Does Living in a Food Desert Increase the Risk of Elevated Blood Lead Levels from Housing-Based Exposures?

A Census Tract Level Analysis

Background

- Lead becomes toxic when it is used by humans in more concentrated forms.¹
- The most common exposure to lead is through paint, dust, and soil originating from housing built prior to 1980.²
- In children, blood lead levels below 5 μg/dL have been associated with developmental delays, behavioral issues, and difficulty learning.³
- Because nutritional deficiencies can increase the absorption of ingested lead, lead’s toxicity may be amplified for children living in areas classified as food deserts.³

Objective

- Examine whether living in a tract designated as a food desert magnifies the relationship between pre-1980 housing and elevated blood lead levels (EBLL) among South Carolina children <6 years of age.

Methods

- We linked aggregate BLL data (SC Department of Health and Environmental Control) to census tract level data (USDA) on food deserts, housing, SNAP participation, and race (n=990).
- An EBLL was defined as BLL ≥5 μg/dL.
- A Census tract was designated as a “food desert” if it met USDA criteria that incorporated measures of income, access to vehicles, and distance to a food store.
- Multivariable linear regression models stratified by food desert classifications were used to assess the relationship between percent pre-1980 housing and percent EBLL by tract.
- Subsequent models were examined that used alternate criteria for identifying food deserts.

Results

Table 1: Food Desert Classification by Census Tract

<table>
<thead>
<tr>
<th>FD Measure #0</th>
<th>Yes</th>
<th>No</th>
<th>1 mile urban, 10 miles rural</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD Measure #1</td>
<td>Yes</td>
<td>No</td>
<td>1/2 mile urban, 10 miles rural</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FD Measure #2</td>
<td>Yes</td>
<td>No</td>
<td>1 mile urban, 20 miles rural</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>FD Measure #3</td>
<td>Yes</td>
<td>Yes</td>
<td>20 miles without a vehicle</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FD Measure #9</td>
<td>No</td>
<td>No</td>
<td>20 miles without a vehicle</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>FD Measure #11</td>
<td>No</td>
<td>Yes</td>
<td>20 miles rural without a vehicle</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 2: Multiple Regression Model (FD Measure #3)

<table>
<thead>
<tr>
<th>Food Desert Measure #3</th>
<th>Percent of Homes Built Prior to 1980</th>
<th>Percent of Households Receiving SNAP</th>
<th>Percent of Population non-Hispanic black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Desert</td>
<td>0.0404024</td>
<td>0.0148</td>
<td>0.02833837</td>
</tr>
<tr>
<td>Not a Food Desert</td>
<td>0.0199053</td>
<td>0.0031</td>
<td>0.01126147</td>
</tr>
</tbody>
</table>

- Where many of the Census tracts are boldly outlined, indicating that the tract is classified as a food desert, the color of the tract is a darker blue, showing that the tract also has a higher percent of the population with EBLL.

Results Continued

- Food desert measure #3 was judged to be the best classification system due to its inclusion of income, vehicle possession, and distance factors.
- Food deserts identified using food desert measure #3 had a higher mean percentage of children with EBLL (3.8% vs. 2.6%, p<0.001).
- For food deserts identified using food desert measure #3, the association between pre-1980 housing and percent EBLL was of greater magnitude than for non-food deserts (β=0.020, p=0.003).
- Living in a food desert did not increase the strength of the relationship when the food desert measure defined access as a distance of >20 miles in rural areas without accounting for vehicle access.

Conclusions

- These analyses provide preliminary evidence of increased risk for EBLL among children living in Census tracts with both high levels of pre-1980 housing and a high proportion of residents with limited access to healthy foods. Future analyses that incorporate individual level data and measure distance from a child’s residence to the nearest healthy food store may be warranted to corroborate these findings.

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References


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Acknowledgements

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