Community Poverty and Child Abuse Fatalities in the United States


abstract

BACKGROUND AND OBJECTIVE: Child maltreatment remains a problem in the United States, and individual poverty is a recognized risk factor for abuse. Children in impoverished communities are at risk for negative health outcomes, but the relationship of community poverty to child abuse fatalities is not known. Our objective was to evaluate the association between county poverty concentration and rates of fatal child abuse.

METHODS: This was a retrospective, cross-sectional analysis of child abuse fatalities in US children 0 to 4 years of age from 1999 to 2014 by using the Centers for Disease Control and Prevention Compressed Mortality Files. Population and poverty statistics were obtained from US Census data. National child abuse fatality rates were calculated for each category of community poverty concentration. Multivariate negative binomial regression modeling assessed the relationship between county poverty concentration and child abuse fatalities.

RESULTS: From 1999 to 2014, 11,149 children 0 to 4 years old died of child abuse; 45% (5,053) were <1 year old, 56% (6,283) were boys, and 58% (6,480) were white. The overall rate of fatal child abuse was 3.5 per 100,000 children 0 to 4 years old. In the multivariate model, counties with the highest poverty concentration had >3 times the rate of child abuse fatalities compared with counties with the lowest poverty concentration (adjusted incidence rate ratio, 3.03; 95% confidence interval, 2.4–3.79).

CONCLUSIONS: Higher county poverty concentration is associated with increased rates of child abuse fatalities. This finding should inform public health officials in targeting high-risk areas for interventions and resources.

WHAT’S KNOWN ON THIS SUBJECT: Fatal child abuse remains a substantial problem for young children in this country. Although individual poverty is a well-recognized risk factor for child abuse, the role of community poverty on child abuse fatalities is not well described.

WHAT THIS STUDY ADDS: Using national death certificate data, we noted higher rates of child abuse fatalities in counties with higher concentrations of poverty over 15 years of study. This study can inform public health officials targeting at-risk groups for interventions and resources.
Despite widespread reforms in child welfare practices over recent decades, child maltreatment, including physical, sexual, or emotional abuse and neglect, remains a substantial problem in the United States. In 2014, an estimated 702 000 children <18 years old were abused or neglected.\(^1\)\(^2\) Fatal cases of abuse, although less common, disproportionately affect the youngest children, with 71% of fatalities occurring in those <3 years old.\(^1\) In their 2016 report to Congress, the Commission to Eliminate Child Abuse and Neglect Fatalities presented recommendations, including targeting resources to high-risk populations and calling for improved collection of data for child abuse fatalities.\(^3\)

Individual poverty is a well-known risk factor for child maltreatment, and the role of community-level poverty on nonfatal child maltreatment is becoming better understood.\(^4\)\(^–\)\(^11\) For decades, developmental psychologists have recognized that a child’s community and surrounding economic conditions are part of the macrosystem that affect a child’s growth and development.\(^12\)\(^–\)\(^14\) In 2016, the American Academy of Pediatrics published a policy statement on poverty and child health in the United States and stated that poverty contributes to many child health disparities, including infant mortality, language development, and injury.\(^15\)\(^–\)\(^17\)

Despite the increasing understanding about the role of poverty in child health, including child maltreatment, the relationship between community poverty concentration and fatal child abuse on a national scale is not as well described.\(^16\) As government and child protective agencies strive to target high-risk communities for preventive interventions and resources, understanding community poverty concentration as a risk factor for fatal abuse is critical.\(^17\) Our objective was to analyze the association between community poverty concentration and child abuse fatality rates, and we hypothesized a positive association between county-level poverty concentration and rates of fatal abuse.

**METHODS**

**Study Design and Data Sources**

This is a retrospective, cross-sectional analysis of child abuse fatalities in US children 0 to 4 years old from 1999 to 2014 using mortality data from the Centers for Disease Control and Prevention (CDC) Compressed Mortality Files (CMF), an administrative database maintained by the National Center for Health Statistics (NCHS).\(^18\) The CMF is comprised of death certificate data from 50 states and the District of Columbia. The NCHS calculates mortality statistics for each county. In accordance with World Health Organization regulations, NCHS classifies cause of death according to the International Classification of Diseases, Tenth Revision (ICD-10) and reports deaths annually.\(^18\) Population statistics and poverty data, reported as the percent of the population living below the federally defined poverty threshold, were obtained from the US Census Bureau.\(^19\) Because the study included only fatalities, it did not meet the definition of human subjects research and was deemed exempt from institutional review board approval.

