

## **Global Health, Justice and the Environment Conference**

**Wayne State University**

**September 10 & 11, 2019**

### **Lightning Talks Abstracts**

#### **1. Alex Haimbaugh, Wayne State University:**

*Environmental Contaminants in Detroit Waterbodies: Seasonal Snapshots*

Pharmaceuticals and personal care products (PPCPs), perfluoroalkyl substances (PFAS), and their degradation products are ubiquitous in the environment, including water used as drinking sources and for recreation. PPCPs predominantly enter waterways via sink drains and excretion after human use. PFAS enter mainly from industrial runoff. Additionally, pesticide runoff from agriculture increases near urban areas due to loss of natural habitats and increased infrastructure. Drinking water treatment plants are not designed to handle removal of these compounds, which persist in water, potentially affecting human and aquatic health. The Lake Huron to Erie corridor is a drinking water source for millions, contains important spawning habitats for numerous fish species, and serves as a heavily-used area for recreation. We collected surface water samples from six locations along the corridor to test for PPCPs, PFAS, and pesticides. We found a range of compounds including synthetic sweeteners, flame retardants, pesticides, and antibiotics, among others; primarily pharmaceuticals. We found contaminant loads generally increased down-river, and higher loads were typically detected in spring compared to fall. The highest concentrations detected by class were synthetic sweeteners. Our lab uses a zebrafish model to study impacts of contaminants of emerging concern. We expose zebrafish during a developmentally critical window to environmentally relevant concentrations of detected compounds from the Lake Huron to Erie corridor to assess phenotypic and genetic endpoints. Though these exposure studies are ongoing, results to-date show that acesulfame potassium (synthetic sweetener), gemfibrozil (cholesterol medication), and PFAS (perfluorooctanoic acid and perfluorooctane sulfonic acid) increase activity of larval fish.

**Authors:** Alex Haimbaugh, Bridget B. Baker, Tracie R. Baker, and Destiny Johnson, Wayne State University WATER Lab

#### **2. Belinda Aberle, Wayne State University:**

*There's so much pollution in Detroit! WSU College of Nursing Student Experiences from the CURES Environmental Health Justice Tour*

Background: Detroit has a long history of environmental injustice and health disparities. Nurses must have the assessment and advocacy skills to address the environmental health of clients and populations. In response, WSU CON faculty have partnered with CURES to empower future nurses to address these environmental injustices and health disparities. For three years, CURES has led undergraduate nursing student-group tours to Detroit's most salient toxic sites and most notable examples of successful environmental health-related resilience and advocacy. The future aim of this partnership is to measure nursing students' experiential learning using a formal pre and post evaluation of the experience and fully integrate the tour into the undergraduate community health nursing course. Methods: More than 200 students have participated in the three-hour tour and program evaluation since 2016. The post-tour survey has provided data on students' reported knowledge gained. A pre-post program evaluation is planned, to assess the program's learning outcomes. We will expand the tour groups to include all undergraduate nursing students during their community health course.

Results: The tour and its content are updated each semester with current environmental health sites, resources and data. The partners have preliminary data on students' learning experiences. Plans to include all BSN students will be formalized, including transportation logistics.

Conclusions: This tour and our academic-community partnership allows our undergraduate nursing students to attain competency on the issues of Detroit's environmental injustice, enabling best practices in individual environmental health assessment and in advocating for environmental justice.

**Authors:** Brian D. Smith II, CURES Community Relations Specialist, Masters of Urban Planning Candidate 2019; Carrie Leach, PhD, CURES Community Engagement Core Program Manager; Belinda Aberle, MSN, RN, APHN B-C, WSU CON Faculty clinical instructor and course coordinator; Barbara Williams, DNP, RN, WSU CON Clinical Instructor

### 3. **Jaime Steis Thorsby, Wayne State University:**

#### *Basement Flooding and the Role of Green Infrastructure in Mitigation Efforts*

In recent years, flooding in the City of Detroit has highlighted the need for further analysis into the causes and potential solutions for basement flooding caused by storm system overflows. In order to learn more about these issues, an engineering investigation was performed to collect data and develop a model of the storm sewer system in the Berg-Lahser neighborhood. Concurrently, a survey was conducted on residents to get a better understanding of the prevalence of flooding in resident's basements in this neighborhood. Utilizing the model and the results of the survey, analysis was then performed to investigate the role of green stormwater infrastructure in reducing resident's basement flooding. The results of this study show some prevalence of basement flooding in this neighborhood and show that strategically placed green stormwater infrastructure can have some effect on decreasing stormwater runoff and can have potentially beneficial effects on basement flooding.

