

## Original Research

# Alarming Trends in Suicide by Firearms in Young Americans

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**Abstract**

In contrast to global trends, in the United States (US), mortality from suicide is rising. These trends are particularly alarming in suicide from firearms and act with a mechanism distinct from homicide by firearms. We explored trends in suicide by firearms in young Americans by race (Whites and Blacks) and age (5 to 24 years) from 1999 to 2018. We used the Multiple Cause of Death Files of the US Centers for Disease Control and Prevention to obtain mortality rates and 95% confidence limits and join point regressions to test for significance of trends. From 2008 to 2018 mortality from suicide by firearms increased significantly. These trends were more common in Whites those ages 5 to 14 years old. Blacks as well as those aged 15 to 24 years old than 5 to 14 years old. Suicide by firearms in those aged 5 to 24 years is increasing at alarming rates in the US. In contrast to homicide from firearms, suicides from firearms are more common in Whites than Blacks. Suicide from firearms is also far more common among those aged 15-24 years than among those aged 5 to 14. Analytic studies designed a priori to do so are necessary to test the many hypotheses formulated from these descriptive data. In the meanwhile, clinicians and public health officials should be cognizant and develop strategies to mitigate this alarming epidemic of suicide by firearms in young Americans.

**INTRODUCTION**

In the United States (US) in contrast to global trends, mortality from suicide is rising at alarming rates, especially by firearms. In 2017, of 47,173 deaths from suicide, 23,869 (50.6 %), were due to firearms. In the US, suicide increased by 31% from 10.7 to 14.0 per 100,000 in 2017. Among those aged 10 to 24 years, suicide is the second leading cause of their mortality [1-3].

Further, of 19,510 deaths from homicide, 14,339 (73.5%) were due to firearms.[1] The rate of homicide by firearms is high in the US, and is about 25 fold greater than in other comparably developed countries.[4, 5] . Among young Americans, homicide from firearms is also rapidly increasing, especially in among Blacks aged 15 to 18 [6]. Thus, suicide and homicide by firearms are increasing clinical and public health problems in the US. Addressing the epidemic of firearm violence in the United States requires further understanding of the distinct mechanisms by which it acts and the specific populations at risk. In this Commentary we explore trends in suicide due to firearms among US Blacks and Whites aged 5 to 24 years.

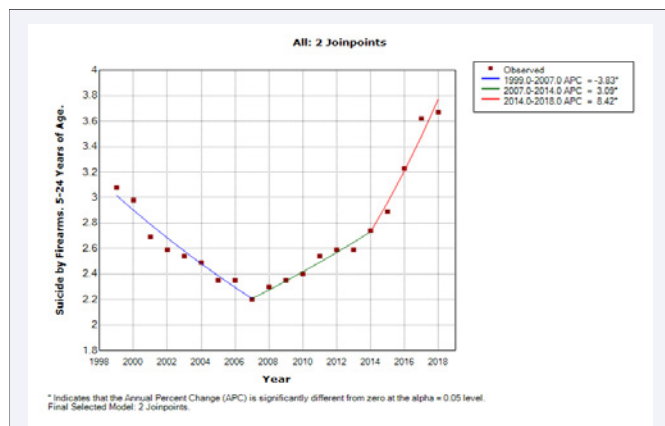
**METHODS**

We utilized descriptive data from the Multiple Cause of Death file and US Centers for Disease Control and Prevention (CDC) Wide ranging Online Data for Epidemiologic Research (WONDER). Age and race specific underlying or contributory death rates from suicide due to firearms and 95% confidence intervals (CI) were obtained using the International Classification of Diseases 10<sup>th</sup> Edition Codes: X72 (Intentional Self-Harm by Handgun Discharge); X73 (Intentional Self-Harm by Rifle, Shotgun and Larger Firearm Discharge); and X74 (Intentional Self-Harm by Other and Unspecified Firearm Discharge). [7] We used annual percent change (APC) as a measure of effect size. Joinpoint regression analyses were used to test for significance of differences by age, race, and time. [8]. We used CDC criteria to compare the rates of suicide by firearm for Whites (non-Hispanic) and Blacks (non-Hispanic) ages 5 to 24 years. We considered children, ages 5 – 14 years, and youth, ages 15 -24 years, as separate age groups.