**Study Measures**

The primary study outcome was child abuse fatality rates. A secondary outcome was child abuse fatality rates over time. Deaths due to child abuse were identified within the CMF by external cause of injury codes. The use of the International Classification of Diseases, Ninth Edition (ICD-9), Clinical Modification codes to identify cases of child abuse in administrative data sets has been previously described.\(^7\)\(^–\)\(^20\) Beginning in 1999, the CMF used ICD-10 codes to classify cause of death. The external cause-of-injury mortality matrix, first developed for ICD-9 and modified for ICD-10, reports both mechanism of death and intent (eg, assault/homicide).\(^21\)\(^–\)\(^22\) Therefore, fatalities were identified in the CMF by using the ICD-10 codes for assault, consistent with the previous work to identify child abuse (ICD-10 codes X85–X92, X96–Y09, and Y87.1, which correspond to ICD-9 codes E960–E969).\(^20\) To target the population most at risk for fatal abusive injuries and to avoid including victims of peer violence, the study population was limited to children 0 to 4 years old. National and state fatality rates were calculated as deaths per 100 000 children 0 to 4 years old.\(^19\)

Because our study question explores the association between community poverty and child abuse fatalities, the primary predictor variables were county poverty concentration and year. County poverty concentration, defined as percent of the population living below the federally defined poverty threshold, was categorized into discrete subgroups (0%–4.9%, 5%–9.9%, 10%–14.9%, 15%–19.9%, and ≥20%) based on previously published studies.\(^20\)\(^–\)\(^24\) The federal poverty threshold for a family of 4 was $17 029 in 1999 and was $24 250 in 2014. Fatality rates for each subgroup of counties were calculated as deaths per 100 000 children 0 to 4 years old.

Previous researchers have noted the role of community racial demographics when studying socioeconomic factors and health outcomes. Therefore, racial composition of the county (defined as percent of the county population that is African American) was included as a priori in our analysis.\(^15\)\(^–\)\(^23\)\(^–\)\(^28\) Children of non-white and non-African American races (including Asian or Pacific Islander, American Indian, or
Alaskan Native) comprised only 7% of the population and were included together as “other” races. The CMF began including a variable for Hispanic ethnicity in 1999; however, misclassification for this ethnic group on death certificates has been noted. As a result, this component of race/ethnicity was not included in our analysis.29,30

In addition to the county-level primary predictor variables, we calculated child abuse fatality rates across strata of individual demographic variables (age, race, and sex). When reporting demographics, the race of the individual child (not the racial composition of the county) is reported. The CMF does not include the poverty level of the individual child’s family, thus, individual socioeconomic status is not included in the descriptive demographic results.

Statistical Analysis
We determined frequencies of child abuse deaths among US children 0 to 4 years old and calculated annual rates of child abuse fatalities by individual demographic variable (age, sex, and race) and by community poverty concentration. We performed a multivariate negative binomial regression with fatality rate as the outcome and county poverty concentration as the independent variable, controlling for county racial composition and year. In this model, poverty concentration was modeled with indicator variables by using the categorized subgroups described above, with the lowest poverty concentration category set as the referent. Adjusted incidence rate ratios (aIRR) for each subsequent subgroup of poverty concentration were calculated. Because our goal was to study the association of community-level poverty concentration, our multivariate analysis was focused on community-level variables. Collinearity diagnostics were performed among the variables.

As a secondary analysis, we estimated another negative binomial model with year as a piecewise linear function, with knots placed at 2007 and 2009. This model facilitated comparisons of the slope of child abuse fatality rates for the years before (1999–2007), during (2008–2009), and after (2010–2014) the recent economic recession. All analyses were performed by using Stata 13 (Stata Corp, College Station, TX).

RESULTS
From 1999 to 2014, 11 149 children 0 to 4 years old died of abuse. Infants <12 months old comprise 20% of US children 0 to 4 years old, but represent 45% (5053) of the child abuse deaths (Table 1). African American children 0 to 4 years old, who represent 16% of US children 0 to 4 years old, were disproportionally represented among the fatalities, accounting for 37% (4174) in the child abuse fatality group (Table 1).