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### 4. **Cameron Davidson, Wayne State University:**

#### *Acute and Long-term effects of environmental-like concentrations of combined exposure to benzene, toluene, ethylbenzene, and xylene*

Benzene, toluene, ethylbenzene, and xylenes (BTEX) are ubiquitous in low concentrations in urban environments and in relatively higher concentrations near industrial and high-traffic areas. We developed a preclinical model testing effects of environmental BTEX exposures on behavior in mice. Two BTEX inhalation exposure groups, adjusted for our exposure paradigm, represented either a 10-fold (ENV10: **B** 1, **T** 17, **E** 23, **X** 24 ppm) or 100-fold (ENV100: **B** 1, **T** 170, **E** 230, **X** 240 ppm) increase of previously documented levels in urban environments. A third group was exposed to the maximum allowable concentrations for occupational settings (OCC: **B** 1, **T** 530, **E** 225, **X** 530 ppm) (positive-control). Lastly there was an air-only control group (AIR: BTEX 0 ppm). Following 15 days' exposure (90 min, twice/day), adolescent male Swiss-Webster mice were assessed for activity, immediate and delayed memory (Y-maze), and motor coordination (gait, rotarod, and inverted screen tasks). Preliminary analysis revealed all BTEX groups (ENV10, ENV100 & OCC) showed increased activity, deficits in memory, and motor coordination compared to unexposed mice (AIR). Our preclinical model suggests that repeated BTEX exposures at environmental levels may have lasting effects on behavior.

**Authors:** Kevin W. Heslip (WSU), Michael M. Naddaf (WSU), John H. Hannigan (WSU), Scott E. Bowen (WSU)

### 5. **Claudia Allou, Michigan State University:**

#### *The health benefits of natural sounds: Identification of and initial steps to address knowledge gaps using soundscape mapping and health data from Detroit*

Emerging research indicates that contact with nature, often defined as the time a person spends in greenspaces (e.g., parks), or within view of greenery, can benefit human health. Another dimension of contact with nature exposure to natural sounds (e.g., birdsong) appears to be largely unexplored. To identify the research extent in this area, we first conducted a systematic review. Following a screening process, thirty-two articles were used to extract study details and findings, and only five of these quantified health outcomes rather than perception-based attributes. To address the little research examining the role of natural sound in human health we conducted a pilot study in Detroit (May-Aug 2018). We recruited 33 adults in one neighborhood. Participants completed a survey, including demographic data, perceived stress, depressive symptoms, neighborhood perceptions, as well as anthropometric measurements and blood test strips. To quantify the soundscape, we deployed Songmeters at four participants' homes and the neighborhood park. We listened to the recordings and annotated insect and bird sounds, from 5am-12pm for 4 days. Using counts of natural sounds, we estimated 'acoustic diversity', a sound diversity metric, at each site using a suite of acoustic indices (which quantify variation in the acoustic environment). We created a kriged soundscape map, assigned values to participants, and examined correlations with neighborhood characteristics and health. Our findings serve as an initial step in addressing the paucity of literature on the health benefits of natural sound.

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**6. Rahul Mitra, Wayne State University:**

*Naturalizing Environmental Injustice: How Privileged Residents Make Sense of Detroit's Water Shutoffs*

Water insecurity disproportionately affects low-income, people of color, and other marginalized groups. In the US, urban-suburban conflicts in particular perpetuate environmental injustice, as with Detroit, MI -- which reels under massive infrastructure and distribution costs for a common water system that also services its wealthier suburbs. Starting in 2014, when mass water shutoffs affected more than 33,600 families who were unable to pay their bills, more than 142,000 households have been disconnected. Using Metro Detroit as a case study, our research addresses communicative sense-making of water access and scarcity among both urban and suburban residents. Specifically, we draw on 46 in-depth interviews with urban and suburban residents to examine how race, class and location-based privilege bolsters sense-making discourses that allow better-off residents to dismiss the concerns of water affordability and shutoffs to less-privileged residents. We first uncover three competing macro discourses of water access as life-giving, as undeniable right, and as commodity, and then unpack how these discourses constitute privilege in participants' micro-level sense-making frames. These sense-making frames include emphasizing personal responsibility, paradoxical roles of government as both problem and solution, general civic action, and narrow community bubbles. Collectively, these sense-making frames deny the real scope of Detroit's water crisis, preserve participants' sense of entitlement to water, de-humanize poor Detroiters unable to afford high water bills, and reduce water to a private commodity. Understanding how privilege works can bolster the efforts of environmental justice activists and community organizers.

