Fine Particle Air Pollution and Preterm Birth Results from North Carolina, 2001-2005

Howard H. Chang
Emory University
hhchang@emory.edu

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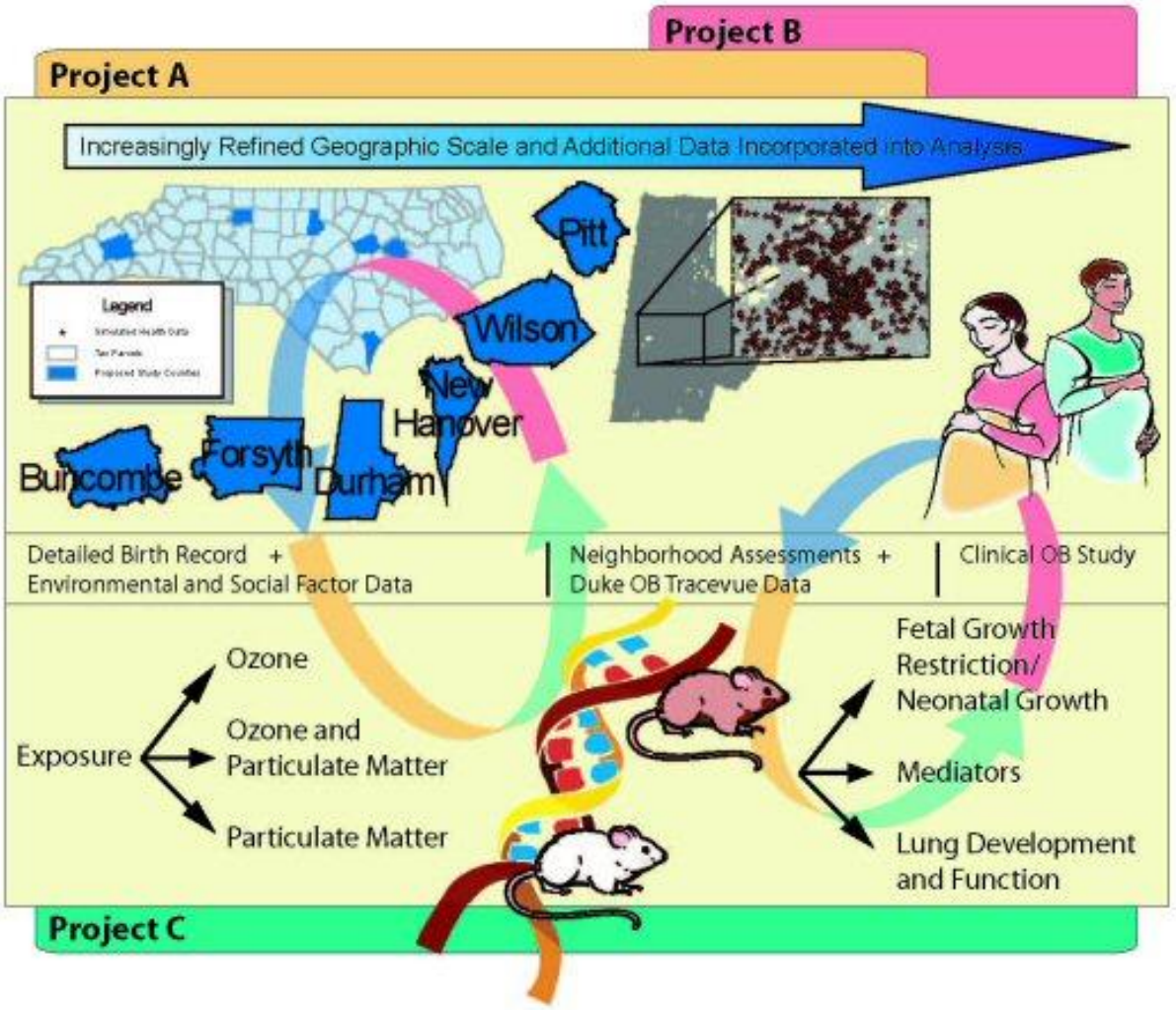
Fine Particle Air Pollution ($PM_{2.5}$)

