

What Happens When You Get an Epidemiologist, an Environmental Health Scientist and a Biostatistician in a Room? A Study of the Associations of Soil Metals with Mental Retardation and Developmental Delay in Children



ESE Distinguished Alumni Award Recipient

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ABSTRACT

A collaborative effort was started from a small seed grant to an Epidemiologist and an Environmental Health Scientist to collect preliminary data on soil contamination and its possible association to high rates of mental retardation and developmental delay (MR/DD) in a susceptible population. Based on data collected, and in the true sense of the word “seed” grant, a larger project was developed incorporating a Biostatistician to develop statistical methods to use the database to identify areas with high prevalence of MR/DD, and use soil metal concentrations as a surrogate for environmental insult. No measurements of human exposure were made, and for the purposes of soil sampling the location on residence was unknown due to confidentiality issues. We identified five areas with elevated prevalence MR/DD in children and one with a MR/DD prevalence rate similar to the state rate. Soil samples were collected from 0-5 cm depths from nodes of a uniform grid laid out across the six sampling areas. Samples were analyzed for arsenic, barium, beryllium, chromium, copper, lead, manganese, nickel, and mercury, many of which have documented negative neurological effects on humans. These data were used in Bayesian kriging to identify associations between metals and maternal monthly residential history and the MR/DD health outcome of the child. In addition, inverse distance weighting, principal component analysis and cluster analysis were used to identify hot spots and potential common sources of metals in each area. Direct causation between soil metal concentrations and MR/DD cannot be concluded from this study. Exposures were not measured and samples were not collected at individual residences. However, associations were measured between metal concentrations and an elevated prevalence of MR/DD. Results of the research can help direct future research on specific metals and areas of anomalously high soil metal concentration. Most importantly, the project has emphasized that one is never too old to learn, and that a few people in a room can be a wonderful thing.

Bio:

C. Marjorie AELION is Dean of the School of Public Health and Health Sciences at the University of Massachusetts, Amherst. She worked for the U.S. Geological Survey, Water Resources Division as a hydrologist for three years before beginning her academic career at the University of South Carolina (USC) in Columbia from 1991-2008. She was an Assistant Professor, Associate Professor, and Professor in the Department of Environmental Health Sciences, and the Associate Dean for Research for the Arnold School of Public Health at USC. She obtained her SMCE from the Massachusetts Institute of Technology in Cambridge, Massachusetts in Civil Engineering and her PhD from the University of North Carolina in Chapel Hill in Environmental Sciences and Engineering Department, Environmental Chemistry and Biology Program in the Gillings School of Global Public Health. She has been a Fulbright awardee to the Université de Bretagne Occidentale in France, and the University of Wageningen the Netherlands. She received the National Science Foundation Presidential Faculty Fellow Award in 1993, one of 30 awarded in all science and engineering disciplines. Her research is in the area of biodegradation of organic contaminants, tools for assessing remedial technologies, including stable isotopes and naturally-occurring radiocarbon, and the application and development of enhanced remediation systems for contaminated ground water. She has additional interests in the impact of land use on coastal contaminant removal and nutrient cycling, and the associations of metals in residential soils with negative health outcomes in children. C. Marjorie AELION is on the Editorial Board of Bioremediation Journal, Oceans and Oceanography, and a Managing Editor for Biodegradation. She is the author of >70 peer-reviewed scientific articles and one edited book.