March 6, 2019

Re: February 14, 2019 City of Milwaukee Common Council Steering and Rules Committee, Freshwater for Life Action Coalition presentation

Dear Members of the Steering and Rules Committee:

We are writing in response to the Freshwater for Life Action Coalition's (FLAC) presentation to the City of Milwaukee Common Council's Steering and Rules Committee that occurred on February 14, 2019. We are both current faculty members at the University of Wisconsin-Milwaukee with expertise in the areas of research design and public health. We have provided more information about our professional training and research backgrounds at the end of this document (see Appendix A).

Infant mortality and elevated blood lead levels in Milwaukee children are complex problems that must be informed by rigorous scientific research that draws on established best practices. We support evidence-based action and policy for their reduction and elimination from our city, region and state. As academic researchers involved in studies of lead as well as community collaborations to address health issues in Milwaukee and beyond, we appreciate the opportunity to respond to FLAC's presentation. Although we were not able to attend the presentation in person, we have reviewed the online video of the presentation. Additionally, Mr. Thomas Welcenbach gave a similar presentation to Dr. Helen Meier on November 2, 2018 at the University of Wisconsin-Milwaukee, thus we believe we are familiar with the matters discussed in the presentation.

The concern that motivates this letter is that the FLAC presentation gives the impression that lead in drinking water may be a central cause of infant mortality in Milwaukee. Based on our review of their presentation, we do not think this should be concluded. While we welcome citizen scientists and appreciate passionate voices advocating for the health of Milwaukee residents, the analysis and assertions made by FLAC's representatives at the Steering and Rules Committee on February 14, 2019 are not supported by the data they presented and suffer from serious flaws in methodology and reasoning. We feel compelled to alert policy makers and the public to these serious scientific errors, many of which were raised with Mr. Welcenbach in a meeting on November 2, 2018 with Dr. Meier, because of the *potential for harm* this may cause in our community. We describe several problems with the methodology and causal reasoning with FLAC's presentation below. We look forward to building collaborative research projects with interested citizen scientists and community members to address these and other health inequities in Milwaukee residents.

Comparison of infant mortality to elevated blood lead levels in Milwaukee Children, 2016

The FLAC presentation could give the impression that that Milwaukee infant mortality in 2016 was caused by lead in water based on the comparison of two separate maps of the geographical distribution of infant mortality (number of infant deaths (death before a child's first birthday) per 1000 live births in a given year) and % of children 5 years of age and younger that were tested for lead who had elevated blood lead levels in 2016. We list concerns we have about this analysis and presentation, below:

- The childhood lead data that were the focus of the presentation only represent the percent of children **ages 0-5 years old** that were tested for lead exposure and had a level greater 5µg/dL. Infant mortality data only include children **who have died in the first year of life (0-12 months)**. Thus, any comparison of the lead data to infant mortality in this format is inherently flawed because the pool of children contributing to the lead data is not the same pool of children contributing to the infant mortality data. It is like comparing apples to oranges. *Only children 12*

months old or less in the lead data should be compared to infant mortality as they are both at risk for both conditions.

- Children 1 year of age or older are NOT at risk for infant mortality because infant mortality is the ratio of deaths of children in their first year of life to live births in a given year. Further, data from the Wisconsin Department of Health Services show that children less than 1 year of age have the lowest percent of new cases of elevated blood lead levels by age group.[i] In Wisconsin, consistent with national data,[ii] new cases of elevated blood lead levels peak at 2 years of age and are highest between 18-36 months of age. Therefore, the maps of childhood elevated blood lead levels in Milwaukee are likely driven by children 1.5-3 years of age, not by infants (children less than 1 year of age).