- 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

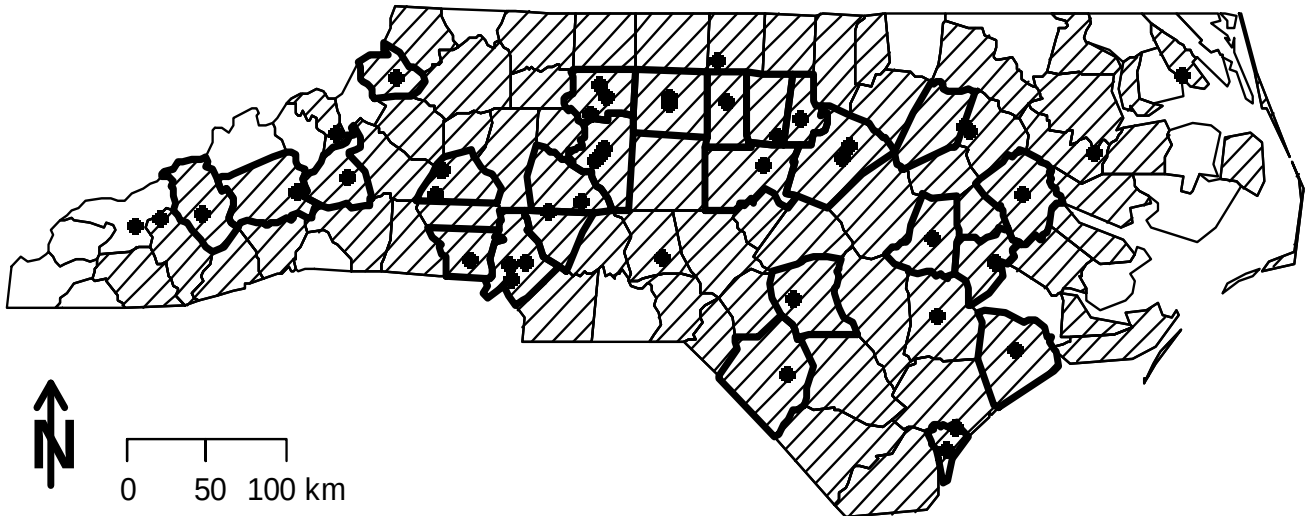
- Source: North Carolina detailed birth records, 2001 – 2005.
- Total population size = 453,562. Included 80 of the 100 NC counties (>99% of births).
- Maternal residential addresses at the time of delivery were geocoded to the street block level (83% success rate).
- Clinical estimate of gestational 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.

Study Population

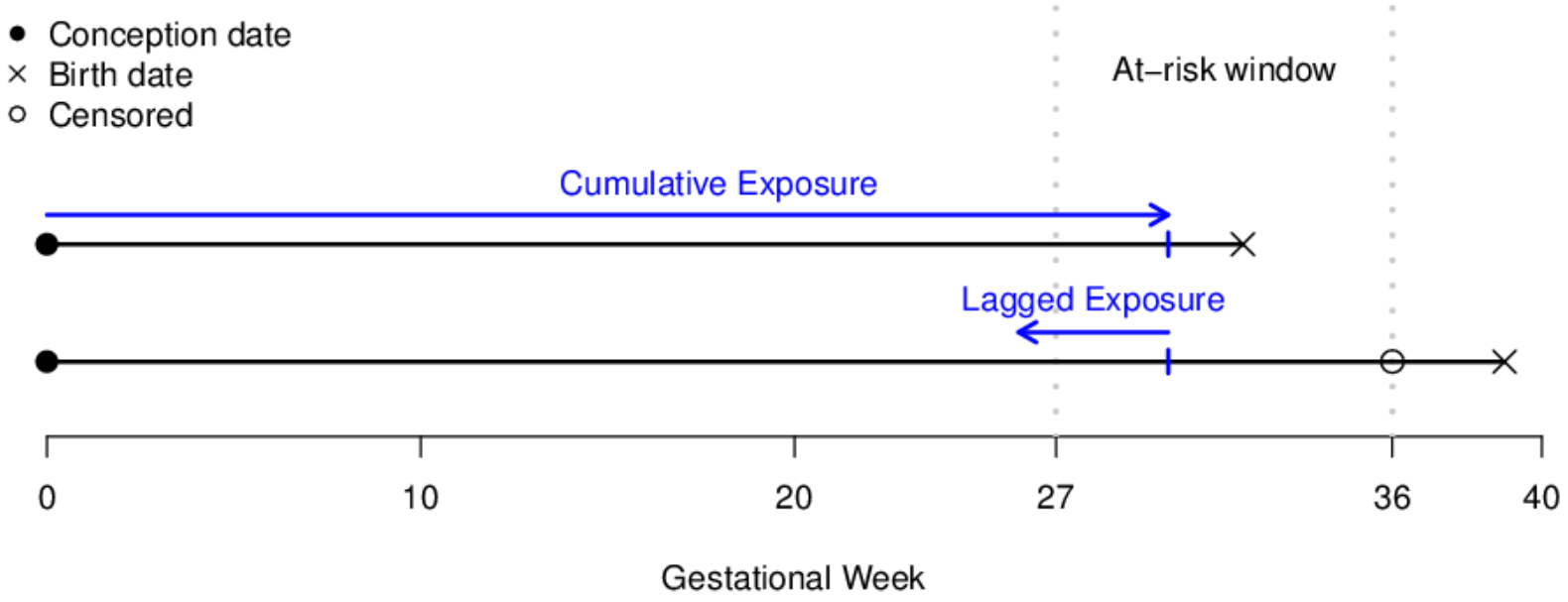


Locations of the North Carolina counties and Air Quality System (AQS) $PM_{2.5}$ monitors (•). Counties contained at least 500 births linked to an AQS monitor within a 12km radius are indicated by thick borders. Counties contained at least 500 births linked to a grid cell of the Statistically Fused Air 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



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.