The Joseph J. Zilber School of Public Health’s Second Annual Graduate Student Research Symposium

April 10, 2015
Welcome from Dr. Elise Papke

Welcome to the Joseph J. Zilber School of Public Health Student Research Symposium! It is fitting that we conclude National Public Health Week with a celebration of our students’ individual and collective scholarly work. Much energy and thought have been spent exploring the various public health issues that are featured in these oral presentations and posters. This event offers us a valuable opportunity to ask important questions and learn from each other. Today we are creating a space for us to grow together as professionals and educators. As we engage each other on challenging topics, let us remember that we are part of a larger national dialogue designed to highlight the accomplishments of public health and underscore our commitment to becoming the healthiest nation in one generation.

Several people contributed to making this day a success. Please join me in thanking Madeline Eisen, Courtney Kamine, Claire Pattison, Nick Tomaro, Chelsea Weirich, and Jenn Woo for their hard work planning the event, Dr. Lance Weinhardt for his support and advice, and Dean Peck for her support and opening remarks. We look forward to a stimulating and rewarding time together.

Best,

Elise Papke
Agenda
9:00-9:45am: Kick-off talk from Dean Peck and welcome from Dr. Elise Papke

9:45-10:00am: Break

10:00-11:30am: Oral Presentations

Lori Bokowy: The clinic is open but no one shows up: Teaching sexual health promotion skills to youth leaders in a high-risk urban community

Lindsay Emer: Can a Combined Structural Microfinance, Food Security and Gender Empowerment Intervention Impact STI Symptoms and Diagnoses in Rural Central Malawi?

Rose Hennessy: Creating a Google Spreadsheet for Multisite Reporting Using a Participatory Approach

Steven John: Information-Motivation-Behavioral Skills model revisited: A network-perspective structural equation model within a public sexually transmitted infection clinic sample of hazardous alcohol users
11:00am-1:00pm: Poster presentations in the lobby with food and beverages

Margaret Thelen: Analysis of Cooling Centers in the SUPAR Extended Neighborhood

Chelsea Weirich: Cyanotoxins in the Lake Michigan Watershed and Drinking Water


11:30 – 12:00 Break with snacks from Beans and Barley

12:00 – 1:30 Poster Presentations

Rose Hennessy: Determinants of Sexual Aggression Perpetration: Implications for Prevention


Kevin Smith: Pre-1940 Home Abatement and Elevated Blood Lead Levels in Milwaukee, WI

Kathryn Staats, Holly Gamblin and Jennifer Murray: Opening the Doors to LGBTQ+ Tobacco Prevention in Milwaukee: A Community Readiness Assessment

Everett Tate: Placental health is affected by Aryl hydrocarbon receptor-dependent regulation of metabolic and oxidative pathways.

1:30 – 2:00 – Feedback forms to be filled out and any last questions
Note:
All oral presentations will follow the same format: a 10-minute talk immediately followed by a 5-minute question and answer session. All oral presentations will take place on the first floor triplex.

Poster presentations will be set up in the first floor lobby.

Please note there are feedback forms for both oral and poster presentations. Please feel free to complete these forms and hand them to the presenter.
The clinic is open but no one shows up: Teaching sexual health promotion skills to youth leaders in a high-risk urban community

Lori Bowoky

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Background:
Reproductive and sexual health is a core component of individual and community health, and a significant concern for the adolescent population. Unintended pregnancies and sexually transmitted diseases, including HIV infections, result in tremendous health and economic consequences for individuals and society. African American youth in Milwaukee experience higher rates of teen pregnancy, sexually transmitted infections (STIs) and HIV infection than other youth. In some cases there are significant disparities such as a Chlamydia rate that is 17 times greater than that of Caucasian youth. Milwaukee has a rate of 35.7 births per 1,000 girls ages 15-17; however, African American girls are 4 times more likely to give birth as teens than white girls.

This community engaged research project utilized a social networks model to address the main objectives. The goal of this study was to test the efficacy of a social networks training model for increasing access to and utilization of sexual health services for adolescents in Milwaukee. Specifically we developed and tested a social networking program designed to teach youth health leaders how to recruit their peers into a youth-friendly, community-based sexual health clinic in Milwaukee.