- The type of comparison between childhood lead data and infant mortality made in the FLAC presentation is an "ecologic" comparison, meaning we are looking at population averages, not individuals. Said differently, we are NOT determining if *individual* children 12 months old or less with elevated blood lead levels die in the first year of life. Instead, the data presented was aggregated (i.e., combined) to groups (such as census block group, zip code, etc.). When data is combined in this way, we must compare data at this *group level* and make our conclusions about the data also at the *group level*.[iii] As many textbooks note, researchers are cautioned against using findings about groups to make "inference" or assumptions about the nature of individuals based on solely on aggregated statistics or grouped data. This is known as the ecological fallacy or ecological inference fallacy and is a common limitation to GIS mapping studies.[iv] FLAC's presentation to the Steering and Rules Committee gives the impression that the 50 infant deaths near North Avenue in 2016 were caused by lead exposure through water based on a high *group level* % of children tested for lead with an elevated blood lead level. This reasoning is an example of the ecologic fallacy.

- The FLAC presentation appears to contain no formal statistical analysis, such as a correlation, documenting the size and direction of the relationship between infant mortality and percent of children tested for lead who had elevated blood lead levels. The presentation instead emphasized "heat maps" of City of Milwaukee infant mortality in 2016, lead poisoning density in 2016 as well as maps of lead laterals and construction activity. If a statistical analysis (not just a visual comparison of maps) was conducted and not presented on February 14, 2019, we kindly ask FLAC to provide the methodology and results of this analysis for independent evaluation. Health researchers often use statistical methods, such as regression, to "rule out" or account for other potential pathways linking an environmental toxin to a health outcome.[v]

- Establishing a ***causal*** link between an exposure and a health outcome is a scientific process that does not rely on one single analysis or study. Rather multiple studies are considered by the scientific community to create consensus that exposure to X factor ***causes*** a health outcome. This process usually includes studies that ensure the exposure occurred before the outcome to establish temporality of events. Until that consensus can be reached, we can only say that an association or a correlation has been observed between an exposure and an outcome. FLAC's presentation described 2016 aggregated data for both elevated blood lead level density and infant mortality rate. However, no evidence was provided that lead exposure *preceded* infant mortality.

- A critically important point to emphasize is that there are multiple sources of lead exposure for children, including paint, soil, water, and industrial air pollutants.[vi] In Milwaukee, many homes are likely to have both lead-based paint dust AND lead water laterals or lead plumbing, making it difficult to determine whether elevated blood lead levels are due to contributions from lead-based

paint, dust or water exposure in specific individuals or aggregated at the community level. Indeed, the suggestion to test infants who have died for lead exposure would not provide information on whether any elevated lead levels were due to paint, water, or other source in these children. Our view, informed by our expertise and research experience, is that we must deal holistically with lead exposure, examining multiple exposure pathways. This may include a focus on drinking water, but should not exclusively focus on this pathway alone.

- Finally, understanding the causes of infant mortality in Milwaukee is an incredibly complex problem. We agree with FLAC that it is important to identify the determinants of infant mortality and disparities in Milwaukee. This issue deserves our attention. Research specifically designed to identify local determinants of infant mortality can inform strategies for reducing infant mortality so that interventions are appropriate and effective.

In summary, the impression that lead exposure through drinking water is causing infant mortality in Milwaukee that underlies this presentation cannot, in our view, be supported given the data and analysis provided. Additional investigation into the drivers of both infant mortality and lead exposure in Milwaukee children is necessary. We do agree that drinking water traveling through lead plumbing in municipal water delivery systems as well as internally in homes can be *one* source of lead exposure. Further examination of the *potential risk* of lead exposure through drinking water may be warranted in Milwaukee. However, we hope any policy solutions identified by the City will be informed by interdisciplinary scientific investigations that employ best practices to determine the role of lead exposure in shaping human health.