The national child abuse fatality rate for the study period was 3.5 deaths per 100 000 children 0 to 4 years old. The fatality rate for children <12 months old was higher at 7.9 deaths per 100 000, compared with the fatality rate for children 1 to 4 years old (2.4/100 000; incidence rate ratio [IRR], 3.3; 95% confidence interval [CI], 3.2–3.4) (Table 1). Boys had a higher fatality rate (3.9/100 000 boys) compared with girls (3.1/100 000 girls; IRR, 1.2; 95% CI, 1.2–1.3). White children had a fatality rate of 2.7 deaths per 100 000 white children. In contrast, for African American children, the child abuse fatality rate was 8.0 deaths per 100 000 African American children (IRR, 3.0; 95% CI, 2.9–3.1).

In counties with the lowest poverty concentration (0%–4.9%), the fatality rate was lowest at 1.3 deaths per 100 000 children. The fatality rate increased with each poverty concentration level. Fatality rates by age, sex, and race of the individual child within each subgroup of community poverty concentration are reported in Table 2. Infants in counties with $\geq$20% poverty concentration were at highest risk of fatal abuse with a fatality rate of 9.6 deaths per 100 000 infants (Table 2). The fatality rate for African American children in the counties with the lowest poverty concentration (5.1/100 000 African American children 0–4 years old) is higher than the fatality rate for white children in areas of highest poverty concentration (3.2/100 000 white children 0–4 years old).

### Table 1 Demographics of US Children and Child Abuse Fatalities, 1999 to 2014

<table>
<thead>
<tr>
<th>Demographics</th>
<th>US Population, N (%)</th>
<th>Child Abuse Deaths, N (%)</th>
<th>Child Abuse Fatality Rates (per 100 000)</th>
<th>Child Abuse Fatality IRR</th>
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<tbody>
<tr>
<td>Total</td>
<td>317 004 331</td>
<td>11 149 (100)</td>
<td>3.5</td>
<td>—</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>63 838 859 (20)</td>
<td>5053 (45)</td>
<td>7.9</td>
<td>3.3</td>
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<tr>
<td>1–4</td>
<td>253 365 472 (80)</td>
<td>6096 (55)</td>
<td>2.4</td>
<td>Reference</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>162 002 938 (51)</td>
<td>6285 (56)</td>
<td>3.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Girl</td>
<td>155 001 355 (49)</td>
<td>4866 (44)</td>
<td>3.1</td>
<td>Reference</td>
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<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>242 603 344 (77)</td>
<td>6480 (58)</td>
<td>2.7</td>
<td>Reference</td>
</tr>
<tr>
<td>African</td>
<td>52 068 751 (16)</td>
<td>4174 (37)</td>
<td>8.0</td>
<td>3.0</td>
</tr>
<tr>
<td>American</td>
<td></td>
<td></td>
<td></td>
<td>2.9–3.1</td>
</tr>
<tr>
<td>Other</td>
<td>22 334 236 (7)</td>
<td>495 (5)</td>
<td>2.2</td>
<td>0.8</td>
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</table>

FATality Rates

<table>
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<tr>
<th>Fatality Rate</th>
<th>95% CI</th>
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<tr>
<td>White</td>
<td>2.4/100 000</td>
</tr>
<tr>
<td>African</td>
<td>3.9/100 000</td>
</tr>
<tr>
<td>White</td>
<td>2.4/100 000</td>
</tr>
<tr>
<td>African</td>
<td>3.9/100 000</td>
</tr>
</tbody>
</table>
County-level poverty concentration across the United States in 2010 as well as the state cumulative child abuse fatality rates from 1999 to 2014 are displayed in Fig 1. Larger areas of high-poverty concentration are noted throughout the Southeast and Southwest. Higher child abuse fatality rates are generally noted in states with higher poverty concentration (Fig 2).

In the multivariate negative binomial regression model, counties with a higher poverty concentration were associated with increased aIRR for fatal child abuse when compared with counties with the lowest poverty concentration level of 0% to 4.9%. Counties with poverty concentration levels of 5% to 9.9% had an aIRR of 1.80 (95% CI, 1.45–2.23) compared with the lowest poverty category. Counties with >10% poverty concentration had more than twice the incidence rate compared with counties in the lowest poverty category. When compared with counties in the lowest poverty category, we had the following results: county poverty concentration, 5% to 9.9%: aIRR, 1.78 (95% CI, 1.42–2.22); 10% to 14.9% poverty concentration: aIRR, 2.68 (95% CI, 2.14–3.33); 15% to 19.9% poverty concentration: aIRR, 2.95 (95% CI, 2.36–3.68); and ≥20% poverty concentration: aIRR, 2.96 (95% CI, 2.36–3.72).

