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

A Census Tract Level Analysis

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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.[2]
- 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.

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Results

### Table 1: Food Desert Classification by Census Tract

	Takes Low Income into Consideration	Uses Vehicle Possession for Access	Distance Set for Access Measure	Food Desert Amplified the Relationship (Simple Regression)	Food Desert Amplified the Relationship (Multiple Regression)
FD Measure #0	Yes	No	1 mile urban, 10 miles rural	Yes	Yes
FD Measure #1	Yes	No	½ mile urban, 10 miles rural	Yes	Yes
FD Measure #2	Yes	No	1 mile urban, 20 miles rural	Yes	No
FD Measure #3	Yes	Yes	20 miles without a vehicle	Yes	Yes
FD Measure #9	No	No	20 miles	No	No
FD Measure #11	No	Yes	20 miles rural without a vehicle	Yes	Yes

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

Food Desert Measure #3	Percent of Homes Built Prior to 1980		Percent of Households Receiving SNAP		Percent of Population non-Hispanic black	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Food Desert	0.0404024	0.0148	-0.02833837	0.4483	0.0216016	0.1426
Not a Food Desert	0.0199053	0.0031	0.01126147	0.5827	0.0062375	0.5018

Image 1: A Map Showing the Relationship Between EBLL and Census Tracts

- 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.
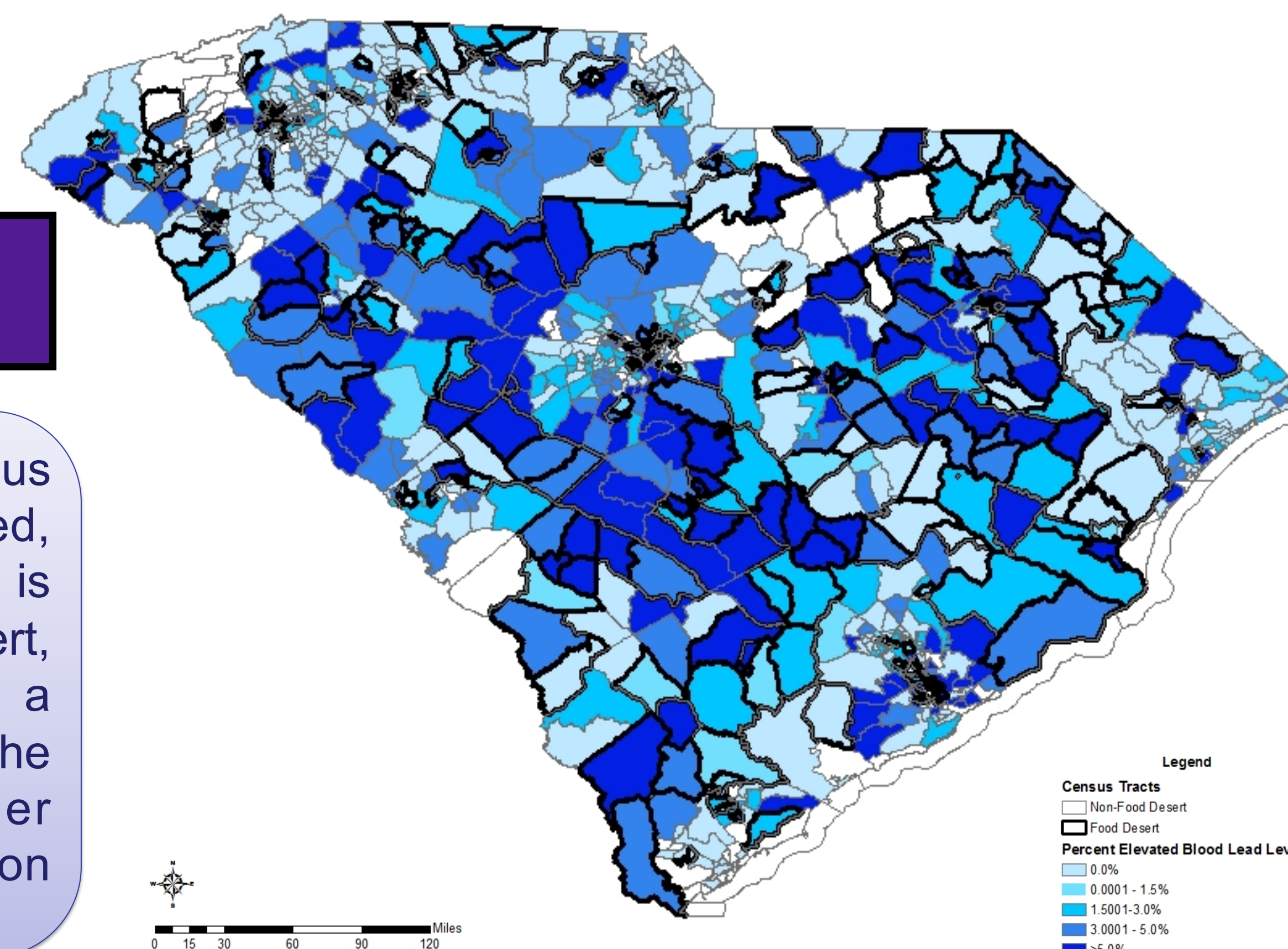
Results Continued

- 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.

Acknowledgements

References

1. Meyer, Pamala A., McGeehin, Michael A., and Falk, Henry: A Global Approach to Childhood Lead Poisoning Prevention. Int. J. Hyg. Environ. Health. 206, 363-9 (2003).
2. Keeshan, Britton, Avener, Catherine, Abramson, Amanda, et. al: Barriers to Pediatric Lead Screening: Implications from a Web-Based Survey of Vermont Pediatricians. Clinical Pediatrics. 49(7), 656-663 (2010).
3. Mahaffey, Kathryn R.: Nutritional Factors and Susceptibility to Lead Toxicity. Environ. Health Perspect. 107-112. (1974).

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