

Evaluating Housing Characteristics Associated with Childhood Lead Poisoning in Providence, Rhode Island

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OBJECTIVE

This research aims to take an in-depth look into the housing characteristics associated with the likelihood of Providence children having elevated blood lead levels (BLL). Specifically, we examine owner-occupied status, the number of properties a landlord owns, type of property, and neighborhood.

BACKGROUND

- Although it has decreased over the years, childhood lead poisoning is still prevalent within Providence, Rhode Island.
- The Lead Hazard Mitigation Law was enacted in 2005 as a primary prevention effort against lead exposure.
- Past research has shown properties in Providence that are exempt, owner-occupied, or single-family homes have children with lower BLLs.
- It is essential to understand where children continue to be exposed to lead.

METHODS

- List of property owners was obtained from the 2019 Property Tax Assessor's dataset from the City of Providence.
- All blood lead tests were received from the Lead Elimination Surveillance System maintained by the Rhode Island Department of Health.
- For children with more than one test result (i.e., test results in multiple years), the most recent test result was retained.
- Properties were categorized into four categories: single family, 2-5 family, apartment building, other.
- Other category included types such as condo, combination, and miscellaneous.
- The child's address at the time of testing was geocoded and spatially joined to the geocoded properties in the Property Tax Assessor's dataset and a file identifying neighborhood boundaries in Providence using ArcGIS 10.7.
- Multivariate logistic regression models were used to assess the relationship between having an elevated BLL and property type, the number of properties owned, and owner-occupancy.

Table 1. Characteristics of Providence children with elevated blood lead levels (BLLs)

	Total (N=9509) N (%)	BLL ≥ 5µg/dL (N=433) N (%)	BLL < 5µg/dL (N=9076) N (%)	p-value
CHILD CHARACTERISTICS				
Sex				0.4328
Female	4698 (49.42)	206 (47.58)	4492 (49.50)	
Male	4809 (50.58)	227 (52.42)	4582 (50.50)	
Test Method				0.7607
Capillary	941 (9.9)	41 (9.47)	900 (9.92)	
Venous	8568 (90.10)	392 (90.53)	8176 (90.08)	
Age (months)				<0.001
0-12	1418 (14.92)	45 (10.39)	1373 (15.13)	
13-24	1991 (20.94)	130 (30.02)	1861 (20.51)	
25-36	1822 (19.17)	89 (20.55)	1733 (19.10)	
37-48	1289 (13.56)	65 (15.01)	1224 (13.49)	
49-60	1577 (16.59)	52 (12.01)	1525 (16.81)	
61-72	1409 (14.82)	52 (12.01)	1357 (14.96)	
HOUSING CHARACTERISTICS				
Owner-Occupied				0.6492
Yes	5654 (59.46)	262 (60.51)	5392 (59.41)	
No	3855 (40.54)	171 (39.49)	3684 (40.59)	
Property Type				0.1935
Single Family	1155 (12.15)	28 (6.47)	738 (8.13)	
2-5 Family	7289 (76.65)	350 (80.83)	6939 (76.45)	
Apartment Building	299 (3.14)	13 (3.00)	286 (3.15)	
Other	766 (8.06)	42 (9.70)	1113 (12.26)	
Number of Properties Owned by Landlord				0.0105
1	6692 (70.38)	317 (73.21)	6375 (70.24)	
2-3	1581 (16.62)	80 (18.48)	1501 (16.54)	
4+	1236 (13)	36 (8.31)	1200 (13.22)	

Table 2. Logistic regression models of factors associated with elevated blood lead levels (≥ 5µg/dL) for children living in Providence, RI, 2017-2019

	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
CHILD CHARACTERISTICS		
Sex		
Female	0.93 (0.76, 1.12)	0.93 (0.76, 1.12)
Male	1.00	1.00
Test Method		
Capillary	1.00	1.00
Venous	1.05 (0.76, 1.46)	1.02 (0.73, 1.42)
Age (months)		
0-12	0.86 (0.57, 1.28)	0.85 (0.56, 1.27)
13-24	1.82 (1.31, 2.53)	1.81 (1.30, 2.51)
25-36	1.34 (0.95, 1.90)	1.34 (0.94, 1.89)
37-48	1.39 (0.96, 2.01)	1.37 (0.95, 1.99)
49-60	0.89 (0.60, 1.32)	0.87 (0.59, 1.29)
61-72	1.00	1.00
HOUSING CHARACTERISTICS		
Owner-Occupied		
Yes	1.00	1.00
No	0.96 (0.78, 1.16)	1.09 (0.86, 1.38)
Property Type		
Single Family	1.00	1.00
Apartment Building	1.20 (0.61, 2.35)	1.23 (0.62, 2.44)
2-5 Family	1.33 (0.89, 1.97)	1.37 (0.92, 2.03)
Other	0.99 (0.61, 1.62)	1.16 (0.76, 1.12)
Number of Properties Owned by Landlord		
1	1.00	1.00
2-3	1.07 (0.83, 1.38)	1.03 (0.78, 1.35)
4+	0.60 (0.43, 0.86)	0.59 (0.39, 0.89)