Methods:
Youth health leaders (15 to 18 years old) were recruited from a non-profit’s leadership program for urban youth. The social networking program focused on sexual health issues, interpersonal communication, social media marketing, and access to care options. Youth participated in pre and post assessment sessions to evaluate changes in communication skills based on video taped role-play sessions. Clinic usage was tracked over time to determine if youth trainings correlated with increased clinic use.

Results:
Two groups of African American health leaders completed the training. Preliminary review of videotaped role-play assessments suggests that youth demonstrated improved recruitment skills from pre to post assessments. However, clinic usage remained constant over time. Over the next two months, follow up interviews with health leaders will be conducted to identify strengths and weakness in the training process and determine why improvement in recruitment skills did not lead to improvements in clinic usage.

Conclusions: Results underscore (a) the challenges of implementing a social networks model for youth sexual health and (b) raise questions about the utility of a social networks model for promoting sexual health among adolescents.
Can a Combined Structural Microfinance, Food Security and Gender Empowerment Intervention Impact STI Symptoms and Diagnoses in Rural Central Malawi?

Lindsay Emer

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Background:
Malawi bears one of the heaviest HIV burdens globally (10.6% adult prevalence). The presence of sexually transmitted infections (STI) increases HIV transmission, making controlling the spread of STIs critical. In a non-equivalent control group effectiveness study (SAGEHealth), we examined how a structural microfinance, food security, and gender empowerment intervention may temper HIV vulnerability in Malawi.

Methods:
We assessed two self-report outcomes: (1) new STI symptoms (reporting one of six STI symptoms at 18-month or 36-month follow-up), (2) new STI diagnosis (clinician-diagnosed with either one of six STIs at 18-month or 36-month follow-up) in intervention participants (N=600) and control participants (N=300). We used Chi-Square tests to analyze the categorical variables and logistic regressions to examine the intervention effect on new STI symptoms and diagnoses.

Results:
Compared to the control group, the intervention group was less likely (OR=.51, 95% CI=.33-.79) to report having new STI symptoms at 36-month, controlling for symptoms presented at 18-month. This holds true for intervention men and women compared to control. Although not statistically significant, participants in the intervention group reported a higher percentage of newly diagnosed STIs at 36-month than the control. Among six STIs assessed, syphilis was the most commonly reported STI diagnosis (prevalence 2.3%-5.3%).

Conclusions:
This combined structural intervention appears to have contributed to a decrease in newly presented STI symptoms. Coupled with the increase in new STI diagnoses, this could mean that the intervention contributed to an increase in STI testing and a decrease in undiagnosed STIs in the intervention group.
Creating a Google Spreadsheets for Multisite Reporting Using a Participatory Approach

This proposal was presented as a demonstration at the 2014 American Evaluation Association Annual Conference in Denver, CO and will be presented in a webinar for AEA members on Thursday April 2nd, 2015.

Rose Hennessy

Author Affiliation:
Rose Hennessy is a doctoral student in the Community and Behavioral Health Promotion program at the Zilber School of Public Health, University of Wisconsin-Milwaukee. She has research interests in violence prevention and has provided sexual assault prevention programming at two major universities, research in child trauma and sexual assault, and case management and advocacy services. She received her Master’s degree in Public Health from UCLA and has experience doing state-level violence prevention work. Her specialty as a program evaluator has allowed her to lead and support multiple agency, community, and statewide evaluation projects.

Background:
Data tracking for evaluation is necessary for reporting and useful for program improvement, but can be challenging in social services agencies and non-profits. There may be low capacity, funding, and motivation to conduct evaluation, which is further complicated in multi-site programs. Funders may require data which is not meaningful for agencies, and as a result data is frequently not used to inform future programming.

Methods:
In 2013 the Wisconsin Coalition Against Sexual Assault initiated a participatory process to improve its tracking of technical assistance. Staff and consultants from across the state used online meetings to develop a flexible online data collection system using Google Docs Spreadsheets. The system is updated frequently to meet multiple needs and track new outcomes.

Results:
The participatory process has resulted in a sustainable data collection system which has been used for the following: (1) grant reporting; (2) board reports; (3) consultant payroll; (4) quarterly team-driven program improvement; (5) funding advocacy; and (6) individual staff performance improvement. Using the System Usability Scale, staff and consultants have graded the system's usability an average of a 76, which corresponds to a grade of "B." Staff report high internal satisfaction with access and use of data.

