Exploring the Relationship Between Child Opportunity and Violent Crime Rates in West Virginia Counties

Brent D. Mast
U.S. Department of Housing and Urban Development

Tricia Ruiz
U.S. Department of Housing and Urban Development

Introduction

The relationship between childhood development and neighborhood quality has important implications in terms of physical and behavioral well-being and long-term socioeconomic outcomes (Acevedo-Garcia et al., 2020; Chetty et al., 2018). One aspect of neighborhood quality can be measured with crime rates. Exposure to violent crime has been associated with child health across multiple dimensions, such as chronic physical conditions, developmental disorders, and mental health (American Public Health Association, 2018; Jackson, Posick, and Vaughn, 2019). Violent crime is known to have geographically concentrated patterns, and exposure to violent crime affects the health of victims, their families, and their communities (Sackett, 2016).

This report analyzes the relationship between child opportunity and violent crime using a geographic case study of counties in West Virginia. It is the authors' understanding that this is the first study to conduct an analysis using these two measures: correlation analysis and mapping. This combination contributes to broader discussions about the effects of local crime on children and also illustrates how the less-common analytical tool of bivariate mapping may be useful in future research.

Data

For this study, child opportunity was measured with Child Opportunity Index (COI) 2.0 data. Specifically, this study uses the COI 2.0 national Z-score for 2015. The COI 2.0 is a composite measure that includes resources and conditions related to children's health development and is tabulated at the Census tract level.[1]

The COI 2.0 includes 29 indicators, including access and quality of early childhood education, school poverty rates, health insurance coverage, access to green space and healthy food, exposure to toxins, and socioeconomic measures including poverty rate, household income, homeownership rates, and high-skill employment rates (Noelke et al., 2020).[2]

Because the COI does not include measures of crime, the study used violent crime rate (VCR) data from the Federal Bureau of Investigation Uniform Crime Reports (UCR) for 2014, which were taken from the National Neighborhood Data Archive (2020). The crime rates represent the number of incidents per 10,000 population in 51 counties in West Virginia for which data were available.

In the next section, the authors describe the data and present summary statistics and Pearson correlation coefficients. The data visualization, using bivariate choropleth maps, is presented in the following section. Concluding remarks are presented in the final section.

Summary Statistics and Correlation Analysis

Summary statistics are reported in exhibit 1. The COI 2.0 national Z-scores range from -.057 to .017, indicating a fairly wide range across West Virginia counties. Because the index is a Z-score, the mean and median are both very close to zero. Violent crime rates also have a wide range, varying from around 2 to 388, with a mean of about 40 and a median approximately equal to 23.

Exhibit 1

Descriptive Statistics

Variable	N	Mean	StdDev	Min	Median	Max
COI 2.0 national Z-score	55	− 0.015	0.015	-0.057	− 0.013	0.017
Violent crime rate	51	39.907	56.787	2.358	22.686	388.350

COI = Child Opportunity Index. Max= maximum. Min =minimum. StdDev = standard deviation.
Sources: COI 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

Pearson correlation coefficients and p-values are reported in exhibit 2. The correlation coefficient between the COI 2.0 national Z-score and the VCR is -.196, but it is not statistically significant at the .10 level. This statistic indicates little relationship between the COI 2.0 index and the violent crime rate.

---

[1] The authors aggregated the COI 2.0 index to the county level by taking a weighted mean, where the weight was child population.

[2] The data for COI 2.0 were developed by researchers at Brandeis University, Waltham, Massachusetts, and are available at data.diversitydatakids.org/.

Exhibit 2

Pearson Correlation Coefficients

Variable	N	Pearson Correlation Coefficient	P-value
		COI 2.0 national Z-score	Violent crime rate
COI 2.0 national Z-score	55	1	
Violent crime rate	51	− 0.196	0.168

COI = Child Opportunity Index.
Sources: COI 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

Data Visualization

Choropleth maps typically display one variable using colors or shades to illustrate geographical patterns and differences between spatial units, such as counties or neighborhoods. However, comparing more than one variable at a time can be difficult. The authors overcame this limitation by displaying the COI 2.0 index and the VCR as a bivariate choropleth map to allow the map reader to analyze two variables in the same map. This method allows the map reader to visualize the spatial patterns of one variable compared with the other.

The child opportunity index and violent crime rate were mapped using tertiles to categorize each measure. Each category contained one-third of all counties, ranked as low, moderate, and high. These findings are detailed in the tables for exhibits 3 and 4. These categories were used to create the maps for exhibit 5 (in color) and exhibit 6 (in black and white). Exhibit 6 provides the same visualization as exhibit 5 but is in black and white, with three shades of gray for the child opportunity index and different patterns of dots, hatch-marks, and cross-hatch marks for levels of violent crime.

