Testing for Lead Poisoning
Are we testing the right kids?
City of Atlanta 2005

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Objective

To assess lead testing of children at high risk for lead poisoning in the city of Atlanta
Rationale

• Childhood Lead Poisoning
  – Adverse health effects: cognitive impairment, behavior disorders, seizures and death, etc
  – Risk factor also well known: old housing, poverty, etc
  – Children with blood lead levels (BLLs) ≥ 10 μg/dL may have no symptoms
  – A blood lead test is the only way to know that a child has been exposed
  – Challenge is knowing which children are at risk and should be tested
Georgia Lead Testing Guidelines

- Risk should be verbally assessed for all children at 12 and 24 months of age
- Georgia children who should be tested:
  - their verbal assessment indicates risk
  - Medicaid/PeachCare for Kids/WIC eligible
  - reside in homes built before 1978
  - adopted from outside the United States
  - parents may be exposed to lead at work
Neighborhood Risk

- Risk for lead poisoning varies geographically
- Smaller geographic unit more accurate to assess risk
- Neighborhoods seem an ideal geographic resolution for assessing testing
  - Residents/physicians can easily identify their location by neighborhoods
Methods: Datasets

• **Childhood blood lead, 2005**
  – Aggregated, de-identified information by neighborhoods
    • number of children tested for lead
    • number of children with elevated BLLs for children ≤ 3 years of age

• **WIC, 2005**
  – WIC data used as proxy for poverty
  – Aggregated, de-identified information by neighborhoods
    • number of children ≤ 3 years of age enrolled in WIC

• **Population, 2000**
  – Number of children ≤ 3 years of age from US Census
- Residential land parcel data
  - Can have one or more housing units depending on type of property
  - Provided by Center for GIS, Georgia Tech.
  - Includes structure construction date, appraised value, land use information etc.
Methods

Lead testing & WIC data
1. De-duplication of addresses
2. Geocoding

Residential land tax parcel data
1. Selecting parcels with year structure built
2. Single and multi-family residential parcels

Population data from census
1. Area-weighted analysis by block groups
2. Children < 3 years

Aggregation
Neighborhood level dataset for analysis
Methods: Neighborhood Risk

- Created priority testing indices
  - To characterize risk by neighborhoods
  - Based on risk factors:
    - % of Pre-1978 housing
    - % of Pre-1950 housing
    - % of WIC children
  - Divided risk factors into percentile groups
  - Developed a scoring scheme to assign value to different percentile ranges of the risk factors
## Scoring Scheme for Priority Testing Index

<table>
<thead>
<tr>
<th>Percent of Neighborhoods with Risk Factors</th>
<th>Percentile Groups</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1978 housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50 %</td>
<td>0-10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1</td>
</tr>
<tr>
<td>51-90 %</td>
<td>11&lt;sup&gt;th&lt;/sup&gt;-50&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>91-99 %</td>
<td>51&lt;sup&gt;th&lt;/sup&gt;-90&lt;sup&gt;th&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>100 %</td>
<td>91&lt;sup&gt;th&lt;/sup&gt;-100&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
</tr>
<tr>
<td>Pre-1950 housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 %</td>
<td>0-10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1</td>
</tr>
<tr>
<td>1-30 %</td>
<td>11&lt;sup&gt;th&lt;/sup&gt;-50&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>31-83 %</td>
<td>51&lt;sup&gt;th&lt;/sup&gt;-90&lt;sup&gt;th&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>84-100 %</td>
<td>91&lt;sup&gt;th&lt;/sup&gt;-100&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
</tr>
<tr>
<td>Children in WIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 %</td>
<td>0-10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1</td>
</tr>
<tr>
<td>1-35 %</td>
<td>11&lt;sup&gt;th&lt;/sup&gt;-50&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>36-100 %</td>
<td>51&lt;sup&gt;th&lt;/sup&gt;-90&lt;sup&gt;th&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>100 % +*</td>
<td>91&lt;sup&gt;th&lt;/sup&gt;-100&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
</tr>
</tbody>
</table>
Priority Testing Index

Combined risk

Housing score
(Pre 1978 or Pre1950)
Score ranges between 1 and 4

WIC score
(WIC)
Score ranges between 1 and 4

Priority Testing Index
Index ranges between 2 and 8
Priority Testing Index

• Priority testing indices categorized further

<table>
<thead>
<tr>
<th>Priority Testing Index (Housing + WIC scores)</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td>3 or 4</td>
<td>Low Medium</td>
</tr>
<tr>
<td>5 or 6</td>
<td>High Medium</td>
</tr>
<tr>
<td>7 or 8</td>
<td>High</td>
</tr>
</tbody>
</table>

• Calculated two priority testing indices
  — Pre 1978 and WIC
  — Pre 1950 and WIC
Methods

