HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2024 September 04.

Published in final edited form as:

Am J Prev Med. 2024 May ; 66(5): 894–898. doi:10.1016/j.amepre.2023.12.019.

The Health and Economic Impact of Youth Violence by Injury Mechanism

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Abstract

Introduction: Violence is a leading cause of morbidity and mortality among U.S. youth. More information on the health and economic burden of the most frequent assault mechanisms—or, causes (e.g., firearms, cut/pierce)—can support the development and implementation of effective public health strategies. Using nationally representative data sources, this study estimated the annual health and economic burden of U.S. youth violence by injury mechanism.

Methods: In 2023, CDC's WISQARS provided the number of homicides and nonfatal assault ED visits by injury mechanism among U.S. youth aged 10–24 years in 2020, as well as the associated average economic costs of medical care, lost work, morbidity-related reduced quality of life, and value of statistical life. The Healthcare Cost and Utilization Project Nationwide Emergency Department Sample provided supplemental nonfatal assault incidence data for comprehensive reporting by injury mechanism.

Results: Of the $86B estimated annual economic burden of youth homicide, $78B was caused by firearms, $4B by cut/pierce injuries, and $1B by unspecified causes. Of the $36B billion estimated economic burden of nonfatal youth violence injuries, $19B was caused by struck by/against injuries, $3B by firearm injuries, and $365M by cut/pierce injuries.

Conclusions: The lethality of assault injuries affecting youth when a weapon is explicitly or likely involved is high—firearms and cut/pierce injuries combined account for nearly all youth homicides compared to one-tenth of nonfatal assault injury ED visits. There are numerous

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2023.12.019.

evidence-based policies, programs, and practices to reduce the number of lives lost or negatively impacted by youth violence.

INTRODUCTION

Youth violence is the intentional use of physical force or power to threaten or harm others by young people ages 10−24 years; a young person can be involved with youth violence as a victim, offender, or witness.[1] Youth violence has significant long-term effects on the physical, social, and emotional health of youth and families.[2] In 2020, there were over 6,500 homicides and over 300,000 emergency departments (ED) for nonfatal assault injuries among U.S. youth ages 10−24 years, each representing an substantial and long-term societal cost for individuals, families, and communities including schools.[3] The annual economic burden of U.S. youth violence is an estimated $120 billion in medical spending, lost productivity, reduced quality of life, and avoidable mortality.[4] More information on the most frequent assault mechanisms—or, causes (e.g., firearms, cut/pierce, etc.)—affecting youth can support the development and implementation of effective public health strategies. Information on the burden of firearm injuries specifically, is critical but analysis requires an intentional method with available data. Using nationally representative data, this study estimated the annual health and economic burden of U.S. youth violence by injury mechanism.

METHODS

In 2023, the number of homicides and nonfatal assault intent ED visits by disposition (treat and release or hospitalized) in 2020 among U.S. youth aged 10−24 years and the average economic cost of those injuries were obtained from CDC's publicly available Web-based Injury Statistics Query and Reporting System (WIS-QARS). Institutional review was not required. Underlying surveillance and cost methods for the data source are described elsewhere.[5] Information on youth homicides came from the National Center for Health Statistics mortality files.[6] Information on ED visits came from the National Electronic Injury Surveillance System-All Injury Program, a U.S. nationally representative probability sample of hospitals.[7] Medical spending and lost work costs due to nonfatal injuries were assessed using regression-based cost of illness methods applied to the Healthcare Cost and Utilization Project National Emergency Department Sample (HCUP-NEDS) (which can produce survey-weighted national estimates of community hospital encounters) and MarketScan Commercial Claims and Encounters Databases (which demonstrate medical payments to providers from approximately 350 health insurance payers—employers, health plans, and public organizations).[8−10] The monetary value of injury morbidity and mortality was determined based on quality of life loss estimates for injuries by mechanism and intent (e.g., assault). It also considered recommended methods for estimating the value of statistical life (VSL), a monetary measure of the collective value placed on reducing the risk of mortality. This estimate is derived from research studies of revealed preferences (e.g., observed wage differences for dangerous occupations) or from stated preferences obtained through surveys of individuals' willingness to pay for mortality risk reduction.[11−13] VSL is higher for children than adults.[14] Cost estimates as 2020 USD used the societal perspective,

including tangible and intangible costs to multiple payers and a 1-year time horizon for nonfatal assaults.

