Is Air Pollution 'Obesogenic'?: Airborne Endocrine Disrupting Chemical Exposure Effects on Gestational Weight Gain in Women from Utah, 2010-2012

-Extended Abstract-

Jessica L. Eckhardt, M.S.
Department of Sociology
The University of Utah
E-mail: jessica.eckhardt@soc.utah.edu

Corresponding Author: Jessica Eckhardt, University of Utah, Sociology Department, 380 South 1530 East, Room 309, Utah 84112. Phone: 303-476-3701.

Jessica L. Eckhardt is a PhD candidate in Sociology at the University of Utah. She studies the social determinants of health, environmental sociology, and how environmental quality affects health outcomes and disparities. Her dissertation examines and tests various environmental health inequality frameworks.

Introduction and Research Question

Contemporary research has broadened our understanding of obesity and illuminated the fact that obesity is most likely caused by complicated interactions between behavioral, genetic and environmental factors[1]. A new, growing body of research suggests that chemical toxins play a leading role in the etiology of obesity. The 'environmental obesogen' hypothesis espouses that environmental pollutants disrupt and interfere with the body's metabolic, energy balancing system[2]. Toxic chemicals, such as biphenyl A (BPA) and formaldehyde, have been shown to affect the endocrine system, which produces hormones that regulate metabolism[3]. Disruptions in metabolism can be especially harmful to pregnant women, as their bodies are more sensitive during gestation, and can affect their long term health. Building on obesogenic and endocrine disruptor research, this study will examine the potential effects airborne pollution exposure has on gestational weight gain among women in Utah between 2010 and 2012. Specifically, this proposal has 1 primary aim:

Aim 1: test the main effect of pollution exposure to airborne endocrine disrupting chemicals (EDCs) on gestational weight gain among women in Utah who were pregnant and gave birth between 2010 and 2012.

The purpose of this aim is examine the association between airborne EDC exposure and the amount of weight gained during pregnancy. My intent is to examine how different levels of airborne pollution exposure affect prepregnancy weight and gestational weight gain (GWG). Focusing on the gestational period is especially important because pregnancy is a sensitive period of a woman's life course and the effects of pollution exposure during this period may alter her long term health and weight trajectory. The primary independent variable of interest will be tract level airborne pollution concentration exposure estimates for 2010-2012. Utah birth certificate records will be used to measure prepregnancy weight and weight gained during

pregnancy. All models will control for demographic variables (age, gender, race/ethnicity, income and educational level and maternal smoking). Models will also control for the built environment, such as residential density, walkability. Analyses will examine the effect of exposure to airborne pollution on prepregnancy weight gain and gestational weight gain of mothers.

Data and Methods

The data to be used in the project come from three sources: (1) the Utah Population Database (UPDB); (2) the 2010 U.S. Census and ACS; (3) and the U.S. Environmental Protection Agency's Risk Screening Environmental Indicator Geographic Microdata dataset (RSEI-GM). Data for maternal and pregnancy related variables will be collected from birth certificates that are accessible through the UPDB. Data for the primary independent variable, airborne EDC pollution exposure, will be collected from RSEI-GM; this database is made up of Toxic Release Inventory data that has been 'plume modeled' to produce an estimate of the annual amount of toxic chemicals that is in the air over a 1 km^2 area for the entire United States (Figure 1 and Figure 2). Specifically, RSEI-GM measures 8 airborne endocrine disrupting chemical (EDC) concentrations for the years of interest: hexachlorbenzene; hexane; polychlorinated biphenyl (PCB); polybrominated diphenyl ether (PBB) and; 4 dichlorobenzene compounds. Thus, the key independent variable will be the annual amount of industrial EDC toxins estimated to be in the air over a block group measured in micrograms per cubic meter (l/mg3).

Finally, built environment and individual level demographic variables such as, residential density, age, gender, race, income and occupation, will be used as control variables. Fixed and

random effect regression models will be used to assess the primary effect airborne EDC pollution exposure has on gestational weight gain.

