Investigation of Association between Environmental and Socioeconomic Factors and Preterm Birth in California

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Background

Preterm birth (PTB), defined birth before 37 weeks of gestation, is a significant cause of neonatal morbidity and mortality, resulting in tremendous individual suffering and societal economic burden. Relationships between environmental exposures and preterm birth have been identified, confounding variables including maternal race/ethnicity, maternal age, maternal education and mom's insurance coverage type (private insurance or not). For certain contaminants of interest, we also performed county-wise analysis comparing their contribution to PTB.

Research Objectives

1. Investigate associations between environmental exposures and PTB;
2. Examine potential effects of environmental and/or socioeconomic factors, that may influence certain aspects or trends in the environment (e.g. smoking rates) and preterm birth;

Data & Variables

1. The California Communities Environmental Health Screening Tool (CalEnviroScreen) Version 3.0 (Data)
2. OSHPD Birth records (Matched Data, 2006-2012)

Methods

Data Merging & Matching

We matched the OSHPD birth records with the CalEnviroScreen data based on coded geographic information (i.e. census tract). If a census tract identifier for a birth record was not available, we used zip code level information as surrogate. All data merging & matching was performed using statistical software R Studio Version 1.0.136 (RStudio, Inc., Boston, MA, 2016).

Statistical Analysis

We used logistic regression to examine the relationship between environmental pollutant data, social factors and preterm birth (<37 weeks). We estimated the relationship between pollutant variables and birth record (e.g. term vs. preterm, gestational age), maternal medical information.

Results

Logistic Regression Models

A. Preterm Birth Category ~ Socio-economic Factors (SES) + Demographic

<table>
<thead>
<tr>
<th>Variable</th>
<th>p-value</th>
<th>Odds Ratio</th>
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</thead>
<tbody>
<tr>
<td>Maternal race</td>
<td>0.001</td>
<td>1.3783</td>
</tr>
<tr>
<td>Maternal age</td>
<td>0.005</td>
<td>1.1649</td>
</tr>
<tr>
<td>Maternal education</td>
<td>0.050</td>
<td>0.9812</td>
</tr>
</tbody>
</table>

B. Preterm Birth Category ~ Pollution Burden (PB) + Drinking Water Contaminants (DW) + Socio-economic Factors (SES) + Demographic

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Table 1. Logistic GLM Output from Experiment A

Interpretations

For an increase of 9.329ppb (the interquartile change) in arsenic (as NO3) average, the adjusted odds ratio was 1.0166 for PTB vs. TB.

Figure 5. Correlation Plot of Contaminant Variables in the Matched Data

Comparison based on arithmetic means (PTB vs. TB)

Figure 6. Arsenic Levels for Term Birth vs. Preterm Birth for Selected Counties

Figure 7. Spatial Distribution of Arsenic Levels (ppb) in Drinking Water in California

Discussion

1. CalEnviroScreen data was useful in providing environmental and social information for identifying exposure-outcome associations;
2. Certain drinking water contaminants such as Arsenic and Nitrates were found to be associated with preterm birth;
3. Association between preterm birth and certain pollutants varied for different counties;
4. Urbanization level of a county modified the above-mentioned associations.

Key References:


Acknowledgement

UCSF Preterm Birth Initiative (PTBi) California

Table 1. Variable Definitions

Table 2. Logistic GLM Output from Experiment B

Logistic Regression Model for each county Preterm Birth Category ~ Arsenic + Race + Maternal Age + Maternal Economic + Private Insurance

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