TRACK IT.
MAP IT.
USE IT.
SC Environmental Public Health Tracking

South Carolina
Environmental Public Health Tracking Program
Putting Tracking to Work for You

Demographic Risk Factors Associated with Blood Lead Levels in South Carolina Children (2010-2014)

Due to the well-documented health effects of lead exposure, leaded gasoline and lead-based paints were phased out. However, childhood lead exposure remains an issue due to its longevity in the environment. The objective of this analysis was to examine associations in blood lead levels (BLL) and demographics.

Introduction

Lead is a naturally occurring element. However, historic (e.g., leaded gasoline, lead-based paints) and present (e.g., industrial processes) anthropogenic use of lead can lead to exposure and cause a variety of permanent health effects including learning difficulties, stunted growth, behavioral issues and premature death in children if exposed. In response to studies that demonstrated BLL below 10 µg/dL can cause negative health effects, the CDC lowered the reference value for elevated blood lead levels (EBLL) in children from 10 to 5 µg/dL in 2012. In 2013, the Centers for Disease Control and Prevention (CDC) reported that an estimated 535,000 children aged 1-5 had BLL ≥5 µg/dL in the United States (US).

Recognizing the health risks associated with lead exposure, the South Carolina Environmental Public Health Tracking (SC EPHT) Program partnered with the South Carolina Department of Health and Environmental Control (DHEC) Bureau of Maternal and Child Health in 2009 to track BLL and promote awareness and prevention of childhood lead exposure. SC EPHT tracks childhood BLL in SC residents below age 16.

The objective of this study was to examine associations between childhood BLL and US Census 2010 demographic variables in order to more accurately identify areas and populations at a higher risk to lead exposure.

Methods

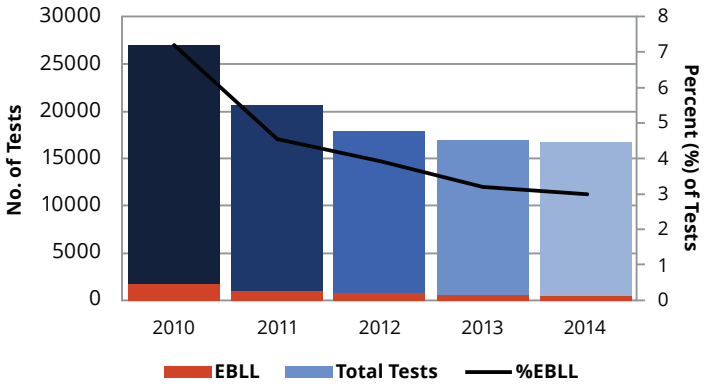
By law, blood lead records are reportable to DHEC. The total sample consisted of BLL records from 94,760 unique children aged 0 to 10 years. Demographics (gender, race and ethnicity) from BLL records were compiled. US Census 2010 demographics at the block group level were also obtained for race/ethnicity, own/rent home, urban/rural setting, poverty level, median income level, limited English speaking, education level and median year homes built. All US Census demographics were measured in percent, except for median year home built and median income level. Children were also categorized by their BLL. Children with a BLL ≥5 µg/dL were categorized as having EBLL; children with BLL <5 µg/dL were categorized as non-EBLL.

The geocoded address points for each BLL record were spatially joined to SC US Census 2010 block groups to link each record to the block group in which it was located. SAS Version 9.2 was used to examine associations between BLL and block group demographics in crude models. Demographics were also compared between children with EBLL and those with non-EBLL. A p-value of <0.05 was used to determine statistical significance.

Results

The number of children tested has been declining over time, and the number and percent of EBLL has also decreased. And for each consecutive year, the mean BLL was significantly lower. In reference to 2014, 2010 had a mean BLL of 2.2 µg/dL, 2011 was 1.9 µg/dL, 2012 was 1.8 µg/dL, and 2013 was 1.6 µg/dL (Figure 1).

Figure 1. Total SC children tested and number and percent of elevated cases (≥5 µg/dL).



In the records examined, significantly higher mean BLL were found for males (1.9 µg/dL; $p < 0.0001$) as compared to females (1.8 µg/dL), and for both non-Hispanic blacks (2.0 µg/dL; $p < 0.0001$) and Hispanics (2.1 µg/dL; $p = 0.0013$), as compared to non-Hispanic whites (1.7 µg/dL). This was in spite of there being a high percentage (47%) of records with unknown race in the sample; these unknowns were excluded for the race comparison.

The crude analysis also showed that block groups with older homes (built 1950-1978) had significantly higher mean BLL (2.0 µg/dL; $p < 0.0001$) in relation to block groups with post-1978 houses (1.7 µg/dL), and records from block groups with homes built before 1950 had the highest mean BLL (2.6 µg/dL; $p < 0.0001$) of home age categories.

Table 1. Mean BLL and US Census 2010 block group demographics for those with EBLL and those without (all p-values <0.0001).

Variable	EBLL Mean[a]	Non-EBLL Mean	p-value
Lead Value (µg/dL)	7.4	1.6	p<0.0001
Below Poverty (%)	22.2%	19.8%	p<0.0001
Rent Home (%)	39.3%	37.1%	p<0.0001
Median Income (USD)	$36,442	$39,777	p<0.0001
Less Education (%)[b]	21.1%	19.2%	p<0.0001
Non-Hispanic White (%)	48.0%	53.4%	p<0.0001
Non-Hispanic Black (%)	46.0%	39.7%	p<0.0001
Median Year Built (year)	1976	1980	p<0.0001
Rural Setting (%)[c]	36.3%	32.7%	p<0.0001

[a] *EBLL = BLL ≥5 µg/dL*
[b] *Less than a high school diploma*
[c] *Rural Setting – encompasses all population, housing, and territory not included within an urban area*

Block groups with EBLL records had a significantly higher percentage of the population below the poverty line, renting their homes, less than a high school diploma, predominately non-Hispanic blacks, lower median income, lower median age of homes and more people living in a rural setting (Table 1).

Conclusions

There were two common record level demographic risk factors identified for higher BLL in children: race/ethnicity (non-Hispanic blacks and Hispanic) and gender (male). For Census block group variables, children with EBLL were more likely to live in block groups that were predominately non-Hispanic blacks and that generally had lower income, lower education and older homes. These findings were consistent with the CDC (2013).

While the percent of EBLL in South Carolina has been declining in recent years, there is still no safe level of lead exposure for children. Testing children for lead exposure may occur for several reasons, such as Medicaid requirements and suspected exposure from a parent's occupation. But no matter the cause of exposure, SC law requires all blood testing results to be reported to DHEC, which allows for documentation of childhood lead exposure throughout the state. However, missing information such as demographics, addresses and inaccurate test values can prevent inclusion of data in further research and analysis. Further examination of data used in this study, as well as other SC EPHT data (e.g., childhood lead birth cohorts), and examining differences in other demographics throughout South Carolina will facilitate efforts to more accurately define areas and populations at a higher risk of lead exposure in the hopes of more focused educational or remediation efforts.

For additional information about this fact sheet, please contact H. Reed Corley of the SC EPHT Program at corleyhr@dhec.sc.gov or (803) 898-1422.

References

Centers for Disease Control and Prevention (CDC). "Childhood Lead Poisoning: Exposure and Risk." Last modified on September 5, 2013. <http://ephtracking.cdc.gov/showChildhoodLeadRisk.action>.

More Information

CDC's Lead Home Page (CDC)

EPA's Lead Home Page (EPA)

dhec
Healthy People. Healthy Communities.