Conclusion:
Including social services staff in the design, collection, analysis, and interpretation of data can lead to more reliable and useful data that is used for program improvement. Free, online, tools such as google docs can assist non-profits to collect data. Participatory and empowerment evaluation approaches can help facilitate these outcomes.
Information-Motivation-Behavioral Skills model revisited:
A network-perspective structural equation model within a public sexually transmitted infection clinic sample of hazardous alcohol users
Steven John

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Background:
The Information-Motivation-Behavioral Skills (IMB) model is useful for understanding sexual risk behavior. However, the IMB model has not been tested with hazardously-drinking sexually transmitted infection (STI) clinic patients, a subpopulation at greater HIV risk, or with a network-perspective sexual risk behavior outcome which considers both primary and non-primary partners.

Methods:
Participants (N=569) were patients at a Midwestern public STI clinic who screened positive for hazardous drinking and risky sexual behavior. Survey items assessed HIV knowledge (information); social norms, attitudes, and intentions (motivation); and self-efficacy (behavioral skills). Sexual risk behavior (SRB) was operationalized as a latent variable with three indicators: 1) number of sexual partners, 2) number of unprotected sex occasions with primary partner, and 3) number of unprotected sex occasions with non-primary partner(s).

Results:
Preliminary analyses suggested SRB was best operationalized as a latent variable with two indicators, while unprotected sex with primary partners should be considered separately. In a structural model with good fit, the IMB model was generally supported. Specifically, behavioral skills predicted less SRB (β=-0.27, p<0.01), fully mediated the association of information with SRB (β_{indirect}=0.21, p<0.01), and partially mediated the association of motivation with SRB (β_{direct}=-0.18, p<0.05; β_{indirect}=0.49, p<0.01). Contrary to expectations, behavioral skills predicted more unprotected sex with primary partners (β=0.17, p<0.01).

Conclusions:
Findings suggest the IMB model functions differently for non-primary and multiple partners compared to primary partners in STI clinic patients with hazardous alcohol use. Intervention strategies based on different theoretical models may be needed to address risk behavior with primary partners.
Analysis of Cooling Centers in the SUPAR Extended Neighborhood
Margaret Thelen

Background:
Wisconsin’s climate is projected to become warmer on average by the year 2050. Even now, the effects of extreme heat can be felt in Wisconsin. In 2012 Wisconsin experienced 27 heat related fatalities. Extreme heat events are known to have negative impacts on human health among vulnerable populations. Access to cooling centers is essential to protecting vulnerable populations during times of extreme heat.

Methods:
To assess a neighborhoods’ capacity of people’s access to cooling centers, a Geographic Information System (GIS) map was created. Current known cooling centers and bus stop locations were geocoded and categorized onto a base map of the Milwaukee School for Urban Planning and Architecture (SUPAR) extended neighborhood area. Milwaukee Master Property Records (MPROP) were used for parcel data and land use codes to identify potential cooling centers. Using the Wisconsin Department of Health Services’ (DHS) Milwaukee Heat Vulnerability Index (HVI), areas of high risk were identified in the neighborhood as well.

Results:
Out of the 56 cooling centers located in the city of Milwaukee, 4 were located in the SUPAR neighborhood, and were in high risk of heat vulnerability areas. The four cooling centers were located within 20 feet of a bus stop. MPROP data showed that there are 54 potential cooling centers within the neighborhood.

Conclusions:
Knowing where heat vulnerability is the highest can help public health officials know where to target information on cooling centers. By locating places where cooling centers could be located, we can reach out to those businesses and places to hopefully set up a cooling center, and protect the vulnerable populations in that area.
Cyanotoxins in the Lake Michigan Watershed and Drinking Water
Chelsea Weirich

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Background:
Lake Winnebago is plagued with annual cyanobacterial blooms and is the largest inland lake in Wisconsin, providing two thirds of Lake Michigan’s nonpoint phosphorus through the Fox River. Lake Winnebago provides drinking water to over 250,000 people through four drinking water treatment plants.

Methods:
We measured cyanotoxins, bioactive peptides and chlorophyll-a at seven sites near two local area beaches, at approximate locations of three drinking water plant intakes, and samples from each plant in 2013. Cyanobacterial secondary metabolites were measured using HPLC/MS/MS, and chlorophyll was measured by spectrophotometry.

