



Identifying Risk Factors and Advancing Services for Violently Injured Low-Income Black Youth

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Abstract

Violent exposure among low-income, Black youth has reached alarming rates. Using administrative data that centers racial equity to understand risk factors and aid in prevention is a promising approach to address this complex problem. Medical records were linked to a comprehensive county-level integrated data system using a case–control design. Chi-square tests, *T*-tests, and multivariate logistic regression assessed for between and within group differences among (1) youth who presented to an emergency department ($N=429$) with an assault or gunshot wound (GSW) and a matched sample of non-injured youth ($N=5000$); and, (2) youth with GSW injuries ($N=71$) compared to assault injuries ($N=358$). Injured youth present with greater early adversity, trauma, and prolonged poverty compared to non-injured peers. Youth with GSW injuries differ from assault in several key ways. An ecosystem of care is needed to address the multifaceted causes of Black youth's severe violence exposure that are rooted in systemic racism and poverty. Integrated data using a racial equity lens can help to illuminate opportunities in this ecosystem of care.

Introduction

Black, Indigenous, and youth of color, especially from low-income communities, bear an unequal burden of adversity and trauma, including violence, assault, poverty, incarceration, and marginalization in the USA [1, 2]. Black youth are killed by guns at rates 2 to 10 times higher than youth of other race/ethnicities [3]. Of youth survivors, 37% will return to the emergency department (ED) in the following 2 years with another violence-related injury [3]. The causes of youth violence are multifaceted and rooted in systemic racism and poverty [4, 5]. Without intervention or key protective factors, adverse childhood experiences (e.g., poverty

and trauma (e.g., child abuse) can negatively affect the body and brain, taking a toll on numerous developmental domains and leading to deleterious effects on physical (e.g., chronic disease), mental (e.g., depression, suicidality), and behavioral health (e.g., violence) lasting into adolescence and adulthood [6, 7].

Using administrative data to look further “upstream” can identify youth's experiences and systems engagement earlier in childhood that may be critical to inform care provision and identify areas for early intervention. To explore the early life healthcare and social systems involvement of low-income Black youth injured by assault and gunshot wounds between ages 6 and 15, we linked medical records to a comprehensive county-level integrated data system using a case–control design to examine between and within group differences.

Literature Review

Impacts of Severe Violence

In addition to physical impacts, injured youth can experience significant mental health challenges (e.g., post-traumatic stress symptoms) and increased risk of reinjury [8]. A cross-sectional survey of adolescents in low-income

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public housing communities showed a correlation between violent injury and feelings of despondency, feeling unloved, uncared for, and fear [8]. Even youth who are not directly injured from gun violence, but live in the same neighborhood, report increased depressive symptoms [9]. The effects of violence may differ across youth's developmental stages. For example, a meta-analysis of 114 studies found that adolescents report a stronger relationship between community violence exposure and externalizing behaviors compared to children, while children express greater internalizing behaviors compared to adolescents [10].

Assault Injuries

Black adolescents and young adults are at higher risk of violent injury and have higher reported adverse childhood experiences than White peers [1, 2]. Moreover, these risks can increase based on where that child lives and in the context of cyberspace [11, 12]. In a cross-sectional study using self-report with 638 African American adolescents residing in low-income communities, key factors associated with greater community violence included individual factors such as poorer mental health, delinquent behavior, increased use of substances, and risky sexual behavior; school factors, such as lower school bonding and student-teacher connectedness; and histories of juvenile court involvement [13]. A meta-analysis of 118 studies found four factors had significant additive or buffering effects longitudinally against youth violence exposure, including self-regulation, family support, school support, and peer support [14].

Firearm Injuries

Scoping reviews have identified numerous risk factors for firearm injury among youth. At the individual-level, youth's prior exposure to firearm violence (injury and witness), substance abuse and delinquency, youth's access to firearms [15], prior aggression, and retaliatory views have emerged as factors that transition and sustain youth from violent injury to perpetrating firearm assault (i.e., victim-perpetrator overlap) [16]. Family involvement with child welfare services is a predictor of firearm violence [15]. Among peers, peer use of firearms [15] and delinquent peer influences [16] contribute to youth's firearm violence exposure. Community distress factors, including poverty rate, housing vacancy rate, and lower educational attainment, are also predictive of firearm injury [17]. Likewise, county-level social capital (i.e., trust in institutions), upward social mobility, and increased public welfare spending have robust reductive links with gun homicide rates [18].

Gaps

Literature has highlighted that individual experiences (e.g., ACEs) can increase the risk of violent victimization and reinjury. However, a couple key limitations characterize this body of research. First, most studies examining firearm injury have relied on cross-sectional designs, limiting understanding of temporal dimensions and potential developmental trajectories [19]. Second, no studies examining early life experiences and firearm-related injuries have included a sample younger than age 10 [19]. Finally, most studies do not include firearm and assault-related injuries, limiting our understanding of key differences among violence-exposed youth based on the mechanism of injury. Longitudinal administrative data, such as that recorded through social and healthcare systems, may be an alternative to improve upon these gaps. However, of the studies utilizing administrative data to examine violent injury, few have incorporated a structural lens putting these individual-level factors into context. Scholars have made a call to center racial equity in research, and this is especially important for administrative data due to the structural biases inherent in these data [20]. Applying a racial equity lens in data analysis involves applying the context of race (individual, community, political, and/or historical) to inform analyses, conclusions, and recommendations [20]. Best practices include correlating place to outcome; contextualizing local policies, systems, and structures; including past harms and future opportunities; using appropriate comparison groups to contextualize the findings; and acknowledging structural racism and other harms embedded in the data, among others [20].

Current Study

The current study takes place in Cleveland, a city home to approximately 380,000 people, with a racial/ethnic makeup of 49% Black, 34% White, and 12% Hispanic/Latino, and a median income of \$30,901 [21]. Cleveland ranks number one in child poverty among US cities with populations over 300,000 [22], in the top 5 most segregated cities in the USA [23], and, like many cities, has a deep history of racial discrimination against Black communities [24]. Historically, racist practices such as redlining, housing discrimination, and predatory lending had a significant negative impact on Black communities in Cleveland that are still evident today [25]. The majority of violent injuries occurring in the city are centralized in these disinvested Black communities.

Recognizing the systemic racism and neighborhood context shaping the lives of Black youth in the city, this study aims to use individual-level administrative data with a racial equity lens to build a rich profile of youth's histories via engagement with social and healthcare systems preceding their violent injury to examine between group differences

(with youth who did not present with a violent injury) and within group differences (gunshot wounds compared to assaults). Though service use itself is not a risk or protective factor, engagement with these systems is an indicator towards these factors. We must acknowledge that the proven history of over-surveillance and unequal treatment of poor communities, particularly communities of color, may bias the administrative data collected, and in turn the narrative of youth experiences. All findings will be interpreted through this lens.

Research Questions

1. Does youth engagement with social and health care systems differ between those who presented to the ED with a gunshot wound or assault compared to similar youth who did not present to the ED during the study period?
2. Are there significant differences in social systems engagement between youth with gunshot wounds compared to youth with assaults?