Annual child abuse fatality rates for each poverty concentration over time are presented in Fig 3, with higher fatality rates noted in counties with higher poverty concentration. Child abuse fatality rates demonstrated a small, but statistically significant decrease over time (aIRR, 0.98; 95% CI, 0.97–0.98). There was no statistically significant difference in the slopes of child abuse fatality rates when comparing the prerecession, recession, and postrecession time periods.

**DISCUSSION**

This study demonstrates increased rates of child abuse fatalities for young children in communities of higher poverty concentration compared with those living in less impoverished areas. The greatest difference is observed when comparing counties with a poverty concentration <5% to counties with a >10% poverty concentration, where the incidence rate of child abuse fatalities is >2.5 times higher. There were also racial differences, with higher child abuse fatality rates for African American children compared with white children across all poverty concentrations.

The effects of poverty on children are wide-reaching. Health disparities exist for children in poverty, ranging from increased lead levels, increased revisit rates after tonsillectomy, structural differences in brain development, as well as fatalities from unintentional injuries.9,31–33 Poor health outcomes, including increased rates of nonfatal child abuse have been reported when comparing areas of high poverty (>20% or >40% of population living in poverty) to areas of low poverty concentration (with substantiated abuse rates 4 times higher in areas of >40% poverty).28,32

Although the individual poverty of a child’s family has been recognized as a risk factor for abuse4,34,35 and for hospitalization from abuse,7,10 the relationship of community poverty on fatal child abuse is less well understood.14,36,37 Local studies have noted increased rates of child abuse in impoverished communities.28,38,39
In this study, we analyzed the association between community poverty and fatal child abuse at the national level and demonstrated a consistent association between community poverty concentration and child abuse fatalities across the study period. These results suggest that the economic atmosphere where a child lives may be associated with their risk of suffering a fatal abusive injury.

Theories to explain the relationship between community poverty and child abuse cite lack of community resources, environmental stressors, differential reporting thresholds, and presence of factors related to economic success. The greatest difference in fatality rates was seen when comparing areas of low poverty concentration to areas of >10% poverty concentration. This suggests that, for fatal child abuse, there are implications for child health and safety even in the middle poverty categories, where most children in the United States reside. Ideally, this will allow public health officials to target high-risk areas for prevention and resources, rather than rely on post hoc responses to a particular tragedy.

Our results suggest that even in communities of low poverty concentration, African American children have higher rates of child abuse fatalities than white children who live in communities of high poverty concentration. With this data set, we cannot determine if an individual child victim was living in an impoverished neighborhood within a more affluent county. The specific effects of community poverty concentration by race on abuse fatality risk is worthy of additional exploration. Previous studies have reported increased rates of child abuse in minority children, and African American children have also had higher reported risks for infant...
mortality, preterm birth, and low birth weight, suggesting increased risk for several poor health outcomes. Although minority children are more likely to be reported to child protection agencies and to have reports substantiated, comparison of child abuse to other negative health measures less subject to reporting bias suggests that the increased rates of poor health outcomes of African American children is not simply due to reporting bias. Thus, despite the potential for bias, the difference in child abuse fatality rates for African American children across each poverty concentration in our study warrants attention from health care providers.

This study contributes new findings to previous research by using a national data source to obtain fatality data. The 2011 Government Accountability Office report on child fatalities from maltreatment stated that there are many challenges to obtaining data on child maltreatment fatalities. To calculate the incidence of child maltreatment, researchers have historically used the National Child Abuse and Neglect Data System (NCANDS) and the National Incidence Study. Although

FIGURE 2
Child abuse fatality rates by state and overall state poverty level. Child abuse fatality rate for each state over the study period, 1999 to 2014, graphed over the overall state poverty concentration level (measured as percent living below the federally defined poverty level).