Exhibit 3

Categories for Child Opportunity Index in West Virginia (Total Number of Counties: 55)

Category	Number of Counties	Minimum	Maximum
Low	18	− 0.0573	− 0.0205
Moderate	18	− 0.0199	− 0.0074
High	19	− 0.0073	0.0172
No Data Available	0	NA	NA

Sources: Authors' calculations of data from Child Opportunity Index 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

Exhibit 4

Categories for Violent Crime Data in West Virginia (Total Number of Counties: 55)

Category	Number of Counties	Minimum	Maximum
Low	17	2.3584	18.5992
Moderate	17	18.9415	31.5259
High	17	38.9964	388.3495
No Data Available	4	NA	NA

Sources: Authors' calculations of data from Child Opportunity Index 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

In the map legend in exhibit 5, the rankings for COI are displayed vertically, with low at the bottom and high at the top of the legend. For VCR, the rankings can be read from left to right, with low levels on the left-hand side and highest on the right side. Both measures converge to create nine different categories: low COI-low VCR, low COI-moderate VCR, low COI-high VCR, moderate COI-low VCR, moderate COI-moderate VCR, moderate COI-high VCR, high COI-low VCR, high COI-moderate VCR, and high COI-high VCR.
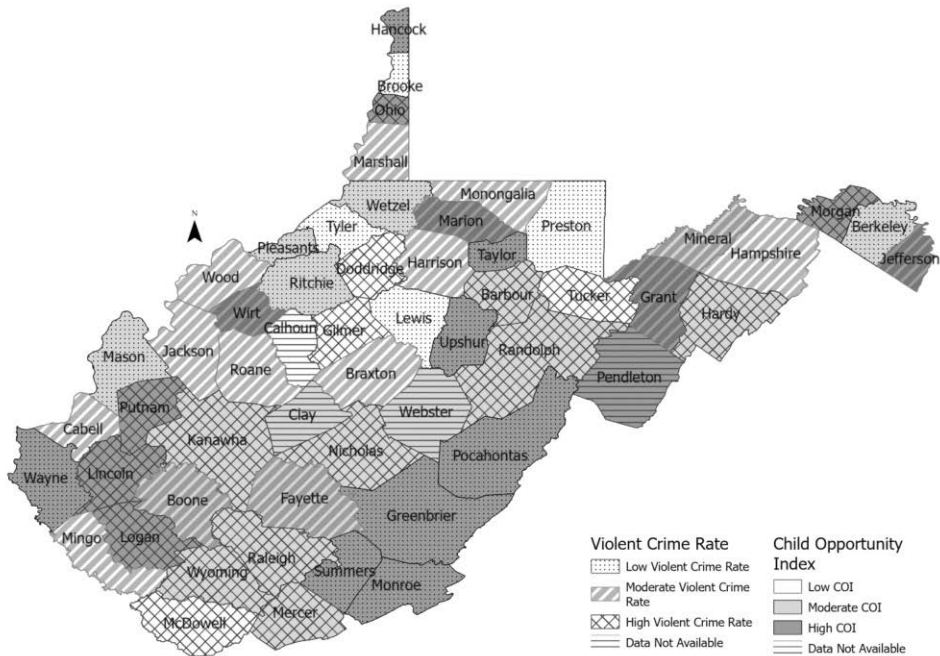
Exhibit 5

Bivariate Choropleth Map (in color) of Child Opportunity Index (COI) and Violent Crime Rate in West Virginia
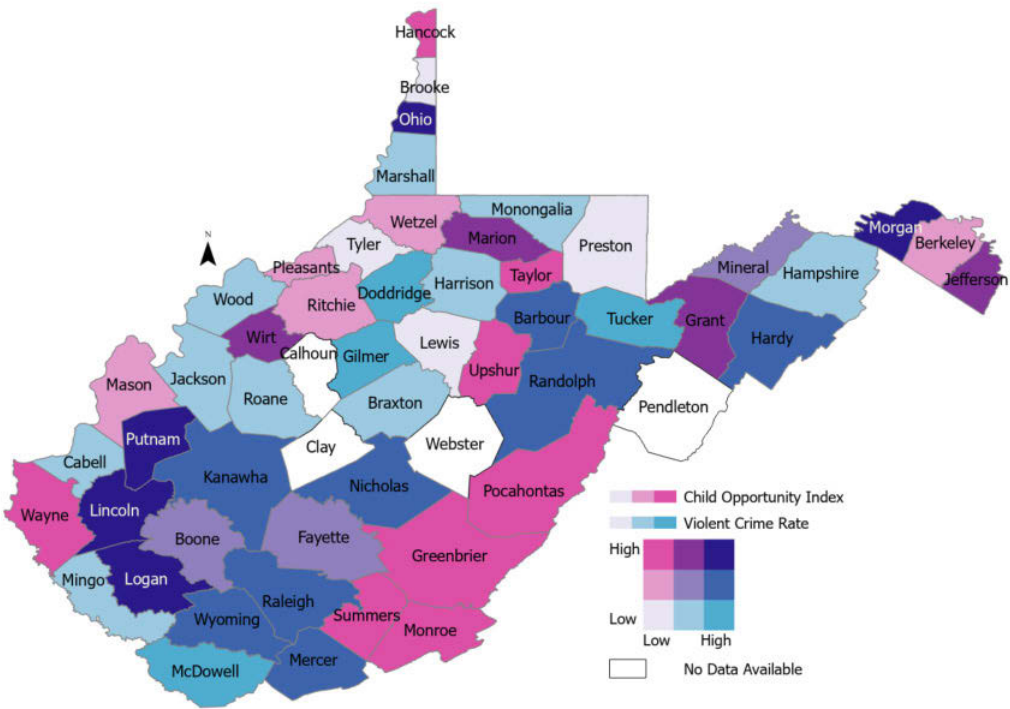
Sources: Authors' calculations of data from COI 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

