The Epidemiology of Firearm Violence in the Twenty-First Century United States

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homicide, suicide, mortality, epidemiology, firearms

Abstract

This brief review summarizes the basic epidemiology of firearm violence, a large and costly public health problem in the United States for which the mortality rate has remained unchanged for more than a decade. It presents findings for the present in light of recent trends. Risk for firearm violence varies substantially across demographic subsets of the population and between states in patterns that are quite different for suicide and homicide. Suicide is far more common than homicide and its rate is increasing; the homicide rate is decreasing. As with other important health problems, most cases of fatal firearm violence arise from large but low-risk subsets of the population; risk and burden of illness are not distributed symmetrically. Compared with other industrialized nations, the United States has uniquely high mortality rates from firearm violence.

INTRODUCTION

During the ten years from 2003 to 2012, the most recent year for which data are available, 313,045 persons died from firearm-related injuries in the United States (20). These deaths outnumber US combat fatalities in World War II; they outnumber the combined count of combat fatalities in all other wars in the nation's history (41). The total societal costs of firearm injuries were estimated to be $174.1 billion in 2010 (47).

Firearm-related deaths and injuries, considered in aggregate, were not deemed a public health problem until late in the twentieth century. Prior convention held that interpersonal violence was the domain of criminologists and criminal justice professionals. Self-directed violence was a mental health problem. Unintentional shootings were "accidents," a safety concern. The National Commission on the Causes and Prevention of Violence took a unifying approach in 1969 (48), but few others followed suit (27, 42). Calls to action in the 1980s by Baker and colleagues (9, 10) and by others (2, 31) led to a series of epidemiologic and policy studies that firmly established the value of this new approach (4, 35, 55, 62, 70). By 1989, the American Medical Association's Council on Scientific Affairs had labeled firearm deaths and injuries "a critical public health issue" (5). That label remains accurate today. Largely as a result of mass-casualty shootings in public places, Congress and many state legislatures have considered policies intended to prevent firearm-related deaths and injuries, and particularly firearm violence.

To encourage and guide such efforts, this review summarizes the basic epidemiology of firearm violence—homicide, excluding death by legal intervention, and suicide—which in 2012 accounted for 96.2% of all firearm-related fatalities. (Another 1.6% of deaths were unintentional, 1.4% were due to legal intervention, and 0.8% were of undetermined intent.) It presents findings for the present in the light of recent trends and uses a comparative approach to highlight common misconceptions that are likely to impede prevention efforts. Except where noted, data were provided by the Centers for Disease Control and Prevention (CDC) via its Web-based Injury Statistics Query and Reporting System (WISQARS) (20). Data for race/ethnicity were available only for 1990–2012.

FINDINGS

Trends

The mortality rate from firearm violence has remained essentially unchanged since just before the turn of the twenty-first century (**Figure 1**). Relatively low rates during the 1950s and early 1960s (average 7.3/100,000 population during 1951–1963) were followed by a rapid increase through the mid-1970s, a secondary increase into the early 1990s to rates higher than ever previously recorded (62), and a rapid decline from 1994 to 1999. Rates remained stable thereafter and above the 1950s–1960s baseline (average 9.9/100,000 population during 1999–2012). By contrast, mortality rates from motor vehicle traffic events declined by 59% from 1969 to 2012, such that in 2012 mortality from motor vehicle traffic events only slightly exceeded that from firearm violence.

Over the past 30 years, trends in mortality from firearm violence have been quite different from those for nonfirearm violence (**Figure 2**). From the mid-1980s through 1999, as mortality from firearm violence rose and abruptly fell, deaths from nonfirearm violence gradually declined. In the twenty-first century, while mortality from firearm violence remained stable, deaths from nonfirearm violence slowly but steadily increased (the spike in nonfirearm violence in 2001 is not an error; it represents deaths resulting from the events of September 11).