**Authors:** Kelsey Husnick (PhD student), Mostafa Aniss (PhD student), and Rahul Mitra (Associate Professor) – Department of Communication, Wayne State University

**7. Jeneen Ali, Wayne State University:**

*An effective community intervention to reduce diabetes risk by addressing health disparities and food insecurity*

This study represents a partnership between Gleaners Community Food Bank, National Kidney Foundation of Michigan, and Wayne State University. The Diabetes Prevention Program (DPP) is an effective community-based intervention, known to reduce diabetes risk. However, program completion rates are known to be low in low-income communities. Cooking Matters (CM) teaches healthy meal preparation, grocery shopping on a budget, and nutrition. We hypothesize that by combining DPP and Cooking Matters curricula, more participants will complete the program and experience lower HgA1C values as compared to DPP alone. We observed a 76% completion rate, as compared to the <50% typically observed in low-income communities. Median HgA1C dropped 10.6% ( $p < 0.0001$ ), from prediabetic to normal levels. Further, all individuals who completed the study reduced their HbA1C values. In conclusion, healthy food support coupled with DPP is a more effective strategy for reducing diabetes risk in low-income communities than DPP alone.

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**8. Danielle Meyer, Wayne State University:**

*Developmental TCDD exposure results in multigenerational histological, transcriptomic, and methylomic abnormalities in male zebrafish gonads*

The industrial by-product TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin) is a potent environmental toxicant and model endocrine-disrupting chemical (EDC) with known teratogenic effects on humans, rodents and fish. Developmental exposure to some EDCs, including TCDD, is linked to the occurrence of adult-onset and multigenerational disease. Our lab uses zebrafish (*Danio rerio*) as a model to study these effects due to their short generation time, transparency in early development, and ease of early-life exposure. Previous work in this lab revealed decreased fertility in adult zebrafish exposed to TCDD as juveniles. Because the unexposed descendants of these fish (F<sub>1</sub> and F<sub>2</sub>) presented with reduced fertility mediated through the males, we examined the testes of TCDD-exposed males from all three generations, looking for changes in histopathology, gene expression, and whole genome methylation that could account for these reproductive deficits. Histological analysis indicated a shift in germ cell ratio towards immature spermatogonia in F<sub>0</sub> and F<sub>1</sub> generations, indicating delayed spermiation in exposed males and descendants. Microarray analysis of exposed testes indicated that genes involved in epigenetic modification as well as multiple reproduction and infertility pathways were affected across all generations, including testis development and spermatogenesis, lipid metabolism and steroidogenesis, oxidative stress response, citric acid cycle, peroxisome, and xenobiotic response. Upon whole genome methylation analysis, we found TCDD-induced methylation changes in reproductive genes as well as histone-modifying enzymes across multiple generations. Overall, we found that the interplay between these transcriptomic and epigenetic changes could account for the transgenerational impact on fertility due to developmental toxicant exposure.

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**9. Victor Carmona, University of Detroit Mercy:**

*An Exploration of Land Use and Poverty as an Integrative Model for Mitigating Chagas Disease in El Salvador*

Chagas disease is a neglected tropical parasitic disease that is caused by the protozoan *Trypanosoma cruzi* and that is transmitted by several insect vectors in the subfamily Triatominae. Research studies suggest that the vector ecology of Chagas disease may be impacted by anthropogenic changes to natural habitats. The objective of this study was to characterize linkages between poverty levels and diverse land use practices throughout El Salvador. Working at the municipal level, we used GIS to intersect map-layers containing poverty-indices and land use. The resulting intersect map was used to characterize the alpha-diversity of different agricultural, natural, and mixed land use types. We found that the richness, diversity, and equitability of municipal land use types changed with municipal poverty-level, size, population density, and population sex ratio. We also detected that changes in green-space, natural landscapes, and agricultural landscapes correlated with municipal socio-demographic considerations. Given the broad exploratory connections between the vector ecology of Triatominae and the socio-demographics of land use practices, we propose that a multidisciplinary approach will be more effective in mitigating Chagas disease in El Salvador.

