



## Technical Appendix. Tool for Identifying High-Risk ZIP Codes for Childhood Lead Exposure

The Children's Environmental Health Initiative (CEHI) partnered with the North Carolina Childhood Lead Poisoning Prevention Program (NCCLPP) to develop a model using aggregated blood lead level (BLL) and publicly available Census data to identify high-risk ZIP codes.

### Knowledge You'll Need:

- Basic knowledge of any statistical software program (e.g., SAS, R, STATA)
- Understanding of distributions of data (e.g., normal vs skewed)
- Ability to run a simple multivariable linear regression model

### Getting Started: Gathering and Preparing the Data

- *Census data for elevated BLL (eBLL) risk factors by ZCTA*

- % non-Hispanic Black, % Hispanic
- Median Household Income
- % of Housing Built Before 1940
- % of Housing Built 1940-1979

- *Blood Lead Data*

- **Combine 2-5 years of your health**

**department's individual-level BLL testing data.** Including several years of data is especially important for areas with a smaller population.

- **Check the distribution of your BLL data.** The distribution of BLL values is often skewed to lower values. Apply a log transformation to obtain log normalized BLLs.

- **Obtain log normalized BLLs for each ZIP code.** Aggregate the log normalized BLLs to the ZIP code level.

- **Assign a ZCTA to each ZIP code using the crosswalk file.**<sup>1</sup> Then, you will have log normalized BLLs by ZCTA.

- *Link the Census data and the Blood Lead data by ZCTA*

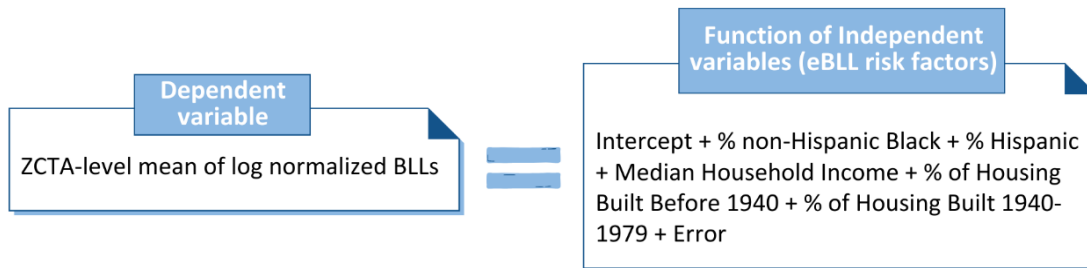
**What is a ZIP Code Tabulation Area (ZCTA)?**

ZIP Codes: US Postal Service; ZCTAs: US Census

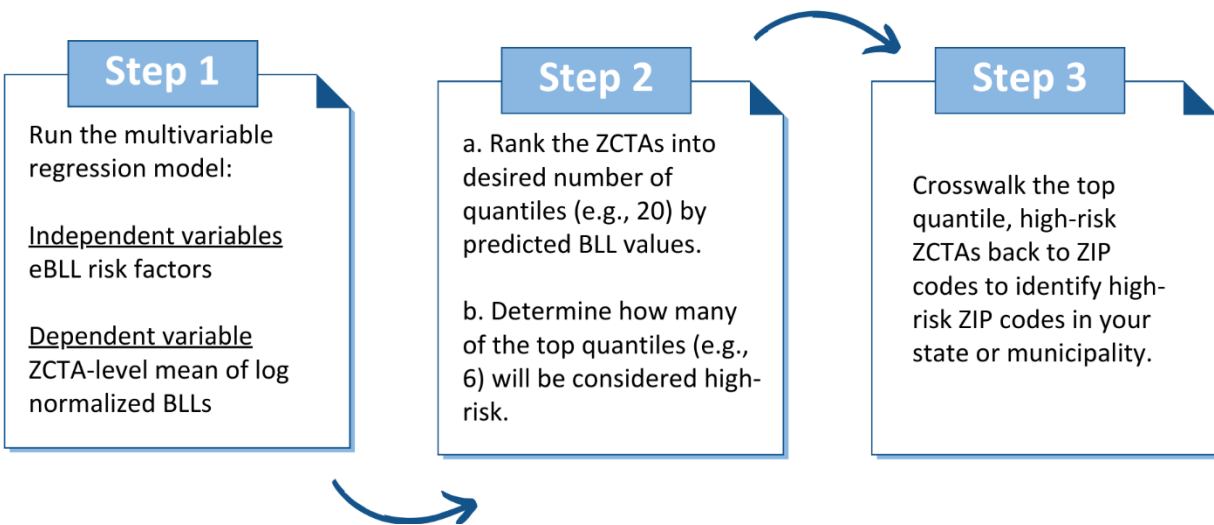
In most cases, ZCTAs and ZIP codes are the same for a given address. The U.S. Census Bureau assigns the most frequently occurring ZIP code in a census block to that entire block. Then, census blocks are aggregated by code to create ZCTAs.

### Running the Analysis: Identifying High-Risk ZIP codes in Your State, County, or Municipality

*Regression Model:*



<sup>1</sup> HUD USPS ZIP Code Crosswalk Files. Office of Policy Development and Research (PD&R). URL: [https://www.huduser.gov/portal/datasets/usps\\_crosswalk.html](https://www.huduser.gov/portal/datasets/usps_crosswalk.html)



### How to Use this Information on High-Risk Zip Codes to Address Childhood Lead Exposure

- *What to do after you identify high-risk zip codes:*
  - Target universal blood lead testing efforts in those ZIP codes.
  - Publish rankings in a format that is accessible to community groups and clinicians.
- *Considerations for selecting appropriate cut-off quantiles for high-risk zip codes:*
  - **Start with the data.** In the paper published in NCMJ<sup>2</sup>, we organized the ZCTAs into 20 quantiles. Then, we identified the first six (of 20) quantiles as high-risk areas, with the help of a statistical test.
    - Use a contingency table to determine the frequency of eBLLs in each quantile.
    - Run a Chi-Square Test of Independence and request cell Chi-square values, to identify quantiles where the observed number of eBLLs is significantly greater than the expected number of eBLLs.
    - We found significant differences in the top 6 quantiles and designated these as high-risk.
  - **Consult with your colleagues.** Larger groupings can help visualize overall trends across your jurisdiction (e.g., entire county or state).
    - In prior work with NCCLPP, we developed the “10-10-40-40” display structure (top 10%, 10-20%, 20-60%, and 60-100%) through conversations with health and housing department staff on how best to present results.
  - **For local health departments,** it may be helpful to look across the 20 quantiles in your state to detect smaller groupings of high-risk ZIP codes in your county or community.

<sup>2</sup> Callender R, Avendano C, Bravo MA, Tootoo J, Norman E, Miranda ML. Identifying High-Risk ZIP Codes for Childhood Lead Exposure: A Statewide ZCTA-Level Priority List for North Carolina. North Carolina Medical Journal. 2024;85(2). doi:10.18043/001c.94878.

**NC Case Study: High-Risk ZIP Code Maps with Different Options for Classifying Zip Codes**