Results:
The highest total microcystin levels occurred in surface waters in mid-September, ranging from 43 to 106 μg/L. Chlorophyll concentrations were not a good predictor of fluctuations in microcystin concentrations at four sample sites. No toxins or bioactive peptides were detected in drinking water from two treatment plants. Microcystin(MC)-LR, MC-RR, MC-LA, MC-YR, microginin 690, two anabaenopeptins, and three cyanopeptolins were detected at concentrations lower than the 1 μg/L WHO standard in finished drinking water from one treatment plant, referred to as Plant 1, in 2013. In 2011, however, total microcystin levels did increase above 2 μg/L on one out of eight sample dates from Plant 1’s finished drinking water.

Conclusions:
This suggests that microcystin levels can rise above recommended guidelines during certain blooming periods in finished drinking water and that other peptides not detected by ELISA are likely also present. Though Winnebago is not a part of the Great Lakes system, the challenges regarding cyanobacterial monitoring in its surface waters are reminiscent of those faced by researchers, public health workers and drinking water plant managers based on Lake Erie.
Jennifer M.P Woo

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Background/Purpose:
The treatment of juvenile systemic lupus erythematosus (jSLE) often requires complex medication regimens in order to address the different disease manifestations. Despite the limited number of medications approved for the treatment of jSLE, standardized treatment protocols have been slow to emerge. Identification of regional and temporal variations in medication usage in jSLE can help to establish more unified treatment practices.

Methods:
Demographic and clinical data were collected for jSLE patients (diagnosis <18 years of age) enrolled in the Childhood Arthritis and Rheumatology Research Alliance (CARRA) Registry between 2009 and 2013. Individuals identified as being diagnosed and starting treatment prior to 2007 (Cohort 1; C1; n = 246) or as being diagnosed and treated between 2007 and 2013 (Cohort 2; C2; n = 260) were used to evaluate temporal changes in treatment practices by region. Regions were identified based on U.S. Census definitions and inclusion in a region was determined by the U.S. Census 3-digit zip code tabulation area (ZCTA) prefix of the area in which the patient resided at the time of symptom onset.

Results:
Of the 925 jSLE enrolled in the CARRA Registry by July 2012, 809 (87%) had geographic data available and were included in the spatial analysis. This cohort was further separated based on year of diagnosis and duration of jSLE treatment, resulting in groups C1 and C2. Although the population distribution of jSLE varied among U.S. Census regions, C1 and C2 population sizes within a region were similar. Both demonstrated comparable female-to-male ratios (~3-4:1), ACR criteria counts, and ACR functional scores at worst disease (Table 1). At symptom onset, approximately 90% of CARRA Registry patients lived in ZCTAs within 50 miles of a CARRA Registry pediatric rheumatology center. Glucocorticoid, non-biologic, biologic, and NSAID use in jSLE varied by region, however, higher uses of steroids and NSAIDs and lower uses of biologic and non-biologic medications were seen in C2 compared to C1 (Fig 1). Furthermore, C2 jSLE required significantly fewer medications compared to C1 (4.4 vs 5.7, respectively; p<0.01).

Conclusion:
The heterogeneous nature of jSLE and regional variation in medication usage may have impacted the previous development of standardized treatment practices. Patients diagnosed with jSLE over the past 6 years have required significantly lower number of medications in order to treat their disease, suggesting a refinement in treatment practices. Regional and temporal variations may reflect the recent trend towards the standardization of medication practices in jSLE.
Determinants of Sexual Aggression Perpetration: Implications for Prevention
Rose Hennessy

Author Affiliation:
Rose Hennessy is a doctoral student in the Community and Behavioral Health Promotion program at the Zilber School of Public Health, University of Wisconsin-Milwaukee. She has research interests in violence prevention and has provided sexual assault prevention programming at two major universities, research in child trauma and sexual assault, and case management and advocacy services. She received her Master’s degree in Public Health from UCLA and has experience doing state-level violence prevention work. Her specialty as a program evaluator has allowed her to lead and support multiple agency, community, and statewide evaluation projects.

Background:
A 2014 review indicates that only three sexual assault prevention programs have demonstrated a decrease in sexual aggression. It is theorized that sexual assault prevention programs are not effective because they are still addressing risk factors for victimization. With the negative health and societal impacts of sexual assault, it is integral to investigate why so few programs are effective at reducing sexual aggression.

