Fine Particle Air Pollution (PM$_{2.5}$)

• Fine particulate matter of less than 2.5 μm (PM$_{2.5}$) is one of the six criteria pollutants currently regulated by US EPA.

• PM$_{2.5}$ represents a chemically diverse mixture of solids and liquids that commonly arise from combustion processes (vehicles, industry, power generation).

• Consistent epidemiological evidence on long-term and short-term associations with mortality, hospital admissions, emergency department visits, cardiovascular and respiratory diseases.

• Associations with adverse birth outcomes is limited and mixed.
SCEDDBO
Southern Center on Environmentally-Driven Disparities in Birth Outcomes
http://cehi.snre.umich.edu/projects/sceddbo
Study Design

Health Data

• Total population size = 453,562. Included 80 of the 100 NC counties (>99% of births).
• Maternal residential addresses at the time of delivery were geocoded to the street block level (83% success rate).
• Clinical estimate of gestational age was used to back-calculate date of conception.

Exposure Data

1. EPA’s air quality monitoring network – spatially sparse and only available every 3rd or 6th day.
2. EPA’s fusion product available daily on a 12km x 12km grid.

Each pregnancy was linked in space based on residential address and time based on conception date.
Locations of the North Carolina counties and Air Quality System (AQS) PM$_{2.5}$ monitors (•). Counties contained at least 500 births linked to an AQS monitor within a 12km radius are indicated by thick borders. Counties contained at least 500 births linked to a grid cell of the Statistically Fused Air Quality Database are shaded.
Time-to-Event Study Design

We examined 7 average PM$_{2.5}$ exposure metrics during pregnancy that reflect

1. Trimester-wide exposure
2. Pregnancy-wide (cumulative) exposure
3. Short-term lagged exposure

- Conception date
- Birth date
- Censored

Cumulative Exposure

Lagged Exposure

At-risk window

Gestational Week
Key Findings

• Across 80 counties, an interquartile range increase in cumulative exposure was associated with a 3.5% (95% posterior interval: 0.8, 6.3) increase in preterm birth risk.

• Statistically significant adverse associations were also found for exposure during the first and second trimester.

• Results are consistent in sensitivity analyses:
  • Alternative approach for exposure assessment.
  • Alternative approach to control for seasonality and long-term trends in preterm birth.
  • Alternative approach to control for unmeasured spatial confounders.
Concluding Remarks

Results suggest exposure to ambient PM$_{2.5}$ during pregnancy is associated with increased risk of preterm birth, even in an area with relatively good air quality.

Additional Research Questions

• Estimating the public health impacts of air pollution on PTB.
• Identifying critical window of exposure during pregnancy.
• Identifying susceptible sub-populations at increased risk.
• Results replication/consistency with longer study period (up to 2010) and additional study locations.
• Identifying differential toxicity of air pollution components and sources.