Most deaths from firearm violence are suicides, not homicides—60.5%, on average, over the decade ending in 2012 (**Figure 3**). Over the past 30 years, suicide has exceeded homicide even when

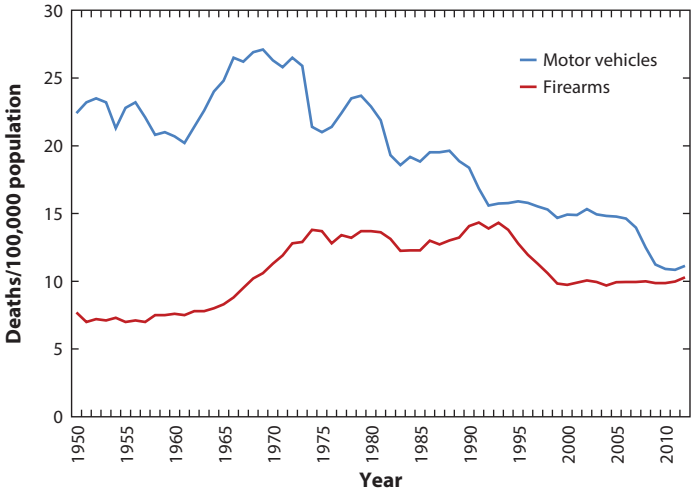

Figure 1

Mortality rates for firearm violence and motor vehicle traffic events, 1950–2012. Originally published in Reference 65; adapted, updated, and reprinted with permission. Data for 1950–1980 are available at the Vital Statistics of the United States website, **http://www.cdc.gov/nchs/products/vsus.htm**. Data for 1981–2012 are available at the CDC WISQARS website (Web-Based Injury Statistics Query and Reporting System), **http://www.cdc.gov/injury/wisqars/index.html**.

firearm homicide rates were at their highest, and it was also the case for most of the twentieth century (62). There has been a notable divergence in firearm suicide and homicide rates since 2006; homicides have decreased, but suicides have increased by a like amount. As a result, nearly two-thirds (64.0%) of deaths from firearm violence were suicides in 2012. We explore the increase in suicide further in the next section.

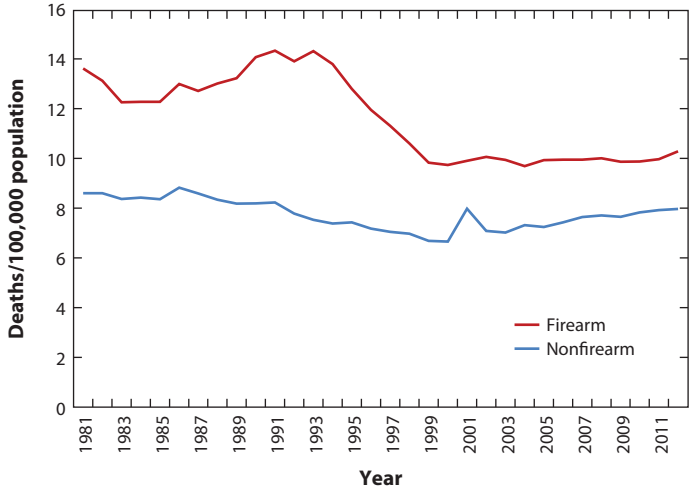

Figure 2

Mortality rates for firearm and nonfirearm violence, 1981–2012.

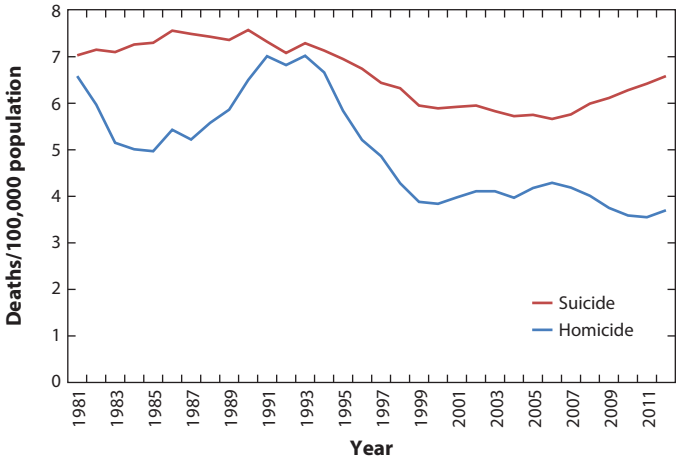

Figure 3

Mortality rates for firearm homicide and suicide, 1981–2012.

Current Status

In 2012, there were 32,288 deaths from firearm violence in the United States, including 11,622 homicides and 20,666 suicides. Firearms were used in 69.6% of all homicides that year (74.2% among men and 52.4% among women) and 50.9% of all suicides (56.4% among men and 31.2% among women, for whom firearms ranked second after poisoning).