WISQARS reporting on nonfatal ED visits for some injury mechanisms—including firearm assaults—is not available due to small sample sizes in the underlying surveillance source data. To comprehensively present the health and economic burden of youth violence injuries by mechanism, when 2020 WISQARS estimates by injury mechanism were unavailable for the 10–24 age group, data were supplemented with annualized estimates from WISQARS and HCUP-NEDS for the years 2018–2020. Nonfatal injuries in HCUP-NEDS were identified using recommended ICD-10-CM codes (Appendix Table 1, available online).[15] The number and cost of nonfatal firearm assault ED visits were not available even with combined 2018–2020 WISQARS data and such injuries are known to be undercounted in administrative data sources including HCUP-NEDS.[16,17] To estimate the annual number of youth firearm assault-related ED visits more accurately, the authors multiplied the percentage of nonfatal firearm ED visits with assault intent among patients aged 10–24 years, as found in the 2018–2020 National Electronic Injury Surveillance-Firearm Special Study (NEISS-FISS), by the total number of nonfatal firearm ED visits (regardless of intent) in 2018–2020 HCUP-NEDS.[16] NEISS-FISS data come from a probability sample of U.S. hospitals; medical records for firearm injuries are validated by medical coders.[7] Nonfatal firearm injury average costs were applied from previous studies.[5,12,18]

RESULTS

Of the $86B estimated annual economic burden of youth homicide, $78B was caused by firearms, $4B by cut/pierce injuries, and $1B by unspecified causes (Table 1). Most of the economic burden of youth homicide came from lost life years valued using VSL (approximately $12–13M per homicide—variation due to victim age) rather than medical spending (not all homicide victims received medical care—$3,000–$25,000 average per homicide by injury mechanism). Of the $36B billion estimated economic burden of nonfatal youth violence injuries, $19B was caused by struck by/against injuries, $3B by firearm injuries, and $365M by cut/pierce injuries (Table 2). Each nonfatal assault ED treat and release visit among youth cost approximately $8,000 in medical spending, $800 in work loss costs, and $97,000 in morbidity-related reduced quality of life over the follow 1 year. Those costs were higher—$96,000, $9,000, and $105,000—for injuries requiring hospitalization (13% of ED visits overall and highest for firearm injuries—52%).

DISCUSSION

In 2020, the estimated economic cost of homicides and nonfatal assaults affecting U.S. youth was $86 billion in fatal injury costs and $36 billion in nonfatal injury costs. Firearms (homicides, assaults), cut/pierce weapons (homicides), and struck/by against an object (assaults) were the most frequent injury mechanisms. Firearms are involved in over 90% of homicides, nearly 10% of ED visits for assault injuries among youth, and a combined estimated annual economic burden of $81 billion. Avoidable mortality based on VSL was the largest contributing element to the economic burden, reflecting the substantial number of life years lost to violence in this young population. Findings point to the lethality of injuries

among youth when a weapon was explicitly or likely involved—firearms and cut/pierce injuries combined accounted for 96% of youth homicides compared to 13% of nonfatal assault ED visits.

Limitations

These findings have several limitations. First, the economic cost of nonfatal assaults is underestimated because only injuries treated in an ED were addressed, other costs including but not limited to property damage and criminal justice activities were not observed, and nonfatal costs addressed only the first year following an injury owing to available data. Second, this study assessed the economic burden of youth violence victimization, based on victim age, and did not address perpetration. Third, this study combined multiple data sources to estimate injury incidence by mechanism; this risked errors in injury identification, but authors used recommended injury classifications. Fourth, despite the use of supplementary data sources, final reporting still included ambiguous injury mechanisms; for example, 1.5% of homicides had an unspecified cause. Related to this, even the most reliable data source for nonfatal firearm injury intent contains a large proportion of undetermined intent cases.[16] Careful clinical reporting can support accurate and complete surveillance of violence injuries.

CONCLUSIONS

In addition to pain and suffering at the individual, family, and community levels youth violence causes a substantial economic burden. Firearm injuries contribute significantly to this burden. Addressing risk and protective factors across various levels is crucial for preventing youth violence. Implementing evidence-based programs, policies, or practices like home visitation programs, pre-school enrichment with family engagement, mentoring or afterschool programs, street outreach, and community norm change campaigns, for example, has been shown to effectively reduce youth violence.[1]

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

No financial disclosures have been reported by the authors of this paper.

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Table 1.

Health and Economic Burden of Youth Homicide by Mechanism

Mechanism[a]	Deaths, n (%)	Average		Total[b]
		Medical	VSL	
Firearm	6,184 (91.6)	$10,348	$12.7 M	$78 B
Cut/pierce	298 (4.4)	$10,427	$12.5 M	$4 B
Unspecified	101 (1.5)	$10,254	$13.1 M	$1 B
Suffocation	49 (0.7)	$3,330	$13.0 M	$638 M
Other specified/NEC	40 (0.6)	$21,339	$13.7 M	$549 M
Transport, other land	22 (0.3)	$20,675	$12.6 M	$278 M
Fire/flame	16 (0.2)	$24,425	$14.7 M	$236 M
Struck by/against	15 (0.2)	$23,703	$13.6 M	$204 M
Other specified and classifiable	14 (0.2)	$8,095	$16.6 M	$232 M
Drug poisoning	7 (0.1)	$1,879	$12.3 M	$86 M
Drowning	4 (0.1)	$18,403	$14.7 M	$59 M
Non-drug poisoning	1 (<0.1)	$1,011	$18.0 M	$18 M
Total	6,751 (100.0)	$10,451	$12.7 M	$86 B

Data source: CDC WISQARS. Costs are 2020 USD.

