An examination of factors contributing to the racial disparity and disproportionality of paediatric firearm-related homicide: a mixed-methods analysis using the national violent death reporting system (NVDRS)

Amy A Hunter [1,2,3] Laura Schwab-Reese,[4] Susan DiVietro,[2,3] Christa Green[5]

[1]Department of Public Health Sciences, UConn Health, Farmington, Connecticut, USA
[2]Injury Prevention Center, Connecticut Children's Medical Center, Hartford, Connecticut, USA
[3]Department of Pediatrics, UConn Health, Farmington, CT, USA
[4]Department of Public Health, Purdue University, West Lafayette, Indiana, USA
[5]Medical University of South Carolina, Charleston, South Carolina, USA

Correspondence to
Dr Amy A Hunter, Injury Prevention, Connecticut Children's Medical Center, Hartford, Connecticut 06106, USA; amhunter@uchc.edu

ABSTRACT

Firearms are a leading cause of paediatric mortality in the United States. This study examines the contributing factors of racial disparity and disproportionality among paediatric firearm decedents aged 0–17 years.

We used the National Violent Death Reporting System (NVDRS) to assess the individual and incident-level circumstances of paediatric firearm homicides from 2014 to 2018 in 17 US states.

Among 1085 paediatric firearm homicides, non-Hispanic blacks (NHB) died at a rate three times greater than their proportion in the general population; they were nine times as likely to die by firearm homicide as non-Hispanic whites (NHW). NHW children were more often the victims of firearm homicide perpetrated by a parent/caregiver, and of homicide-suicides.

Violence interruption programmes among NHB youth, and family-based interventions among NHW youth may be effective in preventing firearm homicide and homicide-suicide. Systematic investigations into firearm homicide perpetrators are necessary to better understand observed racial disparities.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ In 2020, firearms surpassed motor vehicle crashes as the leading cause of death among US children.
⇒ Rates of firearm mortality are significantly different based on child race/ethnicity.
⇒ The National Violent Death Reporting System (NVDRS) contains quantitative and qualitative data which may elucidate the contributing factors for observed racial differences among paediatric firearm homicides.

WHAT THIS STUDY ADDS

⇒ Individual and circumstantial characteristics of paediatric firearm homicide differ significantly by child race/ethnicity.
⇒ Racial disparity and disproportionality of paediatric firearm homicides exists which present opportunities for prevention.

HOW THIS STUDY AFFECTS RESEARCH, POLICY, AND PRACTICE

⇒ Results of this study may be used to inform anticipatory guidance and violence prevention screening during paediatric well-child visits to identify paediatric patients at risk of firearm-related homicide-suicide following parental separation.
⇒ There is an urgent research and policy need to invest resources into identifying the perpetrators of firearm-homicide among NHB children.

Firearms are the leading cause of death in US children aged 0–17 years, surpassing motor vehicle crashes in 2020.[1] From 2010–2019 the rate of paediatric firearm deaths increased by 32%, to 2.4 deaths per 100 000 children.[2] Despite this increase, paediatric firearm research remains understudied.[3] Until recently, lack of allocated resources for firearms research stifled investigation into the causes and consequences of these deaths.

Although several studies have identified that black children are most frequently the victims of firearm homicide[4] and white children the most vulnerable to firearm suicide,[5] underlying reasons for these disparities are unclear. There remains a lack of understanding of the complex factors contributing to these deaths, limiting the development of effective prevention strategies.

More research is needed to inform intervention efforts that include race/ethnicity, familial, community, and circumstantial characteristics. Recently, leaders in the field of injury and violence prevention convened to develop a consensus-driven paediatric firearms research agenda that, if followed, would close many of the extant gaps in the paediatric firearms literature and inform effective primary and secondary prevention efforts.[6] This study addresses one of the priorities identified by this consortium focused on demographic and social environmental factors among paediatric firearm homicide decedents.

METHODS

We conducted secondary analysis of the National Violent Death Reporting System (NVDRS) Restricted Access Database, a multi-state, case-level dataset containing over 600 variables and narratives relating to violent deaths.

The study sample included paediatric firearm homicide decedents aged 0–17 years from 17 states from 2014 to 2018 (Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah,

Check for updates

© Author(s) (or their employer(s)) 2023. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Hunter AA, Schwab-Reese L, DiVietro S, *et al*. *Inj Prev* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/ip-2022-044733

Inj Prev: first published as 10.1136/ip-2022-044733 on 2 March 2023. Downloaded from http://injuryprevention.bmj.com/ on April 19, 2024 by guest. Protected by copyright.