Mass killings in public places account for a very small percentage of deaths from firearm violence (13, 66). The 5 such events in this century with the highest number of fatalities resulted in 96 homicides (13). But during the decade ending in 2012, there were on average 82.3 deaths from firearm violence every day: 32.5 homicides and 49.8 suicides.

Firearm violence is among the leading causes of death for teenagers and young adults. Firearm homicide alone, and by extension firearm violence, was the leading cause of death for Black men ages 15–34 in 2012; unintentional injuries ranked second. Among White and Hispanic men ages 15–34, firearm violence ranked second after unintentional injuries. Firearm violence ranked second as a cause of death among Black women ages 15–24.

Risk for death from firearm violence has a complex relationship with age after childhood, with particularly high rates among both young adults and the elderly, because the relationships between age and risk are substantially different for suicide and homicide (**Figure 4**). In 2012, homicide risk rose steeply through adolescence to ages 20–24 and fell thereafter. Risk for suicide also rose sharply in adolescence, though to a lesser degree, but continued to rise thereafter into old age. At ages 20–24, 63.2% of deaths from firearm violence were homicides. At ages 80–84, 94.9% were suicides.

Figures 5 and **6** present results for firearm homicide and suicide, respectively, specific to age, sex, and race/ethnicity. Homicide risk is concentrated to a remarkable degree among Black males through much of the life span (**Figure 5*a***). At ages 20–29 in 2012, the firearm homicide rate for Black males was at least five times higher than that for Hispanic males and at least 20 times that for White males. Among females as well, homicide rates were almost always higher for Blacks than for Whites or Hispanics (**Figure 5*b***). Rates for females were lower than those for males of the same race/ethnicity; from ages 10–14 through ages 45–49, however, the homicide rate for Black females exceeded that for White males.

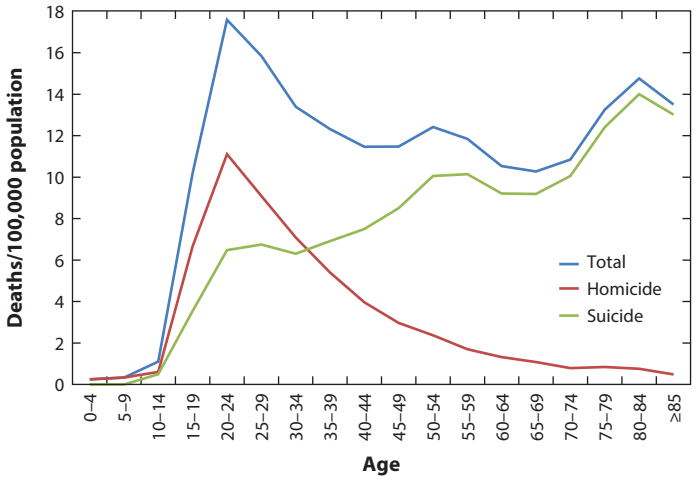

Figure 4

Mortality rates for firearm violence, firearm homicide, and firearm suicide by age, 2012.

Risk for firearm suicide is concentrated among White males, however, and the disparity increases with age (**Figure 6*a***). In 2012, rates for Whites rose more than did those for Blacks and Hispanics during adolescence and early adulthood and continued generally to increase with age thereafter, most rapidly beginning at ages 70–74. In contrast, rates for Black and Hispanic males decreased following young adulthood until middle age, before increasing again among the elderly. At ages 85 and older, the firearm suicide rate for White males was 3.2 times that for Hispanic males and 5.0 times that for Black males. For females, unlike males, suicide risk did not increase among the elderly (**Figure 6*b***). Suicide rates were higher for White females than for Blacks or Hispanics at all ages but decreased steadily after ages 50–54.

The findings so far have followed a traditional public health paradigm, emphasizing subsets of the population that are at highest risk for firearm violence. The population health model, however, stresses that the greatest number of cases of an adverse health condition may arise from low-risk subsets of the population, if those subsets are sufficiently large (50). Mortality from firearm violence among males provides a good example of the advantages of employing both these complementary perspectives at once.

In 2012, risk of death from firearm violence was highest among Black males through ages 45–49 (**Figure 7**). White males were at greatest risk thereafter, but at rates well below those seen among younger Black males. The distribution of the number of deaths from firearm violence (**Figure 8**) is quite different. White males account for a majority of deaths at ages 35–39 (56.2%), with increasing percentages thereafter. Beginning at ages 60–64, more than 90% of deaths from firearm violence occur among White males.