FIGURE 3
Annual child abuse fatality rates by county poverty concentration in the United States, 1999 to 2014. Fatality rates are calculated annually as deaths per 100,000 children 0 to 4 years old. For each subcategory, fatality rates are calculated as deaths per 100,000 children living in that subcategory (ie, 0%–4.9% poverty category).
these are robust data sources, they also carry limitations. NCANDS relies on voluntary reports from child protective services (CPS) in each state and is thus subject to the varying reporting practices of each state’s CPS agencies. The National Incidence Study relies on a nationally representative sample of 122 counties. Our study used the CDC CMF, which provides national data from death certificates and, therefore, does not rely on CPS reporting practices or on data extrapolated from representative counties. The 2011 Government Accountability Office report suggests that incorporating data on child maltreatment fatalities from additional sources like death certificates can better inform government agencies. Additionally, our study demonstrates the ability to use ICD-10 cause of death codes to target similar populations previously studied by using ICD-9.\(^3\)\(^2\)

These findings should be considered in light of the limitations of the data. The CMF is an administrative database with potential for misclassification, and the data analysis is limited by the included variables. As a result, our study focused only on physical child abuse fatalities, and not on other forms of maltreatment, such as neglect (eg, malnutrition, medical neglect), which are not comprehensively captured with ICD-9 and ICD-10 external cause of injury codes. This may explain differences in the numbers of fatalities reported by other sources, such as NCANDS. Our data are comparable to previous NCANDS results when examining physical abuse fatalities, but not overall fatality rates, which include victims of neglect. Although the Vital Statistics program is a well-maintained reporting system, misclassification of a child’s age, sex, race, ethnicity (including Hispanic designation), or cause of death would alter these findings. The use of death certificate data, although a strength of this work, is also a limitation because it requires the medical examiner to identify the child as a victim of fatal assault. Therefore, the death counts are most likely an underestimate of all child abuse fatalities.

Racial bias has been noted in death certificate review when medical examiners are more likely to record the victim of a homicide as African American than white.\(^6\)\(^6\) It is also possible that the poverty level of the community could influence the medical examiner’s determination of cause of death with overreporting of assault in poor counties or underreporting in affluent counties. Researchers have also found census tracts to be more sensitive to economic differences than counties or zip codes.\(^2\)\(^3\)\(^3\)\(^2\)\(^3\)\(^3\)\(^3\) Counties are larger geographic areas of varying size and heterogeneity in each state, often comprised of smaller communities of varying poverty concentration (ie, a city and its suburbs). As a result, the county poverty concentration is a combination of its communities, which may underestimate the association of community poverty to a health outcome. Additionally, the CMF does not provide information on the individual child victim’s economic circumstance. Therefore, any interplay between the socioeconomic status of the individual child and other factors like race and ethnicity cannot be explored with this data set, limiting the analysis for Hispanic children and the interpretation of increased fatality rates seen in African American children in counties of different poverty concentrations. Finally, as an ecological study, we can report an association between community poverty concentration and child abuse fatalities, but we cannot demonstrate causation. Although additional studies are needed to additionally evaluate the complex interplay between poverty and child safety, the findings in this study highlight for pediatricians and community leaders the vulnerabilities faced by children in impoverished communities.

**CONCLUSIONS**

By analyzing the association of community poverty and child abuse fatality rates from a source of national death data, we found that counties with high poverty concentration were consistently associated with higher child abuse fatality rates across more than a decade of study. As the pediatric and public health communities continue to learn about the undue burden poverty places on children,\(^4\)\(^7\) this work highlights that the poverty found in a child’s community is associated with an increased individual risk for fatal child abuse in young children.

Community leaders, child advocates, public health officials, and health care professionals must consider community poverty when developing efforts to prevent child abuse deaths.

**ACKNOWLEDGMENT**

We thank Rebecca Karb, MD, for assistance in acquiring the CDC CMF and the US Census Bureau population data.

**ABBREVIATIONS**

- aIRR: adjusted incidence rate ratio
- CDC: Centers for Disease Control and Prevention
- CI: confidence interval
- CMF: Compressed Mortality Files
- CPS: child protective services
- ICD-9: *International Classification of Diseases, Ninth Revision*
- ICD-10: *International Classification of Diseases, Tenth Revision*
- IRR: incidence rate ratio
- NCANDS: National Child Abuse and Neglect Data System
- NCHS: National Center for Health Statistics
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