Sincerely,

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[i] Wisconsin Department of Health Services. *2016 Report on Childhood Lead Poisoning in Wisconsin*. Division of Public Health. See Table 2, p. 7.
[ii] Hornung, Richard, Bruce P. Lanphear, Kim N. Dietrich. 2009. Age of greatest susceptibility to childhood lead exposure: A new statistical approach. *Environmental Health Perspectives*, 117(8): 1309-1312.
[iii] Singleton, Royce A and Straits, Bruce C. 2010. *Approaches to Social Research*. Oxford, Oxford University Press.
[iv] Wakefield, Jonathan and Lyons, Hilary. 2010. "Spatial Aggregation and the Ecological Fallacy" in *Handbook of Spatial Statistics*, Edited by Gelfand, Diggle, Fuentes, and Guttorp. CRC Press.

[v] If FLAC's representatives had calculated a correlation between % of children tested for lead that had elevated blood lead levels and infant mortality, this would just be a first step in establishing a cause-effect relationship. Good scientific practice compels us to consider alternative factors which may have produced this correlation. For example, poverty is associated with infant mortality rates and elevated blood lead levels in Milwaukee children. If we conduct an analysis of blood lead level and infant mortality, we must account for poverty because it is a "common cause" of the two variables of interest. If we do not account for poverty in the analysis, we may observe a "spurious" or false association between lead levels and infant mortality based solely on the fact that poverty is related to both lead levels and infant mortality. Indeed, if we look at the geographical distribution of other health outcomes, such as obesity and sexually transmitted infections across Milwaukee, we see a similar pattern as infant mortality and elevated blood lead levels in children. Therefore, without an analysis that considers common causes, such as poverty, we cannot make the claim that elevated blood lead levels are associated with infant mortality.

[vi] Levin et al. 2008. Lead exposure in U.S. Children, 2008: Implications for prevention. *Environmental Health Perspectives*, 116(10): 1285 – 1293.

Appendix A: Biographical Sketches

Dr. Helen Meier is an Assistant Professor of Epidemiology in the Joseph J. Zilber School of Public Health. Previously, she trained as a Postdoctoral Intramural Research Training Award (IRTA) Fellow at the National Institutes of Health (NIH) with a joint appointment in the Epidemiology Branch at the National Institute of Environmental Health Sciences and the Translational Gerontology Branch at the National Institute on Aging. She earned a PhD in Epidemiologic Science from University of Michigan School of Public Health, where she trained in the Center for Social Epidemiology and Population Health. She also received her Master of Public Health in Hospital and Molecular Epidemiology from the University of Michigan School of Public Health. She specializes in life course epidemiology studies, including survey development, data collection, quantitative analysis, and interpreting results of study findings. Dr. Meier's research identifies the impact of social and environmental exposures experienced over the life course on later life health. Dr. Meier partners with local health departments and non-profit organizations on projects to better community health. She works with Dr. Chesley and local organizations to identify drivers of elevated blood lead levels and the health inequities resulting from them in the greater Milwaukee area. Dr. Meier and Dr. Chesley's joint research focuses on the contributions of paint and water to lead exposure across the life course as well as the attitudes, behaviors, and circumstances that enhance or detract from effective use of "point-of-use" water filters.

Dr. Noelle Chesley is an Associate Professor of Sociology in the College of Letters and Science at the University of Wisconsin-Milwaukee. Previously, she trained as a post-doctoral fellow at the University of Minnesota with a research focus on work, family, and health. She earned her PhD in Human Development from Cornell University, specializing in family and life course sociology and received research training and support from the Cornell Careers Institute, funded by the Alfred P. Sloan foundation. She also has a Master's in Public Administration from Syracuse University where she studied social welfare policy. She has extensive experience designing both survey and qualitative interviewing studies and teaches, or has taught, courses in both research design and statistical analysis. Her research is focused on understanding the role of technological innovation in shaping work and family experiences that influence health and well-being. Dr. Chesley is a resident of the City of Milwaukee and partners with Dr. Meier and local organizations to better understand the attitudes, behaviors, and circumstances that enhance or detract from effective use of "point-of-use" water filters to address concerns about lead exposure through drinking water.