The two mortality peaks in **Figure 8** provide a useful contrast. Among Black males ages 15–44, a 30-year range, there were 5,893 deaths from firearm violence in 2012, of which 88.7% were homicides. Among White males ages 35–64, again a 30-year range, there were 9,063 deaths, of which 89.2% were suicide.

This concentration of the burden of mortality from firearm violence among White males has been increasing (**Figure 9**). The death rate among Black males ages 15–44 increased just 5.6% from 1999 to 2012; deaths increased by 11.6%, consistent with population growth in this group.

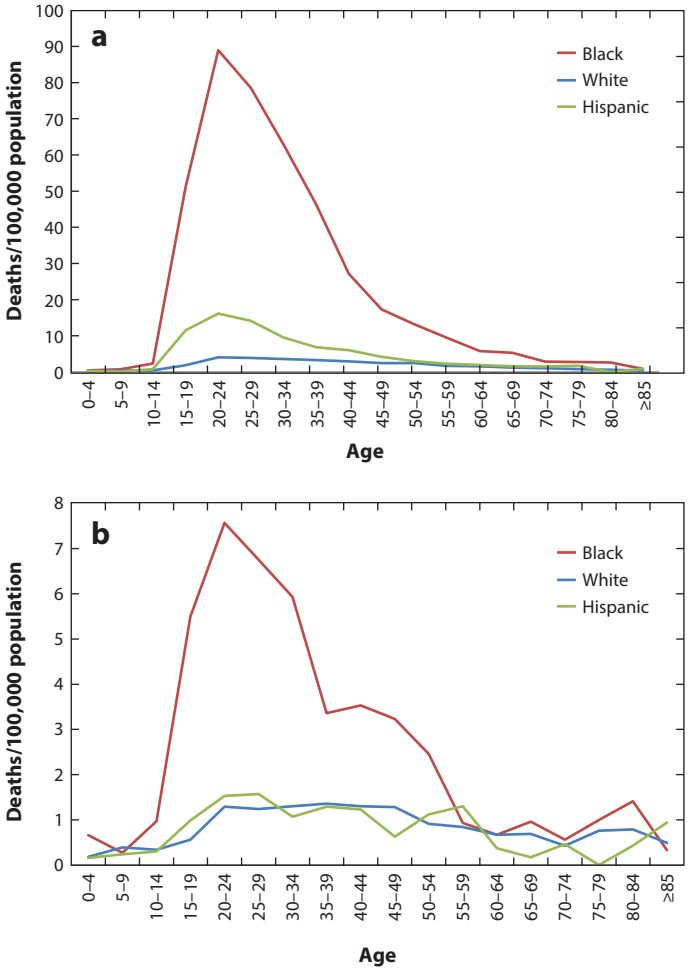

Figure 5

(*a*) Mortality rates for firearm homicide among males by age and race/ethnicity, 2012. (*b*) Mortality rates for firearm homicide among females by age and race/ethnicity, 2012.

The death rate rose by 29.1% during those years among White males ages 35–64, and deaths increased by 35.8%.

The recent overall increase in mortality from firearm suicide (**Figure 3**) and the lack of a decline in firearm-related mortality during the twenty-first century (**Figure 1**) are largely due to this increase in suicide among White males and, though at much lower rates, among White females. In fact, no other demographic group experienced a sustained increase in risk for firearm homicide or suicide during those years (see **Supplemental Material**; follow the **Supplemental Material link** from the Annual Reviews home page at **http://www.annualreviews.org**).

Supplemental Material

Data on nonfatal events are limited. The CDC's National Electronic Injury Surveillance System—All Injury Program, an element of WISQARS that captures reports from 66 hospital emergency departments, estimates that in 2012 there were 63,163 persons treated in US hospital emergency departments for injuries from firearm violence, including 59,077 for injuries related to assaults and 4,086 for injuries related to self-harm. The National Crime Victimization Survey