Exhibit 6

Bivariate Choropleth Map (in black and white) of Child Opportunity Index (COI) and Violent Crime Rate in West Virginia

Sources: Authors' calculations of data from COI 2.0, 2015; Federal Bureau of Investigation Uniform Crime Reports, 2014

Exhibits 5 and 6 illustrate that five counties had a combination of high COI and high VCR. These counties include the three contiguous counties of Putnam, Lincoln, and Logan, in addition to Ohio and Morgan counties. In contrast, Tyler, Preston, and Lewis counties had low COI and low VCR.

Because of the wide variation across these counties, these maps support what was learned from the correlation analysis—there does not appear to be a distinct association between the child opportunity index and violent crime rate in West Virginia at the county level.

Discussion

Violent crime is one component of neighborhood characteristics that affect childhood development. Although the COI is a useful composite measure that includes a broad array of resources and conditions related to child development, it does not include a measure for crime. This analysis looked at the COI combined with county-level measures of violent crime; however, it did not find a strong correlation between the two.

For example, based on the known harmful effects of violent crime on childhood development, it could be expected that there would be an inverse relationship. Areas with high rates of violent crime would also be areas with low childhood opportunity. However, there was not an

overwhelming number of these low COI-high VCR counties. In these maps, only McDowell, Gilmer, Doddridge, and Tucker counties (4 out of the 55 counties) fall into this category.

This finding does not suggest that there is no connection between violent crime and childhood opportunity, which is a complex, multilevel relationship that includes measures beyond the scope of this analysis. However, the findings do indicate a relatively weak relationship between the COI 2.0 index and violent crime rates at the county level in West Virginia. Therefore, because the COI 2.0 index does not include a measure of exposure to violent crime,[3] it would be worth continuing to explore additional measures that include this important aspect of child opportunity, including evaluating other geographies and/or spatial units.

Authors

Brent D. Mast is a social science analyst at HUD's office of Policy Development and Research. Tricia Ruiz is a geographer at HUD's office of Fair Housing and Equal Opportunity.

References

Acevedo-Garcia, Dolores, Clemens Noelke, Nancy McArdle, Nomi Sofer, Nick Huntington, Erin Hardy, Rebecca Huber, Mikyung Baek, and Jason Reece. 2020. "The Geography of Child Opportunity: Why Neighborhoods Matter for Equity, First Findings from the Child Opportunity Index 2.0." https://www.diversitydatakids.org/research-library/research-report/geography-child-opportunity-why-neighborhoods-matter-equity.

American Public Health Association. 2018. "Violence is a Public Health Issue: Public Health is Essential to Understanding and Treating Violence in the U.S." https://apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2019/01/28/violence-is-a-public-health-issue.

Chetty, Raj, John N. Friedman, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. 2018. The Opportunity Atlas: Mapping the Childhood Roots of Social Mobility. Working paper 18–42. Center for Economic Studies: U.S. Census Bureau. https://opportunityinsights.org/wp-content/uploads/2018/10/atlas_paper.pdf.

Diversitydatakids.org. n.d."COI 2.0 Index Data—Child Opportunity Levels, Scores and Averaged z-Scores for the Overall Index and Three Domains" https://data.diversitydatakids.org/dataset/coi20-child-opportunity-index-2-0-database/resource/080cfe52-90aa-4925-beaa-90efb04ab7fb.

Jackson, Dylan, Chad Posick, and Michael G. Vaughn. 2019. "New Evidence Of The Nexus Between Neighborhood Violence, Perceptions Of Danger, And Child Health," *Health Affairs* 38 (5): 746–754.

---

[3] The researchers have noted that this issue is a limitation in their methodology and that it is important to include measures of violent crime, but they could not acquire neighborhood-level data at the time the data were compiled (Noelke et.al., 2020).

National Neighborhood Data Archive: Crimes by County, 2002–2014. Last updated 1/21/2020. Downloaded from the International Consortium for Political and Social Research (ICPSR) at the University of Michigan. https://www.icpsr.umich.edu/web/ICPSR/studies/38649/versions/V1.

Noelke, C., N. McArdle, M. Baek, N. Huntington, R. Huber, E. Hardy, and D. Acevedo-Garcia. 2020. Child Opportunity Index 2.0 Technical Documentation. https://www.diversitydatakids.org/sites/default/files/2020-02/ddk_coi2.0_technical_documentation_20200212.pdf.

Sackett, Chase. 2016. "Neighborhoods and Violent Crime," Evidence Matters. https://www.huduser.gov/portal/periodicals/em/summer16/highlight2.html.