Methods

Design

This study employs a case–control design. Patient-level medical records from a level-1 pediatric trauma center for the study sample were matched to retrospective administrative data in the Child Household Integrated Longitudinal Data (CHILD) System housed at the Center on Poverty and Community Development at Case Western Reserve University. The comparison sample was drawn from existing records contained within the CHILD System. This comprehensive, secure data system, operated under Institutional Review Board protocols and governed by data sharing agreements with partner agencies, contains linked records on more than 750,000 Cuyahoga County residents born since 1989.

Sample

Youth Presenting to the ED with Severe Violent Injury (Study Sample)

This study identified 452 patients aged 6–15 years old who presented to the ED of a level I pediatric trauma center in a large urban Midwest city, for assault or gunshot wounds (GSW) between July 1, 2017 and June 31, 2018. Of the 452 possible cases, the study sample was restricted to 429 patients with non-missing key identifiers (including date of birth, name, and admission date) and who could be successfully identified in the CHILD System (Table 1) (see 26). To identify patients in the CHILD System, we used

the LINKPro SAS Macro to conduct iterative probabilistic linkages based on first and last name, date of birth, race, sex, and most recent address. We conducted multiple rounds of LINKPro matching to allow for variations in name spelling, changes in address, and date of birth errors. In this sample, 91.29% were Black, 57.11% were male, and youth were 12.09 years old on average (see Table 4). Seventy-two percent of assault diagnosis codes were characteristic of fights. Most gunshot wounds were characteristic of accidental discharges (43.7%) and assaults (39.4%). See Appendix Table A.

Comparison Sample

Possible youth for the comparison group were identified in the CHILD System if they were born between 1999 and 2017 and had a last reported address on the east side of the City of Cleveland (where the study sample resided) with the most recent update to their records occurring within 5 years of the study start date. A random subsample of 5000 youth was drawn from the eligible CHILD System population matched on age frequency with the study population. In this sample, 89.02% were Black, 49.50% were male, and youths were 12.11 years old on average (see Table 2).

Measures

In an effort to build a retrospective history of medical and social systems engagement, youth in the study and comparison samples were linked to their administrative records including birth certificates, juvenile delinquency filings, child welfare investigation and foster care records, emergency shelter stays, public assistance receipt, early childhood lead screening and testing results, and public school records (see Table 1). In addition, dual-system engagement of youth was measured as both child welfare and juvenile court involvement. Though incomplete, these records provide a comprehensive retrospective profile of youth's systems engagement which can help to identify previous exposures to trauma, instability, and environmental health risks.

Analysis

Descriptive analyses including means, standard deviations, and percentages detailing the extent to which youth with gunshot and assault wounds were observed in the administrative records for each indicator are presented. Chi-square tests and *T*-tests using a two-sided alpha of 5% were employed to assess crude statistical differences between the study and comparison samples (RQ1) and between injury types (RQ2). The administrative measures that were statistically significant based on crude associations were grouped into three content areas (demographic, education, public services), and

Table 1 Measures utilized in analysis: Patient EMR and Child Household Integrated Longitudinal Data (CHILD) System

| Measure grouping | Variables | Time period | Source |
|----------------------------------|--|-----------------------------------|---|
| Health care | Patient injury code; categorical variable Address; text variable Date of birth; date variable Gender identification; binary variable; 1 = male, 2 = female Admission date; date variable | July 1, 2017–June 30, 2018 | University Hospitals — Rainbow Babies and Children's Hospital |
| Birth and family characteristics | Early teen mother age 10–14 at participant's birth; binary flag Late teen mother age 15–19 at participant's birth; binary flag Teen mother age 10–19 at participant's birth; binary flag Mother had high school diploma or greater at participant's birth; binary flag Birth weight < 2,500 g; binary flag Gestation < 37 weeks; binary flag No prenatal care reported at birth; binary flag | January 1, 2001–December 31, 2012 | Ohio Department of Health (ODH)*; annual records *This should not be considered an endorsement of this study or these conclusions by the Ohio Department of Health |
| Juvenile court | At least one delinquency filing of any type before 1/1/2017; binary flag At least one delinquency filing with “violent” type before 1/1/2017; binary flag At least one delinquency filing with “Drug” type before 1/1/2017; binary flag At least one delinquency filing with “Property” type before 1/1/2017; binary flag At least one delinquency filing with “Other” type before 1/1/2017; binary flag | 2001–present | Cuyahoga County Juvenile Court; received twice annually |
| Child welfare involvement | At least one case of any type opened with DCFS before 1/1/2017; binary flag At least one substantiated or indicated report of abuse or neglect before 1/1/2017; binary flag At least one foster care placement before 1/1/2017; binary flag Age at first DCFS encounter; continuous variable; years | 2001–2018 | Cuyahoga County Division of Child and Family Services (DCFS) |
| Homelessness | Used an emergency homeless shelter \geq 1 night by 1/1/2017; binary flag Age at first homeless shelter stay; continuous variable; years | 2009–present | Cuyahoga County Office of Homeless Services |

Table 1 (continued)

| Measure grouping | Variables | Time period | Source |
|-------------------|---|--|--|
| Public assistance | <p>Receipt of ≥ 1 month of food stamps (Supplemental Nutrition Assistance Program, SNAP) at any time before age 6; binary flag</p> <p>Receipt of ≥ 1 month of cash assistance (Temporary Assistance for Needy Families, TANF) at any time before age 6; binary flag</p> <p>Receipt of ≥ 1 month of child care subsidy at any time before age 6; binary flag</p> <p>Insured by Medicaid ≥ 1 month at any time before age 6; binary flag</p> <p>Receipt of ALL public assistance measures (≥ 1 month of food stamps, cash assistance, child care subsidy, AND Medicaid at any time before age 6); binary flag</p> <p>Receipt of ANY public assistance measures (≥ 1 month of food stamps, cash assistance, child care subsidy, OR Medicaid at any time before age 6); binary flag</p> | <p>SNAP/TANF: 2001–2018 Medicaid: 2001–2016 Daycare: 2001–present</p> | Cuyahoga County Job and Family Services; monthly records |
| Public education | <p>Positive identification in public school records data; Binary flag</p> <p>“On track” Kindergarten Readiness Assessment (KRA) Language and Literacy score (score ≥ 263 points); binary flag</p> <p>Chronic absenteeism ($> 10\%$ absence) in year prior to injury for study sample and prior to 2017 school year for comparison; binary flag</p> <p>At least one grade repeated prior to injury for study sample and prior to 2017 school year for comparison; binary flag</p> | <p>CMSD: 2005–2006 to present; 2008–2009 to present (test scores) Suburban School Districts (Bedford Hts, Berea, Brooklyn, Cleveland Hts, East Cleveland, Garfield Hts, Lakewood, Maple Hts, Richmond Hts, South Euclid / Lyndhurst, and Warrensville Hts): 2008–2009 to present</p> | 14 Public urban and inner ring suburban school districts in the county; annual records |

Table 1 (continued)

| Measure grouping | Variables | Time period | Source |
|--------------------------|---|--|---|
| Cross-system Involvement | At least one case opened with DCFS of any type and one delinquency filing of any type before 1/1/2017; binary flag At least one substantiated report of abuse or neglect and one delinquency filing of any type before 1/1/2017; binary flag DCFS case and juvenile court involvement overlap before 1/1/2017; categorical variable; 1 = no DCFS case of any type and no delinquency filing of any type, 2 = only DCFS case, 3 = only delinquency filing, 4 = both DCFS case and delinquency filing | Cuyahoga County Juvenile Court; received twice annually Cuyahoga County Division of Child and Family Services | Juvenile Court: 2000–present DCFS: 1992–2018 |

each was run as a multivariable logistic regression model with injury status (injured, not injured) as the outcome. A fourth model combining all predictors included in the content-based models was tested using multivariable logistic regression. All analyses were completed using SAS 9.4 and RStudio 2021.09.2 + 382.