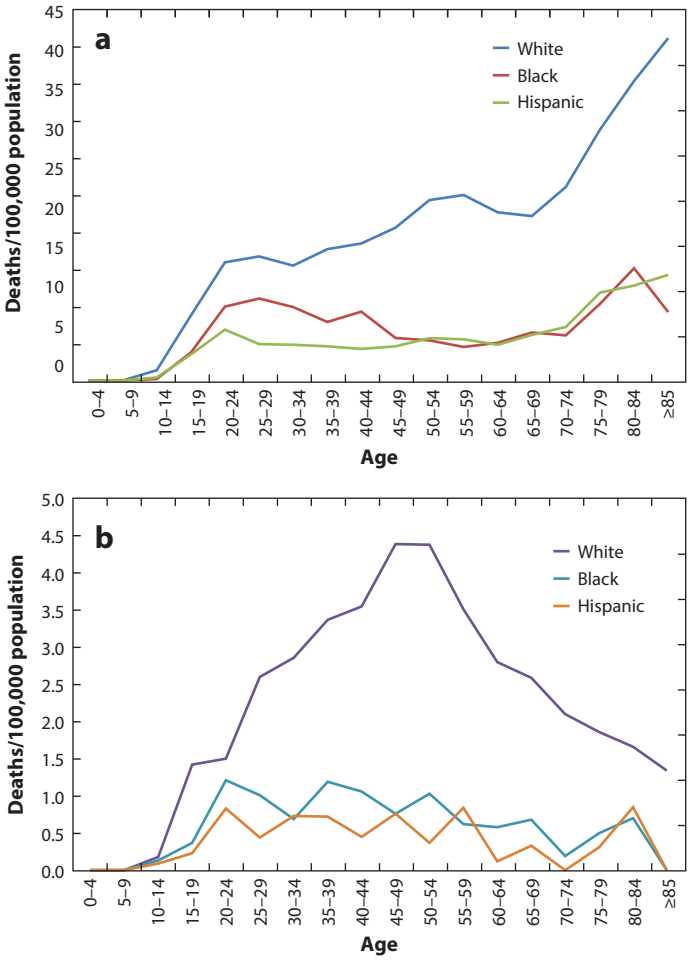

Figure 6

(*a*) Mortality rates for firearm suicide among males by age and race/ethnicity, 2012. (*b*) Mortality rates for firearm suicide among females by age and race/ethnicity, 2012.

estimates that in 2012 firearms were used in 460,718 serious violent victimizations, including 33.4% of robberies and 27.0% of aggravated assaults for which weapon status was known (18). (It is important to remember that these exact numbers are estimates.)

Geography

Mortality rates from firearm violence varied greatly among US states in 2012 (**Figure 10**). The suicide rate in Montana was 8.5 times that in New Jersey; the homicide rate in Louisiana was 9.5 times that in New Hampshire. It was not the case that states with high rates of firearm homicide also had high rates of firearm suicide. To the contrary, there was essentially no correlation (Spearman correlation coefficient 0.09, $p = 0.56$). Instead, states with both the highest and lowest rates of firearm suicide were among those with low rates of firearm homicide. Low-suicide, low-homicide states tended to be in New England; high-suicide, low-homicide states tended to lie in the rural Northwest. High-suicide, high-homicide states were generally in the Southeast.

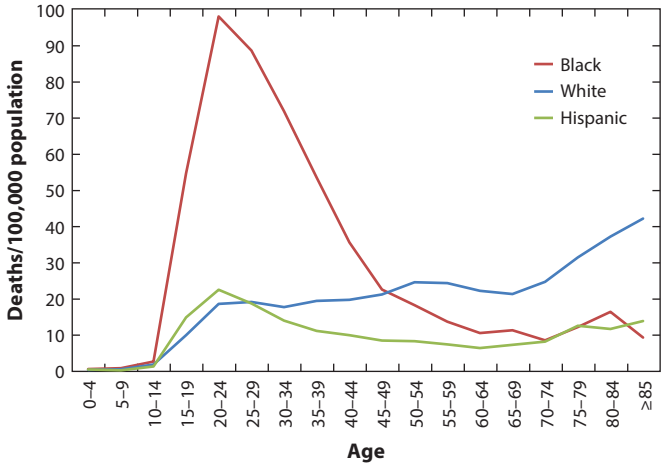

Figure 7

Mortality rates for firearm violence among males by age and race/ethnicity, 2012.

Compared with other nations, the United States is an outlier in its mortality from firearm violence. Its rates of firearm homicide and suicide both substantially exceed those for the other industrialized nations in the Organisation for Economic Co-operation and Development (OECD) (**Figure 11**). This finding is not likely due to a predisposition to violence in the United States, however. Among those same OECD nations, the US ranks near the bottom in its prevalence of self-reported assault (**Figure 12**).

