



# Alarming Trends in Mortality from Firearms Among United States Schoolchildren

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## ABSTRACT

**BACKGROUND:** Mortality from firearms among US schoolchildren is an increasingly major clinical and public health crisis. We explored temporal trends in mortality from firearms among US schoolchildren from 1999 to 2017 by age and race.

**METHODS:** We used the Multiple Cause of Death Files of the United States National Center for Health Statistics; PubMed searches, and joinpoint regressions for trend analyses and calculated mortality rates and 95% confidence limits.

**RESULTS:** From 1999 to 2017, the 38,942 deaths due to firearms in school-age children ranged from 340 per year at ages 5-14 to 2050 at 15-18 years. One epidemic among 5- to 14-year-olds began in 2009 and another among 15- to 18-year-olds began in 2014. The listed intents were 61% assault, 32% suicide, 5% accidental, and 2% undetermined. Blacks accounted for 41% of overall deaths, but only 17% of the school-age deaths. 86% of all deaths were boys.

**CONCLUSIONS:** Mortality from firearms in US schoolchildren is increasing at alarming rates, especially among blacks and those aged 15-18 years. To the best of our knowledge, this is the first report to quantify these recent epidemics. Although federal laws prohibited them until recently, analytic studies designed a priori to do so are necessary to test the hypotheses generated by these descriptive data. We believe that combatting the epidemic of mortality from firearms among US schoolchildren without addressing firearms is analogous to combatting the epidemic of mortality from lung cancer from cigarettes without addressing cigarettes.

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## INTRODUCTION

Mortality from firearms is a major clinical and public health problem in the United States, whose homicide rates are about 6.9-fold higher than those in comparably developed countries.<sup>1</sup> Most are attributable to firearms, occur among blacks,<sup>2</sup> and increased 28% from 2013-2016.<sup>3</sup> In this Brief Observation we explore temporal trends in firearm-related mortality among US school-age children from 5 to 18 years old<sup>4</sup> from 1999 to 2017 by age and race.

## METHODS

We utilized descriptive data from the Multiple Cause of Death Files of the National Center for Health Statistics.<sup>5</sup> Age- and race-specific mortality rates and 95% confidence intervals were obtained using the single-year age feature and the

International Classification of Diseases codes (10<sup>th</sup> edition): Accident (W32-W34), Suicide (X72-X74), Assault (X93-X95), Undetermined Intent (Y22-Y24), and Terrorism (U01.4). PubMed searches were done using the terms US or USA firearm epidemic, US or USA gun epidemic, gun mmwr, firearm mmwr, and US or USA school age firearm. We started with 1999 because this was the first year that non-Hispanic race-ethnicity-specific rates became available from the National Center for Health Statistics.<sup>6,7</sup> Joinpoint regression analyses were used for analyses of trends.<sup>8</sup>

**RESULTS**

From 1999 to 2017, 38,942 firearm-related deaths occurred in 5- to 18-year-olds. These included 6464 from ages 5 to 14 (average 340 per year) and 32,478 from ages 15 to 18 years (average 2050 per year). Among 5- to 14-year-olds, intent was classified as: accident, 12.8% (830 deaths); suicide, 29.6% (1912 deaths); assault, 54.8% (3545 deaths); and undetermined, 2.7% (177 deaths). Among 15- to 18-year-olds, corresponding values were: accident, 3.5% (1121 deaths); suicide, 32.9%

(10,688 deaths); assault, 62.3% (20,247 deaths); and undetermined, 1.3% (422 deaths). There were no deaths classified as terrorism. Percentages of all deaths due to firearms were 5.6% at ages 5 to 14 and 19.9% at 15 to 18 years. Overall, blacks accounted for 41% of deaths and 17% of school-age children. 86% of total deaths were boys.

The Table shows annual percent change (APC) in firearm-related mortality by race and age. Overall, statistically significant increases in firearm-related mortality began in 2009 among 5- to 14-year-olds and in 2014 among 15- to 18-year-olds. Both epidemics have persisted through 2017. Blacks ages 5 to 14 years experienced statistically significant increases in firearm-related mortality beginning in 2013, and in the APC for firearm-related mortality among blacks in 2013-2017 (17.0; 95% CI, 4.9-30.6, which exceeded the human immunodeficiency virus-related APC experienced by blacks ages 15 to 24 during the early years of the human immunodeficiency virus epidemic (7.6; 95% CI, 5.3-10.0 for 1987-1995).

Racial inequalities (expressed as the difference in firearm-related mortality between blacks and whites) increased significantly among 5- to 14-year-olds (APC 60.2; 95% CI, 15.8-

**CLINICAL SIGNIFICANCE**

- Firearm-related mortality among school age children reached epidemic proportions among 5 to 14- year-olds in 2009 and 15 to 18-year-olds in 2014.
- Clinicians,public health officials, and the general public should oppose federal laws and policies limiting research on firearms.
- Combatting the increasing epidemic of mortality from firearms among US schoolchildren without addressing firearms is analogous to combatting the epidemic of lung cancer due to cigarettes without addressing cigarettes.