Methods:
A literature review was conducted to identify the top correlating factors of individuals who perpetrate sexual assault against adults. The review was conducted in PubMed and PsychINFO.

Results:
Between one fifth to half of men in college and community samples indicate they have perpetrated sexual aggression. Many determinants are associated with sexual violence perpetration and can be categorized by past trauma exposure factors, behavioral factors, personality factors, attitudinal factors, and situational factors. There is no one “determinant” of perpetration, but rather it is likely a confluence model of many working along pathways which leads to perpetration. Models can predict up to 78% of the variability in sexual aggression and correctly classify up to 85% of men as sexual aggressors or non-perpetrators.

Conclusion:
Prevention programs may improve by explicitly stating which determinants they aim to target and basing their programming around timely intervention of trauma exposure and factors associated with sexual aggression. Future research should aim to create a predictive confluence model which can be used by prevention practitioners and which could include community and societal-level factors in predictive pathways of sexual aggression.
Wisconsin Sentencing Policies: Black Male Mass Incarceration and its Effects on the Health of Black Female Family Members in Milwaukee
Erika Christenson, Sara Kohlbeck, Elise Mosley-Johnson

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Zilber School of Public Health

Introduction:
This research project, undertaken by Zilber School of Public Health students Sara Kohlbeck, Erika Christenson, and Elise Mosley-Johnson, aims to demonstrate how the absence of men, as the result of inequitable sentencing policies, impacts the health of Black women in Milwaukee, specifically as it relates to stigma, mental health, social support and isolation, and housing insecurity. The overall objective of this study is to understand and describe the experiences of Black women in Milwaukee as they confront male family member incarceration.

Background:
Since 1990, sentencing policies such as three-strike rules, mandatory minimum sentencing laws, truth-in-sentencing, and incarceration for minor probation and supervision violations have resulted in national increases in prison populations and contributed to more than tripling the prison population in Wisconsin. Research has demonstrated that a disproportionate number of Black men in Milwaukee have been incarcerated. According to U.S. Census data, Wisconsin has the highest incarceration rate of Black males in the nation with 12.8% of Black men behind bars, which is nearly double the national average of 6.7%. The majority of those incarcerated come from Milwaukee County; two-thirds of the Black men incarcerated hail from only 6 Milwaukee zip codes while over 90% come 15 zip codes. Studies have also shown that family member incarceration can negatively impact the health of Black women. Black women living in those 15 zip codes disproportionately experience family member incarceration, which can cause decreased income, loss of emotional and social support, increased stress levels, stigma, and isolation.

Methods:
This project relies on a phenomenological epistemology, an approach used to understand the essence of a phenomenon through qualitative data collection, in order to describe the essence of Black women’s experience in Milwaukee when a male family member is incarcerated. The study employs a variety of qualitative data collection techniques, including focus groups, in-person interviews, and observation in order to gather data from Black women in zip codes with high Black male incarceration rates. Our data collection methods will consist of one exploratory focus group with four to six women, which will be conducted at the Dr. Martin Luther King, Jr. Community Center. Also, six individual in-depth interviews will be conducted, along with a non-participant observation at a mothers’ support group. Focus group and interview questions are intended to elicit responses that explain how Black women in Milwaukee are impacted by the incarceration of a male family member, and also how these women cope and are supported by the community. Women will be recruited through local churches and community organizations.
**Results:**
Data collection will be ongoing, and emerging themes are expected to involve issues of resiliency, positive and negative health outcomes, coping, and social support. Results from this study can be used in further research or to inform interventions targeting health disparities among Black women in Milwaukee. Nationally, it will serve as a case-study into how high male incarceration rates can affect women. Given the social justice aspect of our study, along with the relevance of the study taking place in Milwaukee, we feel that the results of our research will be interesting and valuable to colleagues in our institution.
Pre-1940 Home Abatement and Elevated Blood Lead Levels in Milwaukee, WI
Kevin Smith

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Introduction:
Healthy People2020 set the goal to eliminate childhood blood lead levels (BLLs) ≥ 10 µg/dL and disparities between race and social class. In 2011, 0.56% of U.S. children had BLLs ≥ 10 µg/dL. From 1996 to 2011, the City of Milwaukee Lead Primary Prevention Program reduced these rates from 33.18% to 3.45%, however, Milwaukee contains relatively high prevalence rates.

