Urban Air Pollution: Implications for Health Disparities

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Urban Health Disparities Conference
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1993 -- HUD initiated the HOPE VI Program to transform public housing.
  ◦ **Goal**: demolish spatially concentrated public housing and replace it with mixed-income developments to deconcentrate poverty.

2007 -- Atlanta Housing Authority announces plans to demolish remaining public housing
  ◦ **Late 2007**: Faculty at GSU begin working with the Residents’ Advisory Board to conduct a study to follow residents through relocation

2010 -- **Atlanta** became the first city in the nation to effectively eliminate traditional project-based public housing.
Mixed Methodology *(Funded by NIH and NSF)*

- Survey of 382* residents begun pre-relocation in 2008
  - 4 family and 2 senior communities plus one non-relocating senior community
  - Pre-relocation and 6 months post relocation (24 months post relocation completed in November 2012)
  - *87 percent retention rate
Atlanta Public Housing Study

- Built Environment audits of destination blocks for each resident
- Interviews with neighbors about their perceptions of the neighborhood
Findings indicate that residents move to neighborhoods with better housing that are somewhat safer and have about 10 percent less poverty but are just as racially segregated as public housing.

What about other neighborhood dimensions such as air quality?
- Created an air quality pilot study in four neighborhoods where public housing residents moved
- Do disparities in air pollution exposure exist between these neighborhoods?
- What factors drive the disparity?
Urban variation in air pollution

- There is more intra-urban variation than inter-urban variation dependent upon the species of interest.

- Proximity to roadways and other local sources determines concentrations of pollutants.

- Socio-demographic factors (class, race/ethnicity, income) often drive proximity resulting in disparities in exposure and resulting outcomes.

- Higher prevalence of health effects near roadways including cardiovascular disease.

Photos taken by Wig Zamore - Somerville Transportation Equity Partnership
Monitoring Method

- Traffic–related air pollution as measured by nitrogen dioxide (NO$_2$)

OGAWA badge
Monitoring sites

- October 13–27
- Simultaneous monitoring at 120 sites
- 1 Georgia EPD site (not shown)
- 19 volunteers
## Census tract characteristics

<table>
<thead>
<tr>
<th>Census characteristic</th>
<th>&gt;40%</th>
<th>30–40%</th>
<th>20–29%</th>
<th>&lt;20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below poverty line</td>
<td>49%</td>
<td>38%</td>
<td>21%</td>
<td>10%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>8.2%</td>
<td>15.5%</td>
<td>7.0%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Black</td>
<td>99.2%</td>
<td>93.2%</td>
<td>98.3%</td>
<td>94.2%</td>
</tr>
<tr>
<td>Vacant</td>
<td>48.6%</td>
<td>35.6%</td>
<td>10.6%</td>
<td>28.4%</td>
</tr>
<tr>
<td>Population (persons)</td>
<td>1,554</td>
<td>3,397</td>
<td>6,045</td>
<td>5,517</td>
</tr>
</tbody>
</table>
# NO₂ Concentration

<table>
<thead>
<tr>
<th>Census tract poverty</th>
<th>Mean NO₂ (ppb)</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;40%</td>
<td>12.2</td>
<td>2.4</td>
<td>8.9</td>
<td>17.2</td>
</tr>
<tr>
<td>30–40%</td>
<td>11.5</td>
<td>2.4</td>
<td>6.6</td>
<td>16.6</td>
</tr>
<tr>
<td>20–29%</td>
<td>10.1</td>
<td>2.3</td>
<td>6.3</td>
<td>15.0</td>
</tr>
<tr>
<td>&lt;20%</td>
<td>8.8</td>
<td>2.2</td>
<td>4.4</td>
<td>13.2</td>
</tr>
<tr>
<td>EPD site</td>
<td>6.9</td>
<td></td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Prediction error

NO2 Prediction Errors
RMSE
0.5 - 0.8
0.9 - 1
1.1 - 1.1
1.2 - 1.3
1.4 - 1.4
1.5 - 1.5
1.6 - 1.7
1.8 - 1.9
2 - 2.1
2.2 - 2.4

NO2 Samples (ppb)
- 4 - 8
- 9 - 10
- 11
- 12 - 13
- 14 - 17

Expressways
Major Roads

Censustract2010
High Poverty
Low Poverty
Preliminary multivariate model
- Poverty rank
- Distance to interstate highway
- AADT
- High traffic
Implications

- Distant central site monitors may not represent intra-urban variation in concentrations
  - Exposure disparities may go unnoticed without local-scale data
- Proximity to roadway is one main driver of concentrations

**Next steps**
- Continue statistical and spatial analysis of the data
- Understand interaction with social environment
- Identify other local sources or sinks (e.g. body shops, vegetation)
Thank you

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