Table 1 ICD-10 codes and key terms used to identify paediatric firearm homicides

ICD-10 code	Description
X93	Assault by handgun discharge
X94	Assault by rifle, shotgun, and larger firearm discharge
X95	Assault by other and unspecified firearm and gun discharge
Examples of key terms	Gun, firearm, rifle, shotgun

Virginia, and Wisconsin). Prior studies demonstrate that these 17 states represent the demographic and mortality statistics of the US.[7 8]

Measures

International Classification of Disease and Related Health Problems 10th revision (ICD-10) and external cause of injury codes were used in combination with existing NVDRS variables to identify the outcome of paediatric firearm homicides (table 1).

Racial disproportionality was defined as the underrepresentation or overrepresentation of a racial or ethnic group compared with its percentage in the total population and was measured using the disproportionality representation index (DRI).[9] This measure was calculated by dividing the percentage of child decedents in each racial/ethnic group by the percentage of children of that racial/ethnic group in the general population. Racial disparity was defined as the unequal outcome of one racial/ethnic group as compared with outcomes for another racial/ethnic group and was measured using the disparity index (DI).[9] The DI represents DRI ratios of two given racial/ethnic groups.

Table 2 Demographic characteristics of paediatric firearm-related decedents and perpetrators

Victim	Total (n=1085)	NHB (n=661)	NHW (n=239)	Hispanic (n=143)
Characteristic				
Median Age (years)	16.0	16.0	14.0	16.0
Age groups				
	N(%)	N(%)	N(%)	N(%)
<5 years	84 (7.7)	41 (6.2)	31 (13.0)	7 (4.9)
5–11 years	147 (13.6)	47 (7.1)	64 (26.8)	22 (15.4)
12–17 years	854 (78.7)	573 (86.9)	144 (60.2)	114 (79.7)
Sex				
Male	829 (76.4)	540 (81.7)	156 (65.3)	102 (71.3)
Female	256 (23.6)	121 (18.3)	34.7 (34.7)	41 (28.7)
Perpetrators				
Median Age (years)	28.0	25.0	32.0	30.0
Sex				
Male	722 (66.5)	407 (61.6)	186 (77.8)	98 (68.5)
Female	55 (5.1)	9 (1.4)	31 (13.0)	6 (4.2)
Missing/unknown	308 (28.4)	245 (37.0)	22 (9.2)	39 (27.2)
Relationship to victim				
Parent/caregiver	146 (13.5)	26 (3.9)	85 (35.6)	18 (12.6)
Other family member	48 (4.4)	17 (2.6)	23 (9.6)	6 (4.2)
Intimate partner of a parent	23 (2.1)	7 (1.1)	10 (4.2)	5 (3.5)
Intimate partner	22 (2.0)	13 (2.0)	4 (1.7)	4 (2.8)
Friend/acquaintance	130 (12.0)	63 (9.5)	40 (16.7)	19 (13.3)
Stranger	91 (8.4)	56 (8.5)	12 (5.0)	21 (14.7)
Gang	17 (1.6)	8 (1.2)	0 (0)	9 (6.3)
Other relationship	74 (6.8)	53 (8.0)	13 (5.4)	6 (4.2)
Missing/unknown	534 (49.2)	418 (63.2)	52 (21.8)	55 (38.5)

Table 3 Select circumstances associated with paediatric firearm-related homicide among NHW vs NHB (Ref) decedents, NVDRS 2014–2018

	OR	95% CI	OR adjusted*	95% CI adjusted*
Circumstance				
Argument or conflict led to death	0.5	0.3 to 0.8	0.6	0.4 to 1.0
Family relationship problem	1.3	0.5 to 3.2	1.5	0.6 to 3.9
Gang motivated	0.04	0.01 to 0.1	0.04	0.01 to 0.1
Bystander	0.6	0.3 to 1.2	0.3	0.2 to 0.6
Suspect/perpetrator was a caregiver	3.9	2.6 to 6.1	3.3	2.1 to 5.2
Drive by	0.2	0.07 to 0.4	0.2	0.07 to 0.4
Drug involvement	1.9	1.2 to 3.2	2.6	1.5 to 4.3
Homicide-Suicide	2.7	1.8 to 4.2	4.5	2.7 to 7.4

*Adjusted for age and sex.

Decedent-level exposures included child age, sex, race/ethnicity, and state of residence. Perpetrator-level exposures included age, race/ethnicity, sex, and relationship to the victim. Incident-level exposures were also examined. Demographic, circumstance, and incident-level characteristics were compared by decedent race/ethnicity. ORs and 95% confidence intervals were calculated and adjusted for decedent sex and age.