Objectives:
We evaluated the influence of housing and community characteristics on prevalence of elevated BLLs and their effect on successes of Milwaukee lead abatement between 1996 - 2011.

Methods:
City of Milwaukee Health Department lead abatement, lead screening information and Master Property Records, and U.S. Census data were used to correlate year of construction, owner versus renter occupancy, race and household income with prevalence of elevated BLLs. An investigation of these variables with prevalence rates following lead abatement was conducted. Spatial analyses were performed using Geographical Information System (GIS) software.

Results:
Correlations were revealed among prevalence of elevated BLLs and year of construction, renter occupancy, race and income. Number of units abated was inversely correlated with prevalence of elevated BLLs. A negative exponential relationship was present between prevalence and number of units abated and was related to housing and community characteristics.

Conclusion:
Housing and community characteristics are correlated with prevalence of elevated BLLs and reductions of elevated BLLs. An inverse relationship between number of units abated and prevalence of elevated BLLs was found that was affected by housing and community characteristics. We propose future lead abatement programs consider these characteristics.
Opening the Doors to LGBTQ+ Tobacco Prevention in Milwaukee: A Community Readiness Assessment
Kathryn Staats, Holly Gamblin and Jennifer Murray

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Introduction:
LGBTQ+ people are 40-70% more likely to smoke cigarettes than the non-LGBTQ+ population\(^1\), yet few public health efforts target this population for tobacco prevention efforts. Several factors that may contribute to these high rates among LGBTQ+ populations are higher levels of social stress, frequent patronage of bars and clubs, and direct targeting of LGBTQ+ consumers by the tobacco industry.\(^2\) A Community Readiness Assessment was conducted to determine the LGBTQ+ community’s readiness to accept an intervention to prevent and/or stop tobacco use. Three Zilber School of Public Health Master of Public Health students in the Public Health Policy and Administration track- Holly Gamblin, Jennifer Murray, and Kathryn Staats- played crucial roles in carrying out the assessment.

Objectives:
The City of Milwaukee Tobacco-Free Alliance, a community coalition funded by the Wisconsin Tobacco Prevention and Control Program, initiated a Community Readiness Assessment to be done in 2014. This assessment was conducted to inform future actions to address tobacco use in the LGBTQ+ communities of Milwaukee.

Methods:
The Community Readiness model has been used nationally by communities to discover the way an issue should be approached. The outcomes of the assessment are based on the Transtheoretical Model of Behavior Change\(^3\) and give the project leads a quantitative measure of readiness translated into a stage of change. The stages of change are: Pre-Contemplation, Contemplation, Preparation, Action, and Maintenance as well as relapse. The planning team identified stakeholder group categories that were based on age, self-identified orientations, and one for LGBTQ+ health service providers. Respondents were recruited through a snowball method, agreed to share information about tobacco use in the LGBTQ+ community in Milwaukee, and were given one-on-one interviews. The interviews were assessed, giving qualitative and quantitative data on how “ready” the community is for an intervention. A qualitative thematic analysis was conducted, identifying certain themes throughout the stakeholder groups. Using the results of the qualitative and quantitative analyses and the LGBTQ+ community’s stage of readiness, interventions to address tobacco use and prevention in the LGBTQ+ community were formulated.

Results:
The final score of the assessment was 2.86 which determined that the LGBTQ+ communities in Milwaukee are in the Denial/Resistance phase of readiness. Much of community felt that there were bigger issues to focus on and there was an overall feeling of complacency around the culture of tobacco use. It was also identified that there was not a high level of knowledge about the disparity of LGBTQ+ people’s tobacco use versus their heterosexual counterparts.

\(^2\) Ibid.
Conclusions:
The assessment guided the work that must be done in Milwaukee based on the suggestions of the model. Future actions appropriate to the level of readiness will be to build overall awareness of the issue through media, create useful messaging and literature, as well as strategically meeting with community stakeholders to build a network of partners to fight against this disparity.
Placental health is affected by Aryl hydrocarbon receptor-dependent regulation of metabolic and oxidative pathways.