Results

Research Question 1

We found that youth who presented to the ED with gunshot and assault wounds during 2017–2018 had significantly different experiences compared to their uninjured peers. We present the results in chronological order and organized by social and health care systems (see Tables 2, 3, and 4).

Demographics

A greater proportion of males were represented among youth who presented to the ED during the study period relative to youth in the comparison group ($p=0.0025$). Males had significantly higher odds ($OR\ 1.50$, $CI\ 1.20$ – 1.88 , $p=0.0005$) of injury compared to females when modeled in the demographics model; however, male became non-significant in the combined model.

Health Care: Prenatal and Perinatal

Youth in the study sample had significantly higher rates of being born to teenage mothers aged 15–19 than youth in the comparison group ($p=0.0035$). That is, 28.4% of injured youth were born to a teenage mother compared to 21.5% in the comparison sample. This statistically significant association did not, however, hold when controlling for youth's gender (see demographic model, Table 4). The study sample did not differ significantly from their peers on measures of low birth weight, being born prematurely, or receiving adequate prenatal care in the preliminary analyses.

Public Services

Public Assistance Between the ages of 0 to 5, youth entering the ED had significantly higher odds of any public assistance utilization ($OR\ 1.61$, $CI\ 1.14$ – 2.34 , $p=0.0094$) than comparison group youth, when controlling for homeless shelter, child welfare, and juvenile court engagement. The rates of injured youth and comparison youth for each program were Supplemental Nutrition Assistance Program (SNAP) 88.6% compared to 79.0% ($p<0.0001$); Temporary Assistance for Needy Families (TANF) 66.7% compared to 54.7% ($p<0.0001$); childcare subsidies 64.1% compared to

Table 2 Significance tests of youth's engagement with selected social and healthcare systems. Authors' analysis of administrative records from the Child Household Integrated Longitudinal Data (CHILd) System

| | | Study popula- tion | CHILd comparison population | <i>p-value</i> ¹ | Study popula- tion: assault | Study population: gunshot | <i>p-value</i> ² |
|---|---|-----------------------|-----------------------------------|-----------------------------|--------------------------------|---------------------------------|-----------------------------|
| Demographics | | | | | | | |
| Population (<i>n</i>) | | 429 | 5000 | | 358 | 71 | |
| Race | White (%) | 5.65 | 6.89 | 0.3412 | 5.93 | 4.23 | 0.2123 |
| | Black (%) | 91.29 | 89.02 | | 90.40 | 95.77 | |
| | Other (%) | 3.06 | 4.09 | | 3.67 | 0 | |
| Male (%) | | 57.11* | 49.50* | 0.0025 | 53.63* | 74.65* | 0.0011 |
| Average age ³ (<i>SD</i>) | | 12.09 (2.76) | 12.11 (2.79) | 0.8881 | 11.94 (2.78)* | 12.84 (2.56)* | 0.0126 |
| Health care | | | | | | | |
| Birth certificates (%) | | 79.72 | 70.98 | | 78.49 | 85.92 | |
| Teen Births | Age 10 to 14 (%) | 1.46 | 0.73 | 0.1473 | 1.07 | 3.28 | 0.1922 |
| | Age 15 to 19 (%) | 28.36* | 21.50* | 0.0035 | 26.69 | 36.07 | 0.1409 |
| Low birth weight (%) | | 11.14 | 14.18 | 0.1217 | 10.00 | 16.39 | 0.1504 |
| Premature (%) | | 11.99 | 15.27 | 0.1042 | 9.61* | 22.95* | 0.0036 |
| Adequate prenatal care ⁴ (%) | | 67.72 | 69.24 | 0.5949 | 67.97 | 66.67 | 0.8542 |
| No prenatal care ⁴ (%) | | 2.68 | 2.25 | 0.6349 | 2.49 | 3.51 | 0.6686 |
| Public assistance | | | | | | | |
| Child care subsidy before age 6 (%) | | 64.10* | 57.16* | 0.0052 | 61.45* | 77.46* | 0.0102 |
| Cash assistance (TANF) before age 6 (%) | | 66.67* | 54.66* | <0.0001 | 64.53* | 77.46* | 0.0346 |
| Food stamps (SNAP) before age 6 (%) | | 88.58* | 78.98* | <0.0001 | 87.15* | 95.77* | 0.0369 |
| Medicaid enrollment before age 6 (%) | | 90.68* | 81.68* | <0.0001 | 89.39* | 97.18* | 0.0390 |
| Combined enrollment in SNAP, TANF, Daycare, Medicaid before age 6 (%) | | 49.42* | 40.66* | 0.0004 | 46.65* | 63.38* | 0.0100 |
| Child welfare | | | | | | | |
| Department of Child and Family Services | Any contact (%) | 66.90* | 47.94* | <0.0001 | 65.36 | 74.65 | 0.1288 |
| | Substantiated incident (%) | 26.34* | 13.66* | <0.0001 | 27.09 | 22.54 | 0.4256 |
| | Foster placement (%) | 14.92* | 6.16* | <0.0001 | 15.64 | 11.27 | 0.3446 |
| | Substantiated incident and foster placement (%) | 11.19* | 4.02* | <0.0001 | 12.01 | 7.04 | 0.2250 |
| Environmental health—lead testing | | | | | | | |
| Lead test (%) | | 84.85* | 77.74* | 0.0006 | 84.92 | 84.51 | 0.9300 |
| Confirmed elevated blood lead level (% of tested) | | 45.33 | 44.87 | 0.8654 | 44.74 | 48.33 | 0.6091 |
| Housing: homelessness | | | | | | | |
| Emergency homeless shelter use (%) | | 7.93* | 4.36* | 0.0008 | 8.38 | 5.63 | 0.4339 |
| Juvenile court | | | | | | | |
| Any delinquency filing (%) | | 11.19* | 2.44* | <0.0001 | 9.78* | 18.31* | 0.0372 |
| Filing categories ⁵ | Violent (%) | 48.67 | 52.34 | | 47.50 | 51.52 | |
| | Drug (%) | 0 | 0 | | 0 | 0 | |
| | Property (%) | 36.28 | 27.10 | | 36.25 | 36.36 | |
| | Other (%) | 15.04 | 20.56 | | 16.25 | 12.12 | |
| Education | | | | | | | |
| Mother has high school degree ⁴ (%) | | 54.57* | 62.60* | 0.0043 | 55.51 | 50.00 | 0.4504 |
| “On Track” KRA score ⁶ (%) | | 31.54 | 35.69 | 0.1983 | 32.16 | 28.57 | 0.6492 |
| Repeat grade ⁷ (% of those with a school record identified in CHILd) | | 36.41* | 22.06* | <0.0001 | 34.47 | 45.59 | 0.0834 |
| Chronically absent ⁸ (%) | | 50.34* | 33.20* | <0.0001 | 47.30* | 64.15* | 0.0263 |