RESULTS

- Compared to children who lived in properties with landlords who owned only one property, children who lived in properties with landlords who owned four or more properties were less likely to have elevated BLLs.
- There was no significant association between owner-occupancy status or property type with children having elevated BLLs.
- The highest lead exposure rates were found in Blackstone, Mount Hope, Federal Hill, West End, Upper South Providence, Elmwood, and South Elmwood, with 5% or more of children tested having an elevated BLL.
- The lowest rates were found in Manton, Downtown, and Hope, with less than 2% of children tested having an elevated BLL.

CONCLUSION

- Findings suggest the current lead legislation has some impact, but public health efforts should address lead exposure in owner-occupied properties that are currently exempt from complying with the law.

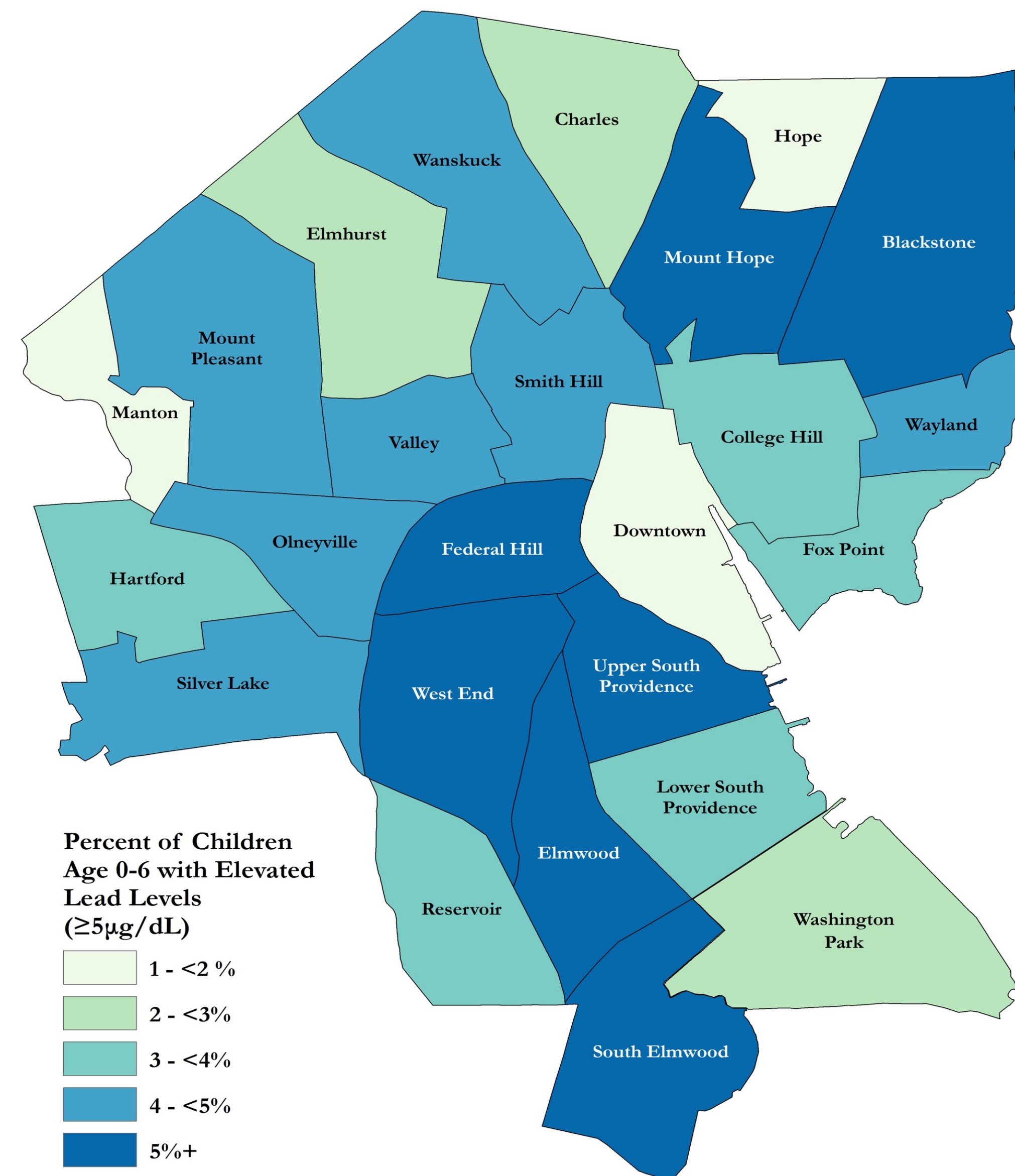


Figure 1. Percentage of children with elevated BLLs in each neighborhood in Providence