Everett Tate

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Background:
Placental regulation of nutrient availability is required for proper fetal development and perturbations during the developmental process can increase susceptibility to multiple later-life pathologies, including those of the blood system. Hematopoietic stem cells (HSCs) are the precursors for all blood cells throughout the life of the organism and emerge in the fetus and placenta at a point where the intrauterine environment is shifting from glycolytic to oxidative metabolism. The increasing energy demands and growth of the fetus coincide with increased placentation and regulation of fetal nutrient availability. Disturbances in nutrient and oxygen availability affect the unique metabolic and oxidative requirements of HSCs and can alter multi-potency and self-renewal, potentially leading to spectrum of diseases from stem-cell exhaustion to hematological malignancies. Given these nutritional needs and the knowledge that placental failure is a common underlying symptom of prematurity and related immune disorders, we set out to determine if there are environmental factors that increase the risk for placental dysfunction. One such environmental factor that is known to impact energy regulation is the ubiquitous contaminant 2,3,7,8 Tetrachlorodibenzo-p-dioxin (TCDD). This environmental contaminant has been shown in numerous studies to disturb the central regulation of metabolic homeostasis, in addition to fatty acid metabolism, insulin resistance, and cholesterol synthesis. In comparison, developmental exposure models using TCDD or AHR null mice show vascular and hematologic irregularities. We hypothesized that the placental energy regulatory systems would be altered by developmental TCDD exposure, which would consequently affect both fetal health and HSCs.

Methods:
- Experimental animals—All animal procedures were conducted according to NIH’s Guide for the Care and Use of Laboratory Animals (National Research Council, 2011) and with the approval of the Institutional Animal Care and Use Committee (IACUC) at the University of Wisconsin-Milwaukee. After overnight pairings, presence of a vaginal plug was designated gestational day (GD) 0.5. All mice were housed in micro-isolator cages in a specified pathogen-free facility at the University of Wisconsin-Milwaukee, were provided food and water ad libitum and maintained on a 12:12-h light cycle.
- TCDD (Cambridge Isotopes, Andover, MA) was prepared as previously described (Ahrenhoerster et al., 2014). Pregnant mice in the treatment group were given 3 μg TCDD/kg body weight by oral gavage on gestational days 0.5, 7.5, 14.5, while control mice received an equivalent volume of olive oil vehicle (0.1 ml per 10 g) on the same days.
- Primary fluorochrome-conjugated monoclonal antibodies were used in flow cytometry analysis on a BD FACS Aria III, DIVA version 6.1.3. All flow cytometry data were analyzed using FlowJo software (Version 9.5, Treestar, Ashland, OR).
- Irradiation/reconstitution assay. Timed pregnant dams were exposed to vehicle or 3μg/Kg TCDD. On GD 14.5, genetically tagged fetal liver hematopoietic stem cells were mixed in equal proportions and used to reconstitute lethally irradiated recipients. (B) Eight weeks after reconstitution, bone marrow
was harvested and cells were stained with CD45.1 and CD45.2 and the percentage of bone marrow cells recovered from each donor is shown with white bars for CD45.1+ and grey for CD45.2+

Results
We found TCDD significant increased ROS production by 1.6-fold in fetal hematopoietic cells, and 2.6 fold in the placental hematopoietic cells. Furthermore, placental weights of TCDD exposed fetuses were 80% of vehicle exposed (p<.0001). Placental HSCs showed significant TCDD-induced changes in genes related to metabolic regulation (14 and 7 fold induction Tsc1 and Lkb1 respectively), redox status (>9 fold induction Sod2), fatty acid metabolism (>5 fold induction Cpt2), and nitric oxide synthesis (>4 fold induction Gtpch). Taken together, developmentally exposed mice show decreased placental weight, increased oxidative stress, and gene expression changes related to glycolytic, redox, and fatty acid metabolism at a time when the fetus has increased need for oxygen and glucose.

Conclusions
• In utero TCDD exposure effects the redox and metabolic state of HSCs
• AHR is involved in the developmental pathways for metabolic homeostasis and mitochondrial biogenesis
• Early life exposures can affect placental health which can have deleterious effects that persist through life

Summary:
Our results add to the knowledge that placental health is key regulator of fetal development and programming, and these changes in the metabolic and oxidative state of HSCs may be an important part for understanding the role of toxicological insults during development and the fetal origins of adult health and disease.

Funding:
This work was supported by the National Institute of Environmental Health Sciences at the National Institutes of Health [grant number R00ES016585], with partial support from the UW-Milwaukee Children’s Environmental Health Science Center [grant number P30ES004184]. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.