Table 2 (continued)

| | Study popula- tion | CHILD comparison population | <i>p</i> -value ¹ | Study popula- tion: assault | Study population: gunshot | <i>p</i> -value ² |
|---|-----------------------|-----------------------------------|------------------------------|--------------------------------|---------------------------------|------------------------------|
| Dual-system involvement | | | | | | |
| DCFS contact and juvenile court filing | 9.32* | 1.90* | <0.0001 | 8.10 | 15.49 | 0.0504 |
| DCFS substantiated incident and juvenile court filing | 4.90* | 0.86* | <0.0001 | 5.03 | 4.23 | 0.7746 |

¹*p*-value indicates significance results after chi-squared or *T*-test analysis between the study population and the CHILD comparison population. ²*p*-value indicates significance results after chi-squared or *T*-test analysis between youth with assault injuries and those with gunshot injuries in the study population. ³Average age is calculated as the years between birth and January 1, 2017. ⁴Some birth certificates have these fields missing, percentages and significance testing was done out of those with a non-missing entry. ⁵Percentage out of those with at least one court filing. A participant can have multiple categories if they have multiple court filings. ⁶Percentage out of those with a Kindergarten Readiness Assessment (KRA) score identified in CHILD. ⁷Percentage out of those with at least 1 year of public school data identified in CHILD. ⁸A student is considered chronically absent if they are absent for at least 10% of the days that they are enrolled in a school. For the study population, the denominator consists of those with a public school record in the CHILD System for the school year prior to their injury. For the comparison population, the denominator consists of those with a public school record in the CHILD System for the 2016–2017 school year. This school year was selected because all injuries in the study population occurred after July 1, 2017. *Denotes a significant difference ($p < 0.05$). Notes: Unless otherwise noted, engagement with the administrative systems is considered between birth and January 1, 2017

Table 3 Age (years) at first engagement with selected systems of care

| | Study population | CHILD comparison population | <i>p</i> -value ¹ | Study popula- tion: assault | Study population: gunshot | <i>p</i> -value ² |
|---|------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|------------------------------|
| Juvenile court | 12.73 (1.61) | 12.84 (1.76) | 0.7161 | 12.49 (1.69) | 13.38 (1.19) | 0.0852 |
| Department of Child and Family Services | 3.96 (3.89) | 3.99 (3.31) | 0.9010 | 4.04 (4.16) | 3.60 (2.00) | 0.4337 |
| Foster care | 3.89 (4.18) | 3.31 (4.19) | 0.3125 | 4.16 (4.31) | 2.00 (2.51) | 0.1733 |
| Emergency homeless shelter | 8.41 (3.83) | 7.76 (4.10) | 0.2558 | 8.67 (3.99) | 7.00 (2.50) | 0.2315 |
| Child care subsidy | 1.86 (1.93) | 1.89 (1.89) | 0.7952 | 1.96 (1.96) | 1.42 (1.42) | 0.0624 |
| Cash assistance (TANF) | 1.26 (2.48) | 1.50 (2.71) | 0.1353 | 1.36 (1.36) | 0.82 (1.64) | 0.1400 |
| Food stamps (SNAP) | 0.86 (2.10)* | 1.38 (2.81)* | 0.0004 | 0.92 (2.18) | 0.57 (1.66) | 0.1987 |
| Medicaid | 0.41 (1.43)* | 0.69 (1.93)* | 0.0051 | 0.41 (0.41) | 0.43 (1.64) | 0.9261 |

¹*p*-value indicates significance results after chi-squared or *T*-test analysis between the study population and the CHILD comparison population. ²*p*-value indicates significance results after chi-squared or *T*-test analysis between youth with assault injuries and those with gunshot injuries in the study population. *Denotes a significant difference ($p < 0.05$). Notes: Authors' analysis of administrative records from the Child Household Integrated Longitudinal Data (CHILD) System.

57.2% ($p = 0.0052$); and Medicaid 90.7% compared to 81.7% ($p < 0.0001$). Notably, youths who presented to the ED were first enrolled into Medicaid at a significantly younger age ($M = 4.9$ months, $SD = 17.2$ months) compared to youth in the same neighborhood ($M = 8.3$ months, $SD = 23.2$ months) ($p = 0.0051$). Finally, 49.4% of the study sample was enrolled in all included public assistance programs compared to only 40.7% of their peers ($p = 0.0004$).

Child Welfare Beginning on average at the age of 4, youth who presented to the ED had significantly more contact with the child welfare system, with 66.9% having any contact (e.g., investigation) compared to 47.9% of their peers ($p < 0.0001$); and 26.3% having a substantiated incident compared to 13.7% of their peers. The proportion of foster care placements were more than double for youth presenting to

the ED (14.9%) compared to their peers (6.2%) ($p < 0.0001$). At nearly three times the rate, 11.2% of youth in the study sample had both a substantiated incident with child welfare and subsequent entry into the foster care system, compared to only 4.0% of their peers ($p < 0.0001$). When controlling for other public services and for demographic and education variables (combined model), youth who interacted with child welfare (and had no juvenile court involvement) had 1.9× higher odds of injury compared to youth with no child welfare or juvenile court involvement ($OR 1.9$, $CI 1.52$ – 2.38 , $p < 0.0001$).

Environmental Health: Lead Exposure By the age of 6, no significant differences in elevated blood lead levels were apparent among youth in the study sample and comparison group. Notably, injured youth had significantly higher

Table 4 Associations from the multivariable logistic regression models (dependent variable: 1 = injury; 0 = no injury). Authors' analysis of administrative records from the Child Household Integrated Longitudinal Data (CHILd) System