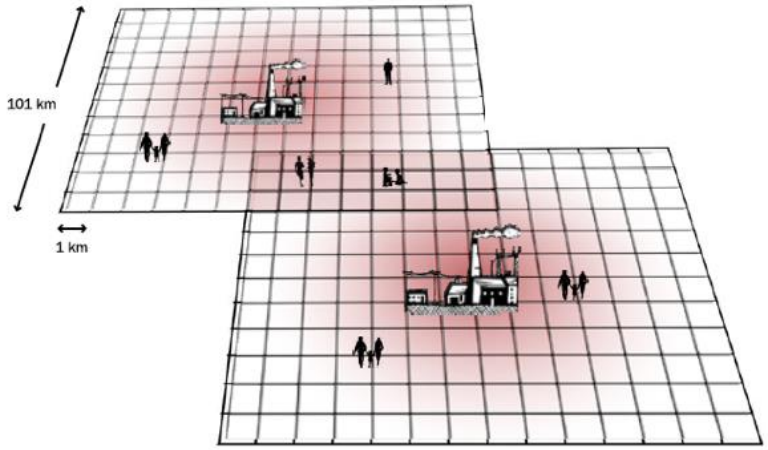

Figure 1. The EPA's Risk Screening Environmental Indicators (RSEI). RSEI takes the toxic air release from each industrial source and uses wind and other info to determine where the releases go within a grid around each facility (these are called fate-and-transport plume models). Where the grids intersect, releases amounts and toxicities can be added up from multiple sources to determine an overall neighborhood exposure score. Census information on the race, age and income composition of the neighborhood can be geospatially linked.

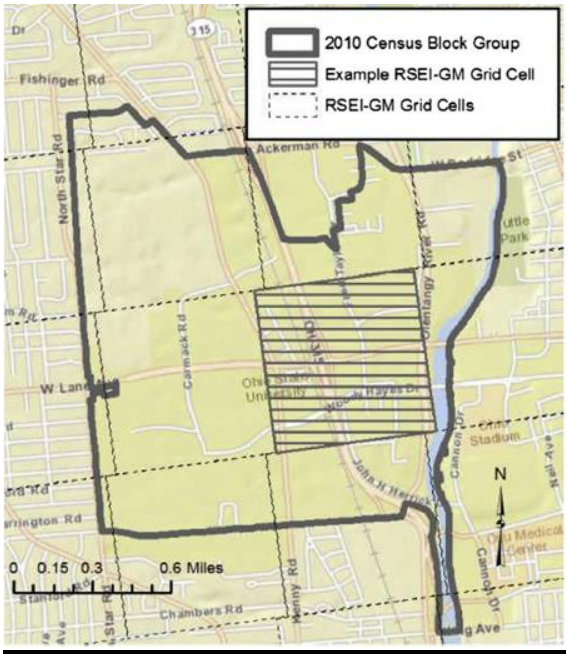

Figure 2. Example of a 2010 census block group in Columbus, Ohio. Overlaid with 1 km^2 grid cells.

Preliminary Results and Expected Findings

Based on preliminary analyses of select block groups in Salt Lake County, I expect to find a statistically significant positive relationship between airborne pollution exposure and gestational weight gain among women from Utah from 2010-2012. Early spatial clustering analyses suggest that airborne EDC pollution concentrations are higher in metropolitan areas and specifically, within block groups that are characterized by low SES and high percentages of minorities. If these initial analyses are indicative of my final results, obesogenic and environmental inequality theoretical frameworks would be supported.

Significance of Research

The major contributions of this study to obesogenic and health research is twofold. First, this study focuses on the association between pollution exposure during a sensitive period in a woman's lifecourse and maternal weight gain, whereas most previous research focuses on fetal health and birth outcomes. Second, I will investigate the relationship between pollution exposure and GWG to determine how individual and neighborhood characteristics, such as socioeconomic status and race, effect weight gained during pregnancy.

References:

1. Hyman, Mark. 2010. "Environmental Toxins, Obesity, and Diabetes: An Emerging Risk Factor". Alternative Therapies in Health and Medicine. 16(2):56-58.
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3. Holtcamp, Wendy. 2012. "Obesogens an Environmental Link to Obesity. Environmental Health Perspectives. 120(2):62-68.