[a] https://www.cdc.gov/injury/wisqars/cost_help/mechanism_injury.html.

[b] Data do not sum to total due to rounding.

B, billion; NEC, not elsewhere classifiable; M, million; VSL, value of statistical life.

Table 2.

Health and Economic Burden of ED Visits for Youth Nonfatal Assault by Injury Mechanism

	Assault injury ED visits		Average cost per ED visit by disposition[f]						
Mechanism[c]	**n (% total)**	**% Hosp**	**T&R**	**Hosp**	**T&R**	**Hosp**	**T&R**	**Hosp**	**Total[g]**
Struck by/against	216,715 (71.5)	5.3	$4,864	$56,860	$684	$9,251	$73,834	$128,933	$19 B
Firearm	24,961[e] (8.2)	51.7[b]	$17,578	$116,928	$1,524	$9,251	$20,300	$96,280	$3 B
Cut/pierce	14,894[b] (4.9)	19.9[b]	$4,520	$46,773	$591	$9,251	$4,616	$28,082	$365 M
Fall	3,666 (1.2)	.	.	.	.	.	.	.	.
Fire/burn	1,888 (0.6)	21.7[b]	$4,894	$68,782	$1,524	$9,252	$9,091	$89,577	$92 M
Other specified	1,819[a] (0.6)	7.5[b]	$4,124	$55,092	$447	$9,251	$5,754	$10,591	$28 M
Overexertion	1,777 (0.6)	.	.	.	.	.	.	.	.
Pedestrian	1,304[a] (0.4)	13.4[b]	$9,237	$103,933	$2,246	$23,249	$81,898	$190,694	$161 M
Motor vehicle occupant	1,109[a] (0.4)	.	.	.	.	.	.	.	.
Inhalation/suffocation	866[a] (0.3)	6.3[b]	$8,173	$52,260	$1,524	$9,252	$7,509	$250,424	$31 M
Poisoning	643[a] (0.2)	18.8[b]	$9,191	$27,264	$1,524	$9,251	$1,415	$6,107	$11 M
Unknown/unspecified	555[a] (0.2)	5.9[b]	$6,920	$53,182	$971	$9,253	$33,319	$98,984	$27 M
Natural/environmental[h]	52[b] (<0.01)	.	.	.	.	.	.	.	.
Drowning/submersion	.	.	.	.	.	.	.	.	.
Other transportation	.	.	.	.	.	.	.	.	.
Total[d]	303,078 (100.0)	13.6	$7,945	$95,722	$792	$9,318	$96,958	$105,267	$36 B

Data source: CDC WISQARS (www.cdc.gov/injury/wisqars; queried July 2023) unless otherwise noted. Costs are 2020 USD.

ED visit count estimate not demonstrated when unstable due to small sample size or coefficient of variation >30%. Cost estimate not demonstrated when either ED visit count or % hospitalized are missing.

[a] Annualized 2018–2020 CDC WISQARS estimate (applied when 2020 CDC WISQARS estimate by mechanism was not available).

[b] Annualized 2018–2020 HCUP-NEDS estimate (applied when neither 2020 nor 2018–2020 CDC WISQARS annualized estimate by mechanism was available).

[c] Appendix Table 1 (available online) shows crosswalk between CDC WISQARS and NCHS ICD–10–CM External Cause-of-injury Framework for reporting here.

[d] Total count and cost values from CDC WISQARS Cost of Injury (query: 2020 USD, year 2020, age 10–24, assault-other intent).

[e] Calculated as the percentage of firearm mechanism nonfatal ED visits with assault intent among patients aged 10–24 years in 2018–2020 NEISS-FISS (39,201/48,988=80%) multiplied by the number of nonfatal firearm mechanism nonfatal ED visits (any intent) in 2018–2020 HCUP-NEDS (n=31,191), or 24,961 (rounded).

[f] Average cost values from CDC WISQARS Cost of Injury (query: 2020 USD, year 2020, age 10–24, all intents). Firearms average costs are from previous studies.[5,12,18]

[g] Data do not sum to total due to rounding and suppressed (low count) estimates for some injury mechanisms.

[h] Natural/environmental includes injuries resulting from exposure to adverse natural and environmental conditions (such as severe heat, severe cold, lightning, sunstroke, large storms, and natural disasters) as well as lack of food or water.

ED, emergency department; HCUP-NEDS, Healthcare Cost and Utilization Project Nationwide Emergency Department Sample; Hosp, hospitalized (following ED visit; includes transferred); NEISS-FISS, National Electronic Injury Surveillance System-Firearm Injury Surveillance Study; QoL, quality of life; T&R, treated and released; M, million; B, billion.