| Predictors | Demographic ¹ (<i>N</i> = 3,890) | | Education ² (<i>N</i> = 1,771) | | Public assistance ³ (<i>N</i> = 5,429) | | Combined ⁴ (<i>N</i> = 1,766) | |
|---|---|---------------|--|---------------|---|----------------|---|---------------|
| | OR (95% CI) | <i>p</i> | OR (95% CI) | <i>p</i> | OR (95% CI) | <i>p</i> | OR (95% CI) | <i>p</i> |
| Male (vs. female) | 1.50 (1.20, 1.88) | 4.6e-4 | - | - | - | - | 1.35 (0.99, 1.85) | 0.06 |
| Teen mother | 1.99 (0.67, 4.81) | 0.16 | - | - | - | - | - | - |
| “On Track” KRA score | - | - | 0.93 (0.66, 1.29) | 0.66 | - | - | 1.07 (0.76, 1.48) | 0.71 |
| Chronically absent | - | - | 1.74 (1.28, 2.36) | 4.1e-4 | - | - | 1.51 (1.10, 2.07) | 0.01 |
| Repeat grade | - | - | 1.56 (1.14, 2.14) | 4.8e-3 | - | - | 1.31 (0.95, 1.80) | 0.10 |
| Any enrollment in SNAP, TANF, Daycare, Medicaid before age 6 | - | - | - | - | 1.61 (1.14, 2.34) | 9.4e-3 | 7.89 (1.70, 140.4) | 0.04 |
| Emergency homeless shelter use | - | - | - | - | 0.85 (0.29, 1.96) | 0.73 | 0.67 (0.10, 2.40) | 0.60 |
| DCFS contact and juvenile court (CS) contact dual-system involvement (vs. no involvement) | DCFS contact only | - | - | - | 1.90 (1.52, 2.38) | 2.5e-8 | 1.90 (1.32, 2.77) | 6.7e-4 |
| | JC contact only | - | - | - | 5.78 (2.41, 12.45) | 2.2e-5 | 3.70 (0.98, 11.63) | 3.4e-2 |
| | DCFS and JC contact | - | - | - | 7.42 (4.87, 11.14) | 1.7e-21 | 4.26 (2.28, 7.82) | 3.8e-6 |
| Likelihood ratio test <i>p</i> -value | 0.0008 | | <0.0001 | | <0.0001 | | <0.0001 | |

¹Youth with non-missing birth certificates. ²Youth with non-missing KRA test scores. ³All youth in study population. ⁴Youth with non-missing birth certificates and KRA test scores. Bold *p*-value indicates statistically significant results after logistic regression analysis. Notes: Authors' analysis of administrative records from the Child Household Integrated Longitudinal Data (CHILd) System

rates of being lead tested compared to non-injured youth ($p = 0.0006$).

Housing: Homelessness Beginning on average between the ages of 7–8 years old, the study sample had significantly higher homeless shelter utilization (7.9%) than their peers (4.4%) ($p < 0.0008$). When controlling for other public service usage, however, this association became non-significant.

Juvenile Court When these youths reached 12 years old on average, youths who presented to the ED with a violent injury were significantly more likely to have a juvenile delinquency filing than those in the comparison group. When controlling for other public service usage, the odds of injury were 5.78 × higher for youth with juvenile court involvement (and no child welfare involvement) compared to youth with no juvenile court interaction ($OR\ 5.78, CI\ 2.41–12.45, p < 0.0001$). When controlling for variables in the demographic and education models (i.e., combined model), the odds of injury were 3.70 × higher for youth who engaged with juvenile court ($OR\ 3.70, CI\ 0.98–11.63, p < 0.0034$).

Education

The study sample did not differ in their Kindergarten Readiness Assessment scores compared to their peers. Youths in the study sample were chronically absent (missing 10% or more school days in an academic year) at significantly

higher rates (50.3%) in the year leading up to their injury compared to youth who did not present to the ED during the study period (33.2%) ($p < 0.0001$). Moreover, 36.4% of youth presenting to the ED repeated a grade compared to only 22.1% of the comparison youth ($p < 0.0001$). When modeled together (education model), youth with chronic absenteeism and repeated grade had significantly higher odds of injury ($(OR\ 1.74, CI\ 1.28–2.36, p < 0.0001)$ and ($OR\ 1.56, CI\ 1.14–2.14, p = 0.0048$), respectively); however, only chronic absenteeism remained significant when including demographic and public service use variables (combined model).

Dual-System Involvement

The study sample's involvement with both child welfare and juvenile court delinquency systems (i.e., dual-system involvement) was significantly higher than their non-injured peers. The preliminary analyses showed that 9.3% of the study sample compared to 1.9% of the comparison sample had “any” contact with child welfare and juvenile delinquency ($p < 0.0001$). And, 4.9% of the study sample compared to 0.9% of the comparison sample had a substantiated incident of child maltreatment along with a juvenile delinquency filing ($p < 0.0001$). Modeling dual-system involvement with other public service use, youth had 7.42 × higher odds of injury compared to youth who

had no interaction with juvenile court or child welfare (*OR* 7.42, *CI* 4.87–11.14, $p < 0.0001$). When including demographic and education variables in the combined model, the odds of injury remained significant, with the dual-system youth having 4.26× higher odds of injury compared to those who did not have juvenile court or child welfare involvement (*OR* 4.26, *CI* 2.28–7.82, $p < 0.0001$).

Research Question 2

Youth who presented to the ED with a GSW during 2017–2018 differed significantly from youth with assault injuries as indicated by measures related to health care, public assistance, juvenile court, and education over their lifespan. No significant within-group differences were found related to child welfare, lead exposure, or homeless shelter stays. We present the significant results in a developmental order and organized by systems (see Tables 2 and 3).

Demographics

Youths with GSW were more commonly male ($p = 0.0011$) (74.7% male) and approximately 11 months older ($p = 0.0126$) at the time of injury compared to youth who were assaulted (53.6% male).

Health Care: Prenatal and Perinatal

More youth with a GSW were born prematurely (23%) compared to youth with an assault injury (9.6%) ($p = 0.0036$).

Public Assistance

Significantly more youth presenting to the ED with a GSW received a childcare subsidy (77.5% vs. 61.5%, $p = 0.0102$), TANF (77.5% vs. 64.5%, $p = 0.0346$), SNAP (95.8% vs. 87.2%, $p = 0.0369$), Medicaid (97.2% vs. 89.4%, $p = 0.0390$), or a combination of all (63.4% vs. 46.7%, $p = 0.0100$) before the age of 5 than youth presenting with an assault injury.

Juvenile Court

Youth presenting to the ED with a GSW had nearly double the prevalence rate (18.3%) of engagement with the juvenile court compared to youth with an assault injury (9.8%) ($p = 0.0372$).

Education

Youths with a GSW were chronically absent at significantly higher rates (64.2%) in the year preceding their injury, compared to youth with an assault injury (47.3%) ($p = 0.0263$).