The Institutional Review Board at Baylor College of Medicine considered this research to be exempt.

## RESULTS

Figure 1 demonstrates statistically significant declines in suicide from firearms among those 5 to 24 years from 1999 to 2007 as reflected by the APC of -3.83 ( $p < 0.05$ ). Subsequently, the US experienced statistically significant increases in suicide by firearms each year from 2007 to 2018. The APC's were +3.09 ( $p < 0.05$ ) from 2007 to 2014 and +8.42 ( $p < 0.05$ ) from 2014 to 2018.



**Figure 1** Aged Adjusted Mortality from Suicide by Firearms in US ages 5-24 from 1999 to 2018.

For 1999-2018, Whites comprised 87.5% of deaths from suicide from firearms and 79.9% of the entire relevant US population aged 5 to 24 years. Specifically, from ages 5 to 24 there were 34,629 deaths from suicide by firearms, among Whites and 5,588 among Blacks. Age-adjusted rates increased from 3.47 per 100,000 (CI 3.31-3.63) to 4.60 (4.41-4.79) among Whites and from 2.88 (2.57-3.19) to 3.03 (2.74-3.33) in Blacks.

The mortality rates from suicide from firearms from 2007 to 2018 were 0.43 (0.40-0.45) for Whites and 0.16 (0.13-0.19) for Blacks aged 5 to 14 years and 6.79 (6.70-6.88) for Whites and 4.05 (3.91-4.19) for Blacks aged 15 to 24. Among Whites aged 5 to 24 the APC was +5.07 ( $p < 0.05$ ) from 2007 to 2018 and among Blacks +13.92 ( $p < 0.05$ ). Thus, the mortality rate ratio between Blacks and Whites decreased from 2.19 in 2013 to 1.52 in 2018.

Overall, from 1999 to 2018, the 47,015 deaths from suicide by firearms among young Americans aged 5 to 24 years included 2,115 (4.5%) aged 5 to 14 and 44,900 (95.5%) aged 15 to 24. In 2018, mortality rates from suicide by firearms were 0.49 (0.43-0.56) per 100,000 for those aged 5 to 14 and 6.97 (6.72-7.22) per 100,000 for those 15 to 24, a 14-fold higher rate. In 2008, the corresponding rates were 0.12 (0.09-0.16) for those aged 5 to 14 and 4.63 (4.43-4.83) for those 15-24 years, a 39-fold higher rate. Thus, between 2008 and 2018 these rates of suicide by firearms quadrupled in those aged 5 to 14 and increased by 50% among those aged 15 to 24.

## DISCUSSION

Suicide by firearms in young Americans aged 5 to 24 years is increasing at alarming rates. They are more common in Whites than Blacks and far more common among those aged 15-24 years than among those aged 5 to 14. Suicide by firearms remains far more common in Whites than Blacks, despite a narrowing

gap. These data are in stark contrast to the overwhelming predominance of firearm related homicides among Blacks.

Several limitations to the interpretability of these descriptive data merit consideration. First, the data were restricted to death certificates with inevitable misclassifications and/or miscoding [9] although their accuracy has been validated for suicide. [10] In addition, data were not available on weapon type, and how youths gained access to the weapon, as well as types of comorbidities such as familial clustering; or other potentially confounding variables which include individual, environmental and societal factors.

