



Epidemiological trends of youth firearm mortality in the U.S. States, 2010-2019



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Introduction

In high-income countries, approximately 9 out of 10 youths <15 years of age killed with firearms were found to be from the United States.¹ In 2019, 3 of the top 10 leading causes of death for youths 1-12 years of age were unintentional injuries (#1), homicides (#4), and suicides (#7), and the leading method of death for these three were firearms.^{2,3} In the same year, for the ages 13-19 years, the three leading causes of death were unintentional injuries (#1), suicides (#2), and homicides (#3) with the majority from firearms.² Most of these studies on youth firearm mortality focus on the cause of death by race and gender across the nation.^{3,4} However, little is known about how these mortality trends have changed over time, overall and within states.

Methods

The Web-Based Injury Statistics Query and Reporting System (WISQARS) data from the Centers for Disease Control and Prevention (CDC) were analyzed for this study from the years 2010-2019.² Youths were defined as individuals 19 years of age and younger. Firearm mortality in the database included unintentional firearm deaths, firearm suicides, firearm homicides, and legal interventions/unknown. Data are reported as raw numbers age adjusted mortality rates nationwide per 100,000 for sociodemographic characteristics, crude rates for statewide numbers to account for differences in population size of each state, and percentage differences for each state and nationwide. Year 2000 was used as the standardized year for age adjusting of rates per 100,000.

Results

The overall firearm mortality rate per 100,000 youths increased by 30% from 2010-2019 [Table 1]. The rates of firearm mortality increased the most for suicides (63%), non-Hispanic Whites (45%), and females (46%). The rate increased 52% in the South and decreased by 28% in the Northeast.

Over the past decade, there were 7 states that had firearm mortality rates which increased by 70% or more (decreasing order): South Carolina, Arkansas, Colorado, Ohio, Kansas, Texas, and Indiana (Table 2). A total of 26 states had increases in their youth firearm mortality rates. In contrast, only 4 states had a decline in youth firearm mortality rates (New York, California, New Jersey, and Pennsylvania). Eighteen states had too few cases in one or both years to reliably predict firearm mortality rate changes among youth.

Discussion

Our findings regarding youth firearm mortality are consistent with previous research on youth firearm-related hospital encounters and community-based studies from other data sources.^{4,5} Hospital data specifically indicate higher rates of firearm injuries in males, black youths, older youths, and those living in the South. The data indicates a worsening epidemic of firearm mortality in youths and in most states. The Northeastern states are leading the way with lower firearm mortality in youths. The significant increase in firearm suicides in youths across the nation may indicate that reversing this trend will require greater access to mental health resources and better storage of firearms by adults in households.^{6,7} Firearm suicide attempts in youths usually results in death before they reach the hospital. To date, Child Access Prevention (CAP) laws have been the best policies to help reduce unintentional and suicide deaths from firearms in children and adolescents.^{8,9}

The results of this study have potential limitations. Under-reporting of firearm fatal events is known to occur, but we cannot determine its impact on the WISQARS data. However, the under-reporting may not substantially vary by state. We also did not attempt to control for state variations in sociodemographic factors such as racial distribution, poverty rates, urbanicity or firearm ownership rates which may have an effect on the rates of firearm mortality^{7,8,9}. However, the key message is that most states have had increases in youth firearm mortality highlighting a need for greater efforts to reverse the trend of this premature mortality by use of effective prevention policies.

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Table 1
Age-Adjusted Firearm Mortality in Youths by Demographic Characteristics, 2010-2019