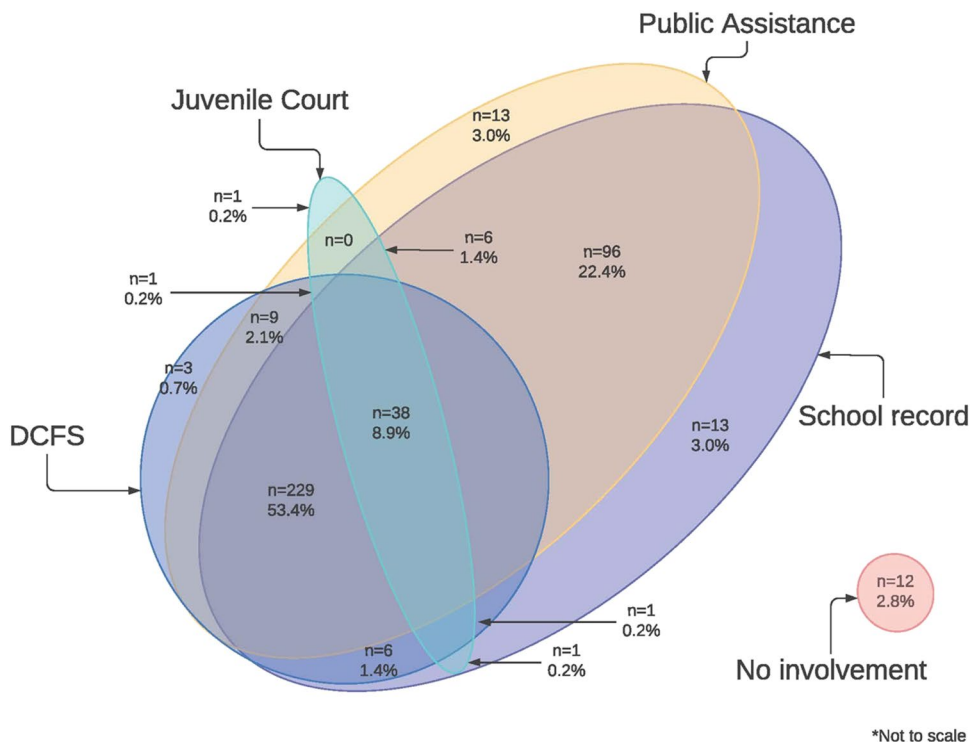
Discussion

This study provides a rich understanding of adverse childhood experiences (approximated through service engagement) among violently injured Black youth and their peers hailing from the same neighborhoods. Based on our findings, we infer several key points that can advance the field of youth violence prevention. First, youths who are dual-system involved (i.e., juvenile court and child welfare) have a much higher risk of injury, as has been documented in previous research [27]; however, this scope is far too narrow. There is substantial overlap between service use among the injured population (see Fig. 1), suggesting potential trajectories towards violent injury and, relatedly, critical opportunities for early violence prevention. Second, schools may prove to be a critical environment to screen for early indicators of risk and to promote protective factors that can promote resilient outcomes among youth. Finally, there may be higher rates of exposure to adversity and trauma experienced by a sample of predominantly Black youth with assaults or GSW compared to similar youth who did not present to the ED with an injury. Considering implications, we offer a multi-systems approach to violence prevention that highlights opportunities “upstream” (e.g., with public assistance, child welfare, and schools) and “downstream” (e.g., with juvenile court, hospital-based violence intervention programs (HVIPs)). We frame these upstream/downstream opportunities on the average age of injury and first contact with relevant systems (see Tables 2 and 3).

Multi-System Involvement

Adding to the body of literature highlighting the link between youth’s victimization and acts of delinquency [27], the odds of injury for youth’s dual-system engagement (i.e., juvenile court and child welfare) were profoundly higher (4.26×) than youth with no juvenile court or child welfare involvement. However, this system overlap is a narrow view of the whole picture. To wit, the rates of injury among youth enrolled in a public school and having any public assistance before the age of 6 or being enrolled in public school and being involved with child welfare (on average starting at 4 years old) are considerably higher than the so-called dual-system involved youth. These findings offer several key takeaways. First, poverty — especially poverty in the early years of life (0–5 years old) — is a determinant of violent injury, as has been documented in previous research [28]. Second, family challenges early in childhood are strongly tied to non-domestic violence-related injuries later in childhood, which highlights the relevance of “polyvictimization” (i.e., being exposed to multiple types of victimization) among low-income, youth of color. Despite evidence linking

Fig. 1 System overlap of injured population. Note. DCFS Department of Child and Family Services



polyvictimization to greater generalizable vulnerability [29], child welfare services tend to focus solely on the presenting “incident” and do not take a holistic approach to child victimization. Finally, this study illuminates the intersection of poverty, public school enrollment, and family challenges as a critical intersection for youth’s risk of future violent injury. Surprisingly, rates of lead poisoning were not significantly different between the injured and non-injured group, contradicting prior research [30]; however, it is quite notable that over 40% of youth in each of the groups had been lead poisoned at some point in their early childhood. The group’s rates of lead tests differed significantly, suggesting there may be key unobserved differences between these groups.

Schools as Nexus

Table 4. We found that injured youth had significantly higher rates of ever repeating a grade and chronic absenteeism in the academic year leading up to their injury, and this was even more evident for youth with gunshot wounds compared to assaults. When controlling for public service usage and demographics, chronic absenteeism remained a significant factor with youth’s odds of injury being 1.5× higher. Similarly, a recent study found that “lack of school enrollment” among other characteristics was significantly associated with pediatric firearm injuries [31]. Together, these findings suggest that schools can be an early detection system for youth who may be at risk for violent injury. Moreover, schools have access to a greater number of

youth at risk for violent injury compared to other systems, such as juvenile courts (see Fig. 1). Schools may even serve as a mitigation system for youth’s injury; for example, a study found that school social support (e.g., youth feeling their teachers cared for them, teachers were fair, feeling safe) was a significant factor in reduced injury among adolescents [32]. These findings are especially salient given the impact of COVID-19 school closures and the unprecedented increase in gun violence in 2020 [33], with a recent study citing guns as the leading cause of child death [34].

Addressing Complex Trauma

Much of the existing HVIP literature focuses on identifying and alleviating trauma symptoms stemming from youth’s violent injuries [35]. The current study adds to the scope of literature by identifying adverse childhood experiences that may threaten children’s sense of safety. For example, our study found that beginning in early childhood, injured youth’s involvement in a substantiated child welfare case and foster care placement was three times higher than their peers. Furthermore, around 7–8 years old on average, injured youth stayed in a homeless shelter at rates nearly two times higher than their non-injured peers (though this did not remain significant in the combined model, likely due to rare occurrence). There were no within-group differences among injured youth relative to rates of child welfare, foster care, or homeless shelter involvement, suggesting these early

experiences threatening safety and stability were similar for all injured youth regardless of injury type. Given the higher rates of early experiences of trauma (e.g., child abuse or neglect, family separation) among injured youth, it is possible that these youths are grappling with complex trauma or “developmental trauma disorder” [36], in addition to the single traumatic event that precipitated their hospital visit.

Practice and Policy Implications

“Upstream” Implications

Funders, policy makers, and practitioners must invest in multi-system, collaborative approaches to enhance family access to healthy environments, especially families with young children. Schools should consider adapting protocols to conduct universal screening for key risk and protective factors (see 37) and service use engagement related to violent injury (such as youth who have received public assistance or have had any contact with child welfare before age 6). To the authors’ knowledge, there are no school-based screening tools that assess risk factors related to violent injury (other than/in addition to school violence). Future measurement development may include expanded ACE checklists (e.g., 38) in addition to key protective factors (e.g., 14). Following screening, researchers recommend adapting primary, secondary, and tertiary levels of preventive measures (e.g., 39–40). Employing “wrap around” models with other system and community partners can provide coordinated and targeted services for families based on the level of need (i.e., primary, secondary, tertiary). In fact, researchers have cautioned prevention programs from narrowly focusing on youth, and, instead, encourage expanding this scope to include microsystems such as families, peer groups, the school community (e.g., educators, coaches, administrators), and youth’s neighborhoods [41]. Finally, systems and organizations serving youth of color must consider embedding trauma informed [42] and healing centered principles [43] in order to deter future re-traumatization and promote healing.