**Table** Overall Trends in Firearm-Related Mortality Among United States Schoolchildren Aged 5-18 Years from 1999-2017 by Age and Race

Race, Ethnicity, Age	Years	Annual Percent Change and (95% Confidence Interval)	P Value
All, 5-14 years	1999-2009	3.0 (4.5 to 1.5)	< .05
	2009-2017*	4.9 (2.7-7.1)*	< .05*
All, 15-18 years	1999-2002	8.0 (11.0 to 5.0)	< .05
	2002-2006	2.3 (1.2-5.9)	.20
	2006-2014	3.1 (4.0 to 2.1)	< .05
	2014-2017*	13.9 (10.1-17.8)*	< .05*
Non-Hispanic black, 5-14 years	1999-2007	2.5 (1.4-6.6)	.20
	2007-2013	7.3 (14.9-0.9)	.10
	2013-2017*	17.0 (4.9, 30.6)*	< .05*
Non-Hispanic white, 5-14 years	1999-2008	5.4 (8.0 to 2.7)	< .05
	2008-2012*	14.5 (0.3-30.7)*	< .05*
	2012-2017	2.7 (2.0-7.5)	.20
Non-Hispanic black, 15-18 years	1995-2001	20.0 (20.0 to 8.5)	< .05
	1999-2002	8.2 (15.13 to 0.51)	< .05
	2002-2007	4.5 (0.5-9.8)	.10
	2007-2013	5.5 (8.8 to 2.1)	< .05
	2013-2017*	10.4 (4.9-16.2)*	< .05*
Non-Hispanic white, 15-18 years	1999-2001	10.9 (22.8-2.8)	.10
	2001-2007	3.2 (6.6-0.4)	.10
	2007-2014	2.5 (0.4-5.4)	.10
	2014-2017*	12.4 (4.4-21.1)*	< .05*

\*.

121.5 for 2013-2017) and 15- to 18-year-olds (APC 10.1; 95% CI, 2.4-18.4 for 2013-2017).

From 2013 to 2017, the firearm-related mortality rate ratio among 5- to 14-year old blacks relative to 5- to 14-year-old whites was 1.6 (95% CI, 1.5-1.8;  $P < .001$ ), while the corresponding value for 15- to 18-year-olds was 4.0 (95% CI, 3.8-4.2;  $P < .001$ ). Among 5- to 14-year-olds, rates (per 100,000) for firearm-related suicide in 2009 and 2017 were 0.16 (95% CI, 0.12-0.20) and 0.45 (95% CI, 0.39-0.52); homicide 0.41 (95% CI, 0.35-0.48) and 0.50 (95% CI, 0.43-0.56); accident 0.08 (95% CI, 0.05-0.11) and 0.07 (95% CI, 0.05-0.10); and in 2009-2011 and 2015-2017 for undetermined intent, 0.02 (95% CI, 0.02-0.03) and 0.03 (95% CI, 0.02-0.04). Corresponding values for 15- to 18-year-olds in 2014 and 2017 were suicide 3.35 (95% CI, 3.07-3.62) and 4.76 (95% CI, 4.43-5.00); homicide 4.87 (95% CI, 4.54-5.21) and 6.77 (95% CI, 6.38-7.17); accident 0.19 (95% CI, 0.13-0.27) and 0.24 (95% CI, 0.17-0.32); and undetermined intent in 2014-2015 (0.12; 95% CI, 0.14-0.28) and 2016-2017 (0.20; 95% CI, 0.15-0.25).

## DISCUSSION

To our knowledge, these descriptive data represent the first report of the alarming recent epidemics of mortality from firearms among US school-age children. We were unable to locate any reports of these epidemics from the US Centers for Disease Control and Prevention's *Mortality and Morbidity Weekly Report*, which is the "primary vehicle for scientific publication of timely, reliable, authoritative, accurate, objective and useful public health information and recommendations."<sup>8</sup>

We detected 2 epidemics, one beginning in 2009 among 5- to 14-year-olds, and a second in 2014 among 15- to 18-year-olds. Each of these epidemics has continued through 2017, the most recent year for which US mortality data are currently available. It is sobering to reflect that in 2017 there were 144 US police officers who died in the line of duty,<sup>9</sup> fewer than 1000 deaths among active duty military,<sup>10</sup> and 2462 school-age children killed with firearms.

We relied on death certificate data, which have been shown to be valid for legal residents,<sup>11</sup> but several limitations merit consideration. We were unable to address types of weapons purchased stored and used; how suicidal children gained access; time of day; types of comorbidities; familial clustering; and other individual social and environmental confounding variables.

The National Violent Death Reporting System is the only state-based surveillance (reporting) system that pools data on violent deaths from multiple sources into a usable, anonymous database. These sources include state and local medical examiner, coroner, law enforcement, toxicology, and vital statistics records.<sup>12</sup> Nonetheless, only 40 states participate.

At present, federal laws prohibit analytic studies designed to test hypotheses concerning the epidemic of mortality from firearms among US schoolchildren. The 1996 Dickey amendment has been a key factor,<sup>13</sup> but laws and policies making it illegal for federal employees to challenge harmful laws and policies like the Dickey amendment (so-called anti-lobbying laws) may have also played a role.<sup>14,15</sup> Such laws limit public

health officials to passively observe continuing harms to the public they are sworn to protect, as well as legally block active challenges to laws that may perpetuate those harms. The circumstances surrounding these current issues may have some analogies to the US Public Health Service Syphilis Study at Tuskegee, whereby medical treatment was withheld, in part, because it was legal to do so. Supporters of anti-lobbying laws assert that intrusion into politics could be harmful. Yet, mortalities from firearms in US schoolchildren are increasing at alarming rates, especially among blacks and those aged 15-18 years, without sufficient intervention.

Clinicians, public health officials, and the general public should oppose federal laws and policies limiting analytic studies on firearms. Analytic studies designed a priori to do so are necessary to test the hypotheses generated by these descriptive data. We believe that combatting the epidemic of mortality from firearms among US schoolchildren without addressing firearms is analogous to combatting the epidemic of mortality from lung cancer from cigarettes without addressing cigarettes.

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