Sociodemographic Characteristics	Year 2010 N (age adjusted rate)	Year 2015 N (age adjusted rate)	Year 2019 N (age adjusted rate)	Rate Differences between 2010-2019 (%)
Sex Females	342 (0.82)	411(1.01)	486(1.20)	+46
Males	2,369 (5.32)	2,413(5.65)	2,904 (6.82)	+28
Race/ Ethnicity Hispanic	514(2.85)	436(2.31)	578(2.87)	+1
Non-Hispanic Black	1,205(8.73)	1,191(9.40)	1,483(11.83)	+36
Non-Hispanic White	907 (1.84)	1102(2.39)	1,196(2.67)	+45
Cause of Mortality Suicide	749 (0.86)	1,017(1.22)	1,167 (1.40)	+63
Homicide	1,773 (2.04)	1,645(1.97)	2,023 (2.43)	+19
Unintentional	134 (0.16)	100(0.12)	117 (0.13)	-19
Legal interventions	17(0.02)	25(0.03)	19(0.02)	0
Undetermined	38 (0.04)	37(0.04)	64(0.08)	+100
Age 0-14 years	380(0.62)	443 (0.73)	510(0.84)	+35
15-19 years	2,331 (10.58)	2,381(11.29)	2880(13.68)	+29
Region Northeast	359(2.35)	251(1.76)	233(1.70)	-28
South	1,103(3.46)	1,236(3.92)	1,696 (5.28)	+52
Midwest	608(3.21)	694(3.88)	814(4.62)	+44
West	641(3.10)	643(3.25)	647(3.26)	+5
Overall	2,711(3.13)	2,824(3.39)	3,390(4.07)	+30

N= indicates number of firearm deaths. Age adjusted rates are based on per 100,000 youths ages 19 years and younger. Year 2000 was used as the standardized year for age adjusting

Table 2
Youth Firearm Mortality by States, 2010-2019

State	2010 n (crude rates)	2019 n (crude rates)	Percentage Changes
Alabama	66(5.17)	98(8.06)	+56
Alaska	18(8.66) *	24(12.19)	*
Arizona	54(2.97)	79(4.30)	+46
Arkansas	25(3.14)	51(6.55)	+109
California	365(3.49)	235(2.37)	-36
Colorado	36(2.64)	74(5.26)	+99
Connecticut	13(1.42)*	10(1.21)*	*
Delaware	10(4.28)*	10(4.37)*	*
District of Columbia	23(18.59)	20(13.39)*	*
Florida	147(3.26)	187(3.97)	+22
Georgia	112(4.03)	163(5.82)	+44
Hawaii	NR	NR	NR
Idaho	12(2.95)*	16(3.22)*	*
Illinois	142(4.06)	179(5.69)	+40
Indiana	60(3.32)	100(5.70)	+72
Iowa	16(1.95)*	26(3.18)	*
Kansas	25(3.08)	43(5.50)	+79
Kentucky	39(3.40)	58(5.18)	+52
Louisiana	87(6.94)	107(8.89)	+28
Maine	NR	10(3.56)	*
Maryland	45(2.97)	59(3.96)	+33
Massachusetts	29(1.79)	18(1.16)*	*
Michigan	103(3.89)	83(3.45)	-11
Minnesota	28(1.96)	37(2.56)	+31
Mississippi	46(5.41)	64(8.20)	+52
Missouri	84(5.25)	122(7.99)	+52
Montana	14(5.58)*	17(6.68)*	*
Nebraska	10(1.95)*	13(2.45)*	*
Nevada	21(2.85)	33(4.34)	+52
New Hampshire	NR	NR	NR
New Jersey	52(2.27)	38(1.77)	-22
New Mexico	30(5.17)	40(7.52)	+45
New York	116(2.37)	50(1.11)	-53
North Carolina	79(3.09)	116(4.47)	+45
North Dakota	NR	10(4.98)*	*
Ohio	80(2.61)	142(4.92)	+89
Oklahoma	48(4.61)	70(6.61)	+43
Oregon	17(1.75)*	25(2.59)	*
Pennsylvania	132(4.15)	100(3.36)	-18%
Rhode Island	NR	NR	NR
South Carolina	42(3.43)	95(7.61)	+122
South Dakota	NR	10(4.16)*	*
Tennessee	63(3.76)	103(6.14)	+63%

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Table 2 (continued)

State	2010 n (crude rates)	2019 n (crude rates)	Percentage Changes
Texas	204(2.68)	388(4.73)	+76%
Utah	17(1.77)*	32(3.11)	*
Vermont	NR	NR	NR
Virginia	56(2.69)	87(4.17)	+55
Washington	45(2.54)	56(3.04)	+20
West Virginia	11(2.50)*	20(4.97)*	*
Wisconsin	43(2.86)	49(3.45)	+19
Wyoming	NR	13(8.77)*	*

*rates based on 20 or fewer deaths may be unstable, NR indicates no recorded deaths. Crude rates are based on per 100,000 youths ages 19 years and younger

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Declaration of Competing Interest

The authors have no conflicts of interests to disclose for this manuscript and the study conducted for the manuscript.

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