Abstract/Aims: A Natural Experiment to Assess Prenatal Exposure to Air Pollution and Long-Term Health and Reproductive Outcomes

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Air pollution is a ubiquitous prenatal exposure but remains understudied, particularly as it relates to long-term health outcomes and potential fetal programming effects. Multiple studies have reported associations between air pollution and adverse pregnancy outcomes, but they are limited by the potential for unresolved confounding and lack of long-term follow-up of the exposed offspring. Several studies indicate that offspring exposed prenatally to air pollution are at greater risk for immunologically mediated disorders such as allergy and asthma, consistent with fetal programming effects. Furthermore, childhood and adult particulate matter exposure has been associated with epigenetic changes in immune cell DNA.

The long-term effects of prenatal air pollution exposure can be studied in the context of the Utah Valley Geneva steel mill, which was closed from August 1986 to September 1987. When compared to the period of mill closure, residents of Utah Valley experienced decreased lung function, increased respiratory hospital admissions, increased school absenteeism, and increased mortality when the mill was in operation. Only one study has examined birth outcomes in relation to the mill closure and found a decrease in the preterm birth rate during the time of closure. The mill closure is a unique, natural experiment that allows us to: 1) study the long-term effects of prenatal air pollution exposure on health and reproductive outcomes, 2) control for potential confounders, and 3) identify individuals for future epigenetic studies in relation to the effects of air pollution.

Using the Utah Population Database (UPDB), we propose a trans-generational study (utilizing within-family controls) of the long-term health and reproductive outcomes of individuals exposed prenatally to the closure or operation of the Geneva steel mill. We will address the following Specific Aims:

1. Identify a cohort of women (1st generation) with a pregnancy during the mill closure and a preceding or subsequent pregnancy during the mill operation.
2. Assess the relative risks between exposed (mill in operation) and unexposed (mill closed) offspring for adverse adolescent/adult health and reproductive outcomes (2nd generation).
3. Assess whether timing of exposure (1st, 2nd, 3rd trimester) to the mill closure modifies the risk for these adverse adult outcomes.
4. Assess whether offspring (3rd generation) of those individuals born during the mill operation are at increased risk for adverse birth outcomes (e.g. low birthweight).

This project is significant because it exploits the naturally occurring experiment in Utah Valley and the UPDB resources to examine how prenatal exposure to air pollution may influence long-term, trans-generational health outcomes. Data from this study will be utilized for an extramural funding application to contact adult offspring (and their children) born during the steel mill closure or operation and obtain detailed health information, define phenotypes, and collect biospecimens for epigenetic analyses.