“Downstream” Implications

Hospital-based violence intervention programs (HVIPs) and emergency department (ED) staff should consider adapting assessments and protocols to screen, address, and refer for complex trauma among injured youth. Pediatric EDs should also receive training (e.g., impact of structural racism on healthcare, implicit bias) to critically examine and adapt practices to minimize the likelihood of retraumatizing youth and families presenting with assaults or gunshot wounds, given that system engagement may enhance their sense of fear, anxiety, and distrust. This may be especially salient for Black, Indigenous, and People of Color families due to legacies of structural racism

embedded in healthcare systems, among others [44]. One study shows benefits from a pediatric ED receiving trauma-informed care training that positions the patient as the expert [45]. Furthermore, the success of HVIPs will depend on their ability to build strong partnerships with other systems and community partners, particularly schools. For example, schools could have HVIPs engage with youth who are flagged for chronic absenteeism to provide services before youth experience a violent injury (see University of Maryland’s Shock Trauma’s Educational Program as one application). The primary aim of these partnerships should enhance youth’s positive relational experiences in key microsystems such as peer groups, educational settings, and families which has important buffering effects against negative outcomes [46].

Limitations

Several limitations qualify our findings. Though we took several steps to center racial equity in this study, we first acknowledge the best practices we were not able to incorporate, including engaging the community in developing the research questions and using qualitative data to complement the quantitative data [20]. Second, we cannot be certain that all youth who experienced GSW and assaults presented at the focal ED since there is also another major trauma center in the city. However, the focal ED in this study is the only level-1 pediatric trauma unit in the region suggesting they may receive the majority of severe cases. Third, due to the case–control design of the study, we cannot be certain that the comparison group of youth did not also experience a violent injury in years prior to or after the study, and for this, we suggest using caution when interpreting the results. Fourth, the homelessness data is inconsistent before 2009; however, in 2009, only 10% of youth were 7 years old or older (the average age of entry into homeless shelters for youth in the sample) and the remaining sample was younger than age 7, suggesting minimal impact. Finally, this retrospective profile is inherently biased towards negative experiences due to the purpose of several systems (e.g., child welfare, homelessness services) and does not account for informal systems of care that may be more positive in nature (e.g., afterschool programs, churches, community centers). Moreover, administrative data is likely biased due to the over-surveillance and unequal treatment of poor communities, especially Black, Indigenous, and communities of color.

Conclusion

Social and health care systems are designed to aid and assist families in time of need, positioning them to affect change at the intersection of trauma, social determinants of health, and violence. Nevertheless, most systems focus on a single experience or dimension of a child’s life and lack attention to the intersection of youth’s experiences across the lifespan,

missing critical opportunities [47]. Using administrative data can help illuminate these intersections (48). This paper highlights the incredible potential for social and health care systems to serve as part of the ecosystem to heal interpersonal and systemic violence, rather than perpetuate social inequalities among people hailing from low-income communities of color.

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Declarations

Ethics Approval This study was approved by the Institutional Review Board at University Hospital (STUDY20191163, approval date: 4/15/21).

Consent to Participate A waiver to obtain consent was approved due to the nature of the study.

Consent for Publication n/a.

Competing Interests The authors declare no competing interests.

References

- Sacks V, Murphey D. The prevalence of adverse childhood experiences, nationally, by state, and by race or ethnicity. *Child Trends*. 2018 Feb;2.
- Fowler KA, Dahlberg LL, Haileyesus T, Gutierrez C, Bacon S. Childhood firearm injuries in the United States. *Pediatrics*. 2017;140(1): e20163486.
- Cunningham RM, Carter PM, Ranney M, Zimmerman MA, Blow FC, Booth BM, et al. Violent reinjury and mortality among youth seeking emergency department care for assault-related injury: a 2-year prospective cohort study. *JAMA Pediatr*. 2015;169(1):63–70.
- Serchen J, Doherty R, Atiq O, Hilden D. Racism and health in the United States: a policy statement from the American College of Physicians. *Ann Intern Med*. 2020;173(7):556–7.
- Wilkins N, Myers ML, Kuehl MT, Bauman MA, Hertz MM. Connecting the dots: state health department approaches to addressing shared risk and protective factors across multiple forms of violence. *Journal of public health management and practice*: JPHMP. 2018 Jan/Feb;24(Suppl 1 INJURY AND VIOLENCE PREVENTION):S32.
- Shonkoff JP, Garner AS. Committee on Psychosocial Aspects of Child and Family Health, Committee on Early Childhood, Adoption, and Dependent Care, and Section on Developmental and Behavioral Pediatrics, Siegel BS, Dobbins MI, Earls MF, Garner AS, McGuinn L, Pascoe J, Wood DL. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics*. 2012;129(1):e232–46.
- Harris NB. *The deepest well: healing the long-term effects of childhood adversity*. Houghton Mifflin Harcourt; 2018.
- Howard DE, Feigelman S, Li X, Cross S, Rachuba L. The relationship among violence victimization, witnessing violence, and youth distress. *J Adolesc Health*. 2002;31(6):455–62. [https://doi.org/10.1016/s1054-139x\(02\)00404-4](https://doi.org/10.1016/s1054-139x(02)00404-4) (PMID: 12457578).
- Leibbrand C, Hill H, Rowhani-Rahbar A, Rivara F. Invisible wounds: community exposure to gun homicides and adolescents' mental health and behavioral outcomes. *SSM Popul Health*. 2020;12:100689. <https://doi.org/10.1016/j.ssmph.2020.100689>.
- Fowler PJ, Tompsett CJ, Braciszewski JM, Jacques-Tiura AJ, Baltes BB. Community violence: a meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. *Dev Psychopathol*. 2009;21(1):227–59.
- Sampson RJ, Morenoff JD, Gannon-Rowley T. Assessing, “neighborhood effects”: social processes and new directions in research. *Ann Rev Sociol*. 2002;28(1):443–78.
- Tripathi V. Youth violence and social media. *J Soc Sci*. 2017;52(1–3):1–7.
- Voisin DR, Patel S, Hong JS, Takahashi L, Gaylord-Harden N. Behavioral health correlates of exposure to community violence among African-American adolescents in Chicago. *Child Youth Serv Rev*. 2016;1(69):97–105.
- Yule K, Houston J, Grych J. Resilience in children exposed to violence: a meta-analysis of protective factors across ecological contexts. *Clin Child Fam Psychol Rev*. 2019;22(3):406–31.
- Ranney M, Karb R, Ehrlich P, Bromwich K, Cunningham R, Beidas RS. FACTS Consortium What are the long-term consequences of youth exposure to firearm injury, and how do we prevent them A scoping review. *J Behav Med*. 2019;42(4):724–40. <https://doi.org/10.1007/s10865-019-00035-2>.
- Schmidt CJ, Rupp L, Pizarro JM, Lee DB, Branas CC, Zimmerman MA. Risk and protective factors related to youth firearm violence: a scoping review and directions for future research. *J Behav Med*. 2019;42(4):706–23. <https://doi.org/10.1007/s10865-019-00076-7> (Epub 2019 Aug 1 PMID: 31367936).
- Tracy BM, Smith RN, Miller K, Clayton E, Bailey K, Gerrin C, et al. Community distress predicts youth gun violence. *J Pediatr Surg*. 2019;54(11):2375–81. <https://doi.org/10.1016/j.jpedsurg.2019.03.021>.
- Kim D. Social determinants of health in relation to firearm-related homicides in the United States: a nationwide multilevel cross-sectional study. *PLoS Med*. 2019;16(12):e1002978. <https://doi.org/10.1371/journal.pmed.1002978>.
- Schmidt CJ, Rupp L, Pizarro JM, Lee DB, Branas CC, Zimmerman MA. Risk and protective factors related to youth firearm violence: a scoping review and directions for future research. *J Behav Med*. 2019;42(4):706–23.
- Nelson ALH, Zanti S. A framework for centering racial equity throughout the administrative data life cycle. *International Journal of Population Data Science*. 2020;5(1):1–10.
- U.S. Census Bureau. Quick Facts, Cleveland, OH. [Internet] 2019 [updated 2019 Jul 1; cited 2021 Sep 13]; Available from: <https://www.census.gov/quickfacts/clevelandcityohio>.
- U.S. Census Bureau. American Community Survey, 2019 1-Year Estimates, Large U.S. cities with total population above 300,000. Compiled by The Center for Community Solutions.