In summary, in young Americans suicide from firearms is increasing at alarming rates especially among Whites as well as those aged 15 to 24. While further research is necessary, in the meanwhile there are important public health implications. For example, it seems reasonable to conclude that addressing the epidemic of suicide from firearms without addressing firearms is analogous to addressing the epidemic of lung cancer from cigarettes without addressing cigarettes. [2, 3] It is tempting to speculate about which of the multifactorial mechanisms for deaths from suicide by firearms would be most amenable to public health interventions. These include, but are not limited to, individual behavioral, physiological, demographic or environmental risk factors. [2-6] While all these hypotheses require further analytic studies including investigation of racial inequality within both individual and environmental risk factors. Nonetheless, individual risk factors amenable to intervention include increases in anxiety and depression, as well as gun ownership, socioeconomic status, social networks as well as access to and utilization of appropriate social and healthcare services. Environmental risk factors include geography, specifically, urban and rural classifications.

Analytic epidemiological studies designed a priori to do so are necessary to test the many hypotheses generated by these descriptive data to frame the optimal design and implementation of appropriate public health interventions. From 1996 to 2020, US federal laws effectively prohibited such investigations. In 2020, however, \$25 million was appropriated to CDC and NIH to conduct analytic studies. Descriptive data such as these provide important and relevant information to the totality of evidence but are useful only to formulate but not test hypotheses. [9] Perhaps their greatest utility is to guide further research to determine the most effective public health targets and interventions. In the meanwhile, existing public health knowledge must be implemented to curb the alarming increasing epidemic of suicide by firearms in young Americans.

## CONFLICT OF INTEREST STATEMENT

VM, AR, SW, JD, and RL have no relevant disclosures. CHH discloses that he serves as an independent scientist in an advisory role to investigators and sponsors as Chair or Member of Data and Safety Monitoring Boards for Amgen, British Heart Foundation, Cadila, Canadian Institutes of Health Research, DalCor, Lilly, Regeneron and the Wellcome Foundation; to the United States (U.S.) Food and Drug Administration, legal counsel for Pfizer, and UpToDate; receives royalties for authorship or editorship of 3 textbooks and as co-inventor on patents for inflammatory markers and cardiovascular disease that are held by Brigham and

Women's Hospital; has an investment management relationship with the West-Bacon Group within SunTrust Investment Services, which has discretionary investment authority and does not own any common or preferred stock in any pharmaceutical or medical device company.

## REFERENCES

1. United States Department of Health and Human Services, National Institutes of Health, National Institute of Mental Health. 2019. Suicide. Retrieved on January 21, 2020.
2. Miron O, Yu KH, Wilf-Miron R, Kohane IS. Suicide rates among adolescents and young adults in the United States, 2000 to 2017. *JAMA*. 2019; 321(23): 2362-2364.
3. Center for Collegiate Mental Health. 2015 annual report, Pennsylvania State University. Retrieved on January, 2020.
4. Hennekens CH, Drowos J, Levine RS. Mortality among young Black men: A new American tragedy. *Am J Med*. 2013;126 (4):282-283.
5. Grinshteyn E, Hemenway D. Violent death rates in the US compared to those of the other high-income countries. 2015. *Prev Med*. 2019; 123: 20-26.
6. Rubenstein A, Wood SK, Levine RS, Hennekens CH. Alarming trends in mortality from firearms in schoolchildren. *Am J Med*. 2019; 132(8): 992-994.
7. Centers for Disease Control and Prevention, and National Center for Health Statistics. "Underlying Cause of Death. 1999-2017 on CDC WONDER Online Database, released December, 2018. Data are from the Multiple Cause of Death Files, 1999-2017, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program.
8. Ingram DD, Malec DJ, Makuc DC, Kurszon-Moran D, Gindi RM, et al. National Center for Health Statistics Guidelines for Analysis of Trends. *Vital Health Stat*. 2018; 179: 1-71.
9. Hennekens CH, DeMets D: Statistical association and causation: Contributions of different types of evidence. *JAMA*. 2011; 306: 1134-1136.
10. Moyer LA, Boyle CA, Pollock DA. Validity of death certificates for injury-related causes of death. *American Journal of Epidemiology*, 1989; 130(5): 1024-1032.

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