations may differ by pre-pregnancy BMI.

Statistical methods for detecting changes in taxonomy and abundance in microbial communities

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Abstract: UniFrac is a common method for detecting differences between microbial communities with respect to both phylogeny and abundance. Unfortunately, estimation of UniFrac has not been explored in the statistical literature, and instead has been proposed and evaluated from a bioinformatics perspective. Given the widespread use of UniFrac in microbial ecology, an evaluation of its robustness to model misspecification is warranted. This rotation will investigate the effects of unknown phylogeny and unknown abundance on the estimation of UniFrac. To accomplish this, the project aims have been broken into two components. The literature review component will consist of: (1) Developing a clear understanding of how UniFrac distances are calculated, (2) Developing a clear understanding of how hypothesis testing is performed with UniFrac. The research component will consist of: (1) Developing a detailed description of population-level UniFrac distances, (2) Investigating the effect of an incorrect estimate of the phylogenetic tree on hypothesis testing using UniFrac using simulations, (3) Investigating the effect of rare (unobserved) taxa on estimation of UniFrac distance, and (4) Investigating if the placement of the rare taxa on the phylogenetic tree affects the estimate.

Transcriptomic Profiling of PBDE-exposed HepaRG cells Unveils Critical lncRNA-PCGs Pairs Involved in Intermediary Metabolism

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Abstract: The recently banned flame retardants Polybrominated diphenyl ethers (PBDEs) are persistent environmental toxicants that are known to bio-accumulate in humans through inhalation or ingestion and can adversely impact human health. Long non-coding RNAs (lncRNAs) act as signals, decoys and scaffolds and can regulate transcriptional and translational processes. Recently, lncRNAs are increasingly recognized as key regulators during toxicological response. Little is known regarding the effect of PBDE exposure on lncRNAs in liver, which is a major organ for xenobiotic metabolism and nutrient homeostasis. HepaRG cells are human-derived hepatic cells that have been shown to more accurately represent gene expression profiles of human liver tissue in vivo than other pre-existing methods. We hypothesized that lncRNAs can regulate nearby protein-coding genes (PCGs), and changes in transcription of lncRNAs caused by exposure to PBDEs may act in cis to perturb gene expression of its neighboring PCGs. The goals of this study were to 1) characterize what PCGs and lncRNAs are differentially regulated from PBDE exposure; 2) identify PCG-lncRNA pairs through genome annotation and predictive binding tools; and 3) determine enriched canonical pathways caused by differentially expressed lncRNA-PCGs pairs. HepaRG cells were exposed to the human-relevant PBDE congeners (BDE-47 and BDE-99) at various concentrations (0, 25μM, and 50μM) for 24 hours. Total RNA was harvested and libraries were prepared using poly-A selection method and sequenced using an Illumina HiSeq 2000 sequencer. Data were analyzed using an array of bioinformatics tools. Differentially expressed lncRNA-PCG pairs were identified through DESeq2 and HOMER and the resulting significant canonical pathways were determined through Ingenuity Pathway Analysis (IPA). LncTar was used to predict binding of selected lncRNA-PCG pairs with known roles in xenobiotic biotransformation pathways. Genomic annotation revealed that the majority (>72%) of the differentially expressed lncRNAs were mapped to PCG introns. PBDEs regulated overlapping pathways with prototypical PXR and CAR ligands (e.g. protein ubiqutination and the lipid-sensing PPARα-RXRα pathways), but also regulated distinctive pathways such as GDP-fucose biosynthesis from GDP-D-mannose (both PBDE congeners), signaling by Rho Family GTPases (BDE-47 only), as well as JAK/Stat signaling, bile acid biosynthesis, sirtuin signaling pathway, and autophagy (BDE-99 only). Among the 20 drug-processing genes, 19 paired lncRNAs were validated by LncTar. In conclusion, lncRNAs play essential roles in modifying PBDE-mediated changes in PCGs involved in intermediary metabolism. (Supported by UW BEBTEH Training Program, NIH R01 grants GM111381, ES025708, University of Washington Center for Exposures, Diseases, Genomics, and Environment [Grant P30 ES0007033], and the Murphy Endowment.)