23. Massey DS, Tannen J. A research note on trends in black hyper-segregation. *Demography*. 2015;52(3):1025–34.
 24. United States District Court Northern District of Ohio Eastern Division. *United States of America v. City of Cleveland*, No. 1:15-cv-01046 [Internet]. [cited 2021 Sep 13]. Available from https://www.justice.gov/sites/default/files/crt/legacy/2015/05/27/cleveland_agreement_5-26-15.pdf.
 25. Nardone A, Chiang J, Corburn J. Historic redlining and urban health today in US cities. *Environmental Justice*. 2020;13(4):109–19.
 26. Fischer RL, Richter FG, Anthony E, Lalich N, Coulton C. Leveraging administrative data to better serve children and families. *Public Adm Rev*. 2019;79(5):675–83.
 27. Kelley, BT, Haskins, PA. Dual system youth: at the intersection of child maltreatment and delinquency. *NIJ Journal*. 2021; 283. Available from: <https://nij.ojp.gov/topics/articles/dual-system-youth-intersection-child-maltreatment-and-delinquency>
 28. Armstead TL, Wilkins N, Nation M. Structural and social determinants of inequities in violence risk: a review of indicators. *J Community Psychol*. 2021;49(4):878–906.
 29. Finkelhor D, Shattuck A, Turner HA, Ormrod R, Hamby SL. Poly-victimization in developmental context. *J Child Adolesc Trauma*. 2011;4(4):291–300.
 30. Coulton, C., Richter, F. G. C., Cho, Y., Park, J., & Fischer, R. Downstream consequences of childhood lead poisoning: a longitudinal study of Cleveland children from birth to early adulthood. [White Paper]. Center on Poverty and Community Development; 2020.
 31. Bernardin ME, Moen J, Schnadower D. Factors associated with pediatric firearm injury and enrollment in a violence intervention program. *J Pediatr Surg*. 2021;56(4):754–9.
 32. Azimi AM, Daigle LE. Violent victimization: the role of social support and risky lifestyle. *Violence Vict*. 2020;35(1):20–38.
 33. Sutherland M, McKenney M, Elkbuli A. Gun violence during COVID-19 pandemic: paradoxical trends in New York city, Chicago, Los Angeles and Baltimore. *Am J Emerg Med*. 2021;1(39):225–6.
 34. Goldstick JE, Cunningham RM, Carter PM. Current causes of death in children and adolescents in the United States. *New England Journal of Medicine*. 2022 Apr 20.
 35. Corbin TJ, Purtle J, Rich LJ, Rich JA, Adams EJ, Yee G, et al. The prevalence of trauma and childhood adversity in an urban, hospital-based violence intervention program. *J Health Care Poor Underserved*. 2013;24(3):1021–30.
 36. Ford JD. Complex trauma and developmental trauma disorder in adolescence. *Adolesc Psychiatry*. 2017;7(4):220–35.
 37. Center for Disease Control. Risk and protective factors [Internet]. Maryland: National Center for Injury Prevention and Control, Division of Violence Prevention [updated 2020 March 2; cited 2022 April 22]. Available from: <https://www.cdc.gov/violenceprevention/youthviolence/riskprotectivefactors.html>
 38. Cronholm PF, Forke CM, Wade R, Bair-Merritt MH, Davis M, Harkins-Schwarz M, Pachter LM, Fein JA. Adverse childhood experiences: expanding the concept of adversity. *Am J Prev Med*. 2015;49(3):354–61.
 39. Thakore RV, Apfeld JC, Johnson RK, Sathiyakumar V, Jahangir AA, Sethi MK. School-based violence prevention strategy: a pilot evaluation. *Journal of injury and violence research*. 2015;7(2):45.
 40. Walker HM, Shinn MR. Structuring school-based interventions to achieve integrated primary, secondary, and tertiary prevention goals for safe and effective schools. *Interventions for academic and behavior problems II: Preventive and remedial approaches*. 2002;44:1–25.
 41. Turanovic JJ, Pratt TC, Kulig TC, Cullen FT. *Confronting school violence: a synthesis of six decades of research*. Cambridge University Press; 2022 March 18.
 42. Bloom SL, Sreedhar SY. The sanctuary model of trauma-informed organizational change. *Reclaiming children and youth*. 2008;17(3):48–53.
 43. Ginwright S. *Hope and healing in urban education: how urban activists and teachers are reclaiming matters of the heart*. Routledge; 2015 Jul 30.
 44. Paul DW Jr, Knight KR, Campbell A, Aronson L. Beyond a moment—reckoning with our history and embracing antiracism in medicine. *N Engl J Med*. 2020;383(15):1404–6.
 45. McNamara M, Cane R, Hoffman Y, Reese C, Schwartz A, Stoltz B. Training hospital personnel in trauma-informed care: assessing an interprofessional workshop with patients as teachers. *Acad Pediatr*. 2021;21(1):158–64.
 46. Sege R, Bethell C, Linkenbach J, Jones J, Klika B, Pecora PJ. *Balancing adverse childhood experiences with HOPE: new insights into the role of positive experience on child and family development*. The Medical Foundation. 2017.
 47. Hamby S, Taylor E, Jones L, Mitchell KJ, Turner HA, Newlin C. From poly-victimization to poly-strengths: understanding the web of violence can transform research on youth violence and illuminate the path to prevention and resilience. *J Interpers Violence*. 2018;33(5):719–39.
 48. Putnam-Hornstein E, Ghaly M, Wilkening M. Integrating data to advance research, operations, and client-centered services in California: integrating millions of administrative records across California’s health and human services programs to improve operations, coordinate services, develop targeted interventions, and more. *Health Aff*. 2020;39(4):655–61.
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