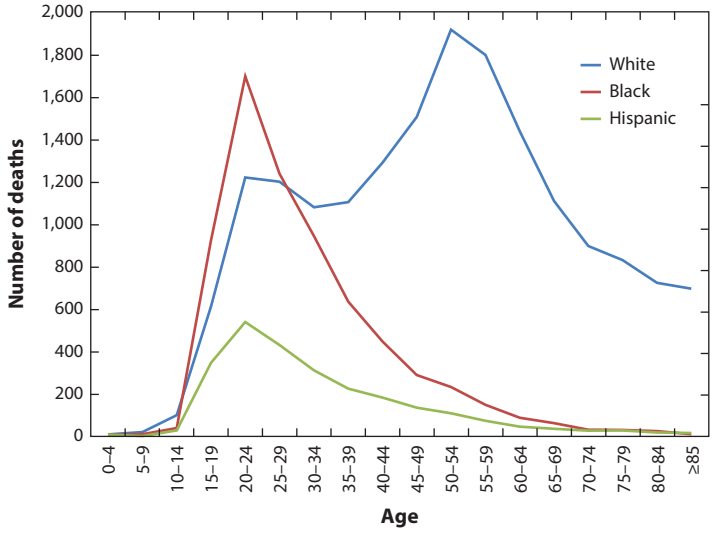

Figure 8

Number of deaths from firearm violence among males by age and race/ethnicity, 2012.

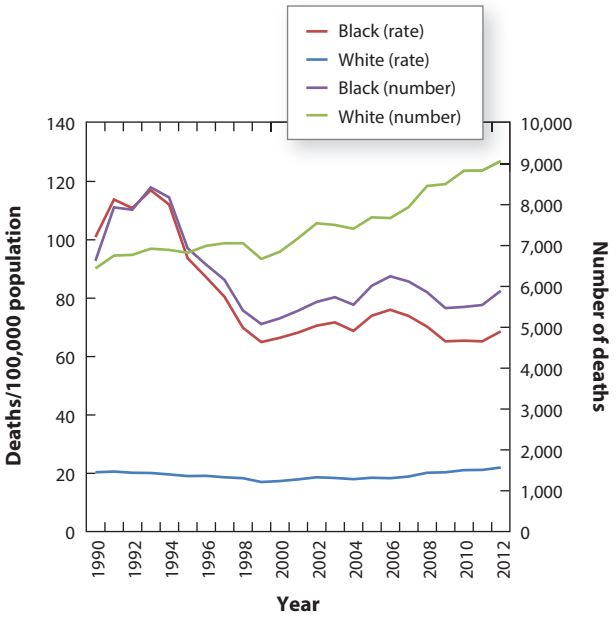

Figure 9

Mortality rates and number of deaths from firearm violence for White males ages 35–64 and Black males ages 15–44, 1990–2012.

DISCUSSION

David Satcher, who in 1993 had just become director of the Centers for Disease Control and Prevention, asked this rhetorical question about violence (7): "If it's not a public health problem, then why are all those people dying from it?" Firearm violence, responsible for more than 30,000 deaths per year, clearly qualifies as a significant public health problem. The societal costs of firearm suicides and homicides occurring in 2010, estimated at $164.6 billion, approximated 1.1% of the US gross domestic product that year (**http://data.worldbank.org/indicator/NY.GDP.MKTP.CD**). The overall rate of fatal firearm violence has remained essentially unchanged in the United States for more than a decade.

Risk for firearm violence varies substantially across demographic subsets of the population and between states in patterns that are quite different for suicide and homicide. A further example is the variation across the urban-rural continuum. In 2004, although there was almost no difference in overall mortality from firearm violence between the most urban and most rural counties, suicide rates were 54% higher in the rural counties and homicide rates were 90% higher in the urban counties (15).

As with other important health problems, most cases of fatal firearm violence arise from large but low-risk subsets of the population; risk and burden of illness are not distributed symmetrically. Other aspects of the epidemiology of firearm violence also run counter to popular conceptions of the problem. This mismatch between perception and reality probably impedes our efforts to prevent violence.

Contrary to popular belief, for example, mental illness by itself is not a leading contributor to interpersonal firearm violence (53). Future discussion of the involvement of mental illness in violence might focus more productively on its contribution to suicide, the leading form of lethal