- Lead testing & WIC data
- Residential land tax parcel data
- Population data from census

Aggregation

Neighborhood level dataset for analysis

Statistical Analysis

Priority testing Index

SPSS

Visualization in a GIS

ArcGIS
Results

- Demographics
  - 236 neighborhoods in the city of Atlanta
  - 18,627 children aged (0-3) years
Results

- **Testing and WIC**
  - 2,231 children tested for lead
  - 23 children had BLL $\geq 10$ $\mu$g/dL
  - 8,229 children aged (0-3) enrolled in WIC

- **Housing**
  - 84,055 residential parcels with year housing built
  - Of these 75,286 (89.6%) parcels were built before 1978
  - 47,142 (53.5%) residential parcels built before 1950
An estimated 39 children live in each neighborhood.

Of the 18,627 children in the City of Atlanta, 2,231 (11.9%) were tested for lead.

Of children tested, 23 (1%) had elevated BLLs.

Overall low testing.
Results

- Pre 1950 housing concentrated in central Atlanta
- Testing does not match housing risk
% of Children (0-3) in WIC by neighborhood

- 0%
- 1% - 5%
- 6% - 35%
- 36% - 67%
- 67% - 100%
- 100+%  

Major Interstates

- Percentage of children in WIC increases from North to South
- Neighborhoods with high percentage of WIC children have higher testing

Testing for children (0-3) by neighborhood -- Tests / Total Children (0-3)

- 0%
- 1% - 2%
- 3% - 8%
- 9% - 17%
- 18% - 34%
- 35% - 100+%
Results

- Testing increases as percent of WIC children increases
- Housing risk and testing do not follow clear trend
## Results

<table>
<thead>
<tr>
<th>Priority Testing Index (Housing + WIC scores)</th>
<th>Category Rating</th>
<th>Neighborhoods</th>
<th>Pre-1978 and WIC N (% of total)</th>
<th>Pre-1950 and WIC N (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Low</td>
<td></td>
<td>6 (2.5%)</td>
<td>6 (2.5 %)</td>
</tr>
<tr>
<td>3</td>
<td>Low Medium</td>
<td></td>
<td>22 (9.0%)</td>
<td>18 (7.6%)</td>
</tr>
<tr>
<td>4</td>
<td>Medium</td>
<td></td>
<td>62 (26.3%)</td>
<td>57 (24.2%)</td>
</tr>
<tr>
<td>5</td>
<td>High Medium</td>
<td></td>
<td>71 (30.1%)</td>
<td>82 (34.7%)</td>
</tr>
<tr>
<td>6</td>
<td>High Medium</td>
<td></td>
<td>50 (21.2%)</td>
<td>54 (22.9%)</td>
</tr>
<tr>
<td>7</td>
<td>High</td>
<td></td>
<td>17 (7.2%)</td>
<td>15 (6.4%)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>8 (3.4%)</td>
<td>4 (1.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total: 236 (100.0%)</td>
<td>Total: 236 (100.0%)</td>
</tr>
</tbody>
</table>

- More than 120 neighborhoods fall under high medium category
• Low category virtually non-existent
• High priority neighborhoods located in center of the city
In general, testing reflects the numbers of WIC children and not housing risk.

Creating priority testing indices was an approach to characterize neighborhood risk.

Combining risk factors can improve risk assessment and ultimately testing.
Discussion

• Dissemination of information about high risk neighborhoods can be accomplished by community-based organization

• Maps can help communities and providers identify children living in high risk neighborhoods

• Primary prevention strategies are key for achieving the 2010 goal of eliminating childhood lead poisoning
Discussion
Fact Sheet: Bedford Pine Neighborhood

Lead screening
Number of screens in 2005: 73
Cases with elevated Blood lead level (BLL >= 10 ug/dL): 1
Blood lead screening rate: 30.41%

Demographic and Housing Information
# of children aged (0-3) years: 172
# of children enrolled in Women Infant and Children (WIC): 133
Size of neighborhood: 0.4 sq. mile
Total # of residential parcels: 187
# of Pre 1978 residential parcels: 133

Community Information
Organizations:
1. Atlanta Downtown Neighborhood Assoc.
2. Central Atlanta Neighbors
# of Pediatricians: 2
# of Family Practitioners: 1
Strengths and Limitations

• Strengths
  – Use of tax parcel data enables accurate assessment of housing risk
  – Smaller geographic units recognized by residents, such as neighborhoods, are better suited for outreach

• Limitations
  – Datasets used in our analyses used data covering different times
Next Steps

• Assess testing among children enrolled in Medicaid
• Reducing error in area-weighted analysis by using advanced GIS techniques.
• Translate methods of this study into a statewide effort
Conclusion

There is a need to increase testing of children living in old housing and in poor families.
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