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10. **Yongli Zhang, Wayne State University:**

*Fate and Transport of Microplastics During Drinking Water Treatment Processes*

Water pollution due to the widespread presence of microplastics is an urgent global problem. Recent studies of 159 tap water samples taken from several countries and 259 bottled water samples across 11 brands showed that 81% of tap water and 93% of bottled water contained MPs. This work aims at better understanding the occurrence, fate and partitioning of microplastics in water treatment systems, as well as the interactions of microplastics and water microbiome. Bench-scale experiments and field-water sampling were conducted to evaluate the removal efficiency and partitioning of microplastics in different water treatment processes, as particularly pertaining to sedimentation and filtration. In addition, the interactions of microplastics and water microbiome were investigated by studying bacterial growth, profile, and antibiotic resistance in water with and without the presence of microplastics. Results suggest that microplastics' densities / sizes and filtration materials can affect the removal efficiency of microplastics in water treatment systems. The presence of microplastics significantly enhances bacterial proliferation and antibiotic resistance. In addition, biofilms are easily formed on microplastic surfaces and are able to breakdown microplastics to smaller particles, posing significant challenges for the monitoring and detection of microplastics.

11. **Carrie Leach, Wayne State University:**

*There needs to be more dialogue between researchers and decision makers regarding environmental justice issues: Communicating Science Best Practices*

Background/aims: Scientists can contribute to environmental justice efforts by providing reliable and accurate information to assist decision makers and leader's problem solving around environmental health issues. While scientists are well equipped to communicate with academic audiences in scholarly venues, it is uncommon to have developed skills for engaging lay audiences. This project aimed to strengthen capacity amongst researchers to engage with advocates who can use the information to address environmental issues and improve public health. Methods: This project was a collaboration between the Community Engagement Cores of three Environmental Health Science Core Centers at Wayne State University, the University of Michigan, and Texas A&M. A review of existing resources and literature was conducted, followed by stakeholder and key informant interviews across three sites. The data were analyzed collaboratively to identify themes along with a community partner for member checking.

Results: The interview findings coalesced and addressed gaps in the literature and informed the development of "best practices" for communicating environmental health information. Those were piloted by translating scientific information and refined through community partner evaluation and synthesized into a one-page fact sheet. Finally, a primer was created to inform researcher interactions with legislators as well as a webpage to house the resources.

Conclusion: Along with development of skills in framing scientific research in a manner that is responsive to questions and concerns of decision makers, practical skills for interfacing with frontline communities and policy-makers are essential to ensuring that environmental health decisions are informed by the highest quality scientific evidence.

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12. **Colleen Linn, Brendan O’Leary, Sadaf Teimoori, Wayne State University:**

*Groundwater in Detroit and Risks*

Groundwater plays a critical role in the water balance of the Great Lakes, contributing between 22-42% of the total water input, with precipitation and surface water runoff accounting for the remaining difference. In this way, groundwater impacts many systems ranging from supplying drinking water, to industrial water supply, to transportation. Understanding groundwater is critical in assessing urban hydrology budgets as well as economic, health, and social implications. This integration of socio-natural systems creates the hydrosocial cycle. The hydrosocial cycle integrates levels of social structure and politics to understand different levels of water management and nuances of water access. This talk will introduce ideas of a “life course” perspective of groundwater: how groundwater travels, how groundwater affects us, and how groundwater is managed. Establishing estimates of groundwater flow will contribute to optimizing green stormwater infrastructure design, understanding groundwater contribution to the migration of subsurface pollution, and identify exposure pathways within communities in southeastern Michigan. In this project, a multiscale model was developed using Detroit’s four major watersheds and datasets from the RecoveryPark field site. This model will help develop and assess the potential risks posed to urban environments and human health. Findings of this project are aimed at tailoring responses and communication efforts by the scientific community while illuminating the challenges cities and states face when responding to drinking water concerns.