Qualitative analysis

To better understand the circumstances surrounding paediatric firearm-related homicides, we applied qualitative content analysis using a proportionate stratified random sampling framework based on age and race/ethnicity.[10] Once the qualitative sample was identified, we reviewed the corresponding law enforcement and medical examiner/coroner narratives, noting patterns that appeared frequently, and instances where circumstances diverged. Based on those themes, we created and applied a codebook from which we identified patterns and themes to provide important context to our results.

RESULTS

Paediatric firearm homicide decedents

We identified 1085 paediatric firearm homicides (table 2). Decedents were most often male (76.4%), and NHB (60.9%); just 13% of decedents were Hispanic. Median age was 16.0 years; 21% were 0–11 years old. Compared with NHBs, firearm homicides in NHW children more often involved drugs (AOR=2.6; 95% CI=1.5 to 4.3), and involved homicide-suicide (AOR=4.5; 95% CI=2.7 to 7.4) by a parent or caregiver. In contrast, firearm homicides among NHB children were more often related to community violence (table 3).

Table 4 Disproportionality Representation Index and Disparity Index for paediatric firearm-related homicides in 17 NVDRS states, 2014–2018

Decision point	DRI	DI
Race/ethnicity		
NHW	0.3	ref
NHB	3.1	9.0
Hispanic	0.8	2.4

Inj Prev: first published as 10.1136/ip-2022-044733 on 2 March 2023. Downloaded from http://injuryprevention.bmj.com/ on April 19, 2024 by guest. Protected by copyright.

Paediatric firearm homicide perpetrators

We observed differences in perpetrator characteristics based on decedent race/ethnicity. Notably, the relationship of the perpetrator to the victim was missing or unknown in 63.2% of paediatric firearm homicides involving NHB children and in 38.5% involving Hispanic children, compared with 21.8% involving NHW children. Perpetrators of NHB decedents were significantly younger (25.0 years) than perpetrators of NHW (30.0 years) and Hispanic (30.0 years) children.

Racial disproportionality and disparity

We found that NHB children died by firearm homicides at a rate that was three times greater than expected given their proportion of the general population. Hispanic and NHB children were 2.4 and 9.0 times as likely to die by firearm homicide than NHW children, respectively (table 4).

Themes from qualitative analysis

While no two incidents were identical, firearm homicides may be broadly categorised by the relationship between the victim(s) and the perpetrator(s). Incidents were divided almost evenly between perpetrators who were parents/caregivers, acquaintances, no relationship, or unknown.

Most homicides involving parents and caregivers were followed by suicide. This is the only category where the majority of victims were NHW and split evenly between males and females. Middle-aged white males were the most common perpetrators of these incidents. Victims were most often under the age of 10 years and perpetrator mental illness was a contributing factor. Common themes among homicide-suicides included history of domestic violence or anger issues, and in some instances, families were in the process of separating or re-negotiating custody agreements.

Firearm homicides perpetrated by an acquaintance involved victims who were predominantly older and male. These homicides often involved theft, and occasionally a subsequent theft-related homicide occurred days or weeks later in retaliation; decedents were often beaten before being shot. In other instances, males were killed during or after a fight or argument. These incidents did not appear to be premeditated, and alcohol or marijuana were identified as contributing factors. Few females were killed by acquaintances, and the factors contributing to these deaths were unique; no common patterns could be identified.

In the majority of homicides perpetrated by strangers, decedents were 15 to 17 year-old NHB males. The decedent was often in the process of a theft and the shooting occurred during the crime. Some of these incidents occurred during a drug deal or were attributed to gang-related activity. Of note, some decedents were killed by rival gang members after posting gang signs on social media.

DISCUSSION

Using large multistate data, this study identified factors contributing to racial disparity and disproportionality among paediatric firearm homicides. We found differences in family and community-level circumstances related to decedent race/ethnicity.

Our primary findings suggest that firearm homicides among NHB and Hispanic youth are poorly investigated. Far more homicides among these race/ethnic groups lacked an identified perpetrator, which may reflect law enforcement's approach to investigating these deaths in predominantly black and brown communities. Lack of an identified perpetrator prevents our ability to understand relational factors contributing to these deaths and impedes our ability to develop effective interventions. Additionally, relationships and trust between law enforcement and community members informs willingness to participate in homicide investigations and may be impeded by high-profile and/or local police shootings involving black and brown people.

Less than 5% of NHW children in our study had gang ties noted in their narratives despite evidence from the Department of Justice's National Gang Centre citing that at least 11% of youth gang members in the US identify as NHW.[11] In contrast, NHB children in our sample were more likely to have gang activity noted. Assumptions about gang involvement may influence police investment in homicide investigations and could account for the lack of information provided about perpetrators among NHB and Hispanic firearm decedents.

Our data showed that NHW children were at increased risk of firearm homicide and homicide-suicide perpetrated by their parents/caregivers. The best way to protect children is to support their parents/caregivers. Paediatricians and other healthcare providers are in a unique position to intervene. For infants, enhanced screening for postpartum depression and providing anticipatory guidance about parental stress are recommended.[12 13] For older children, guidance on discipline and parenting, screening for parental mental illness and substance misuse, universal education on intimate partner violence, and facilitating appropriate referrals for treatment are recommended.[14] Extreme Risk Protective Orders, which can limit access to guns, can also prevent these deaths.[15]

Identifying root causes of violence are necessary to establish prevention strategies. Our results show that NHB children are vulnerable to community firearm violence, while NHW children are vulnerable to firearm violence within their family unit. The evidence-base for effective violence prevention strategies is growing and interventions exist across the socioecological model, addressing either specific types of violence or modifiable risk factors. To be effective, it is vital to also consider racial/ethnic factors attributed to differences in the risk of violence within this model.

Limitations and strengths

This study carries the following limitations: (1) our analysis was limited to 17 states, (2) despite our analysis showing comparability between the study population and the US, it is possible that our results may not generalise to all states, (3) NVDRS data is manually abstracted, and it is probable that errors in coding exist which may have influenced our results.

Contributors AAH conceived the study and conducted the quantitative analyses. LSW and SD conducted the qualitative analysis. CG provided content expertise. All authors contributed to the interpretation of results and writing of this manuscript.

Funding This research was funded by R03HD104738, Eunice Kennedy Shriver National Institute of Child Health and Human Development.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD

Amy A Hunter http://orcid.org/0000-0002-6399-6090

REFERENCES

1 Goldstick JE, Cunningham RM, Carter PM. Current causes of death in children and adolescents in the United States. *N Engl J Med* 2022;386:1955–6.

Inj Prev: first published as 10.1136/ip-2022-044733 on 2 March 2023. Downloaded from http://injuryprevention.bmj.com/ on April 19, 2024 by guest. Protected by copyright.

2 Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. Web-based injury statistics query and reporting system (WISQARS). n.d. Available: www.cdc.gov/injury/wisqars
3 Galea S, Branas CC, Flescher A, *et al*. Priorities in recovering from a lost generation of firearms research. *Am J Public Health* 2018;108:858–60.
4 Bachier-Rodriguez M, Freeman J, Feliz A. Firearm injuries in a pediatric population: african-american adolescents continue to carry the heavy burden. *Am J Surg* 2017;213:785–9.
5 Fowler KA, Dahlberg LL, Haileyesus T, *et al*. Firearm injuries in the united states. *Prev Med* 2015;79:5–14.
6 Cunningham RM, Carter PM, Ranney ML, *et al*. Prevention of firearm injuries among children and adolescents: consensus-driven research agenda from the firearm safety among children and teens (FACTS) consortium. *JAMA Pediatr* 2019;173:780–9.
7 Hunter AA, Schwab-Reese L, DiVietro S, *et al*. An examination of fatal child poisonings in the united states using the national violent death reporting system (NVDRS), 2012-2017. *Clin Toxicol (Phila)* 2022;60:342–7.
8 Hunter AA, DiVietro S, Schwab-Reese L, *et al*. An epidemiologic examination of perpetrators of fatal child maltreatment using the national violent death reporting system (NVDRS). *J Interpers Violence* 2021;36:9035–52.
9 Children's Bureau. *Racial disproportionality and disparity in child welfare*. Washington, DC: U.S. Department of Health and Human Services, 2016.
10 Schreier M. *Qualitative content analysis in practice*. Sage publications, 2012.
11 National Youth Gang Survey Analysis. Department of justice. n.d. Available: https://nationalgangcenter.ojp.gov/survey-analysis
12 Jennings KD, Ross S, Popper S, *et al*. Thoughts of harming infants in depressed and nondepressed mothers. *J Affect Disord* 1999;54:21–8.
13 Barr JA, Beck CT. Infanticide secrets: qualitative study on postpartum depression. *Can Fam Physician* 2008;54:1716–7.
14 Friedman SH, Horwitz SM, Resnick PJ. Child murder by mothers: a critical analysis of the current state of knowledge and a research agenda. *Am J Psychiatry* 2005;162:1578–87.
15 Gondi S, Pomerantz AG, Sacks CA. Extreme risk protection orders: an opportunity to improve gun violence prevention training. *Acad Med* 2019;94:1649–53.

Inj Prev: first published as 10.1136/ip-2022-044733 on 2 March 2023. Downloaded from http://injuryprevention.bmj.com/ on April 19, 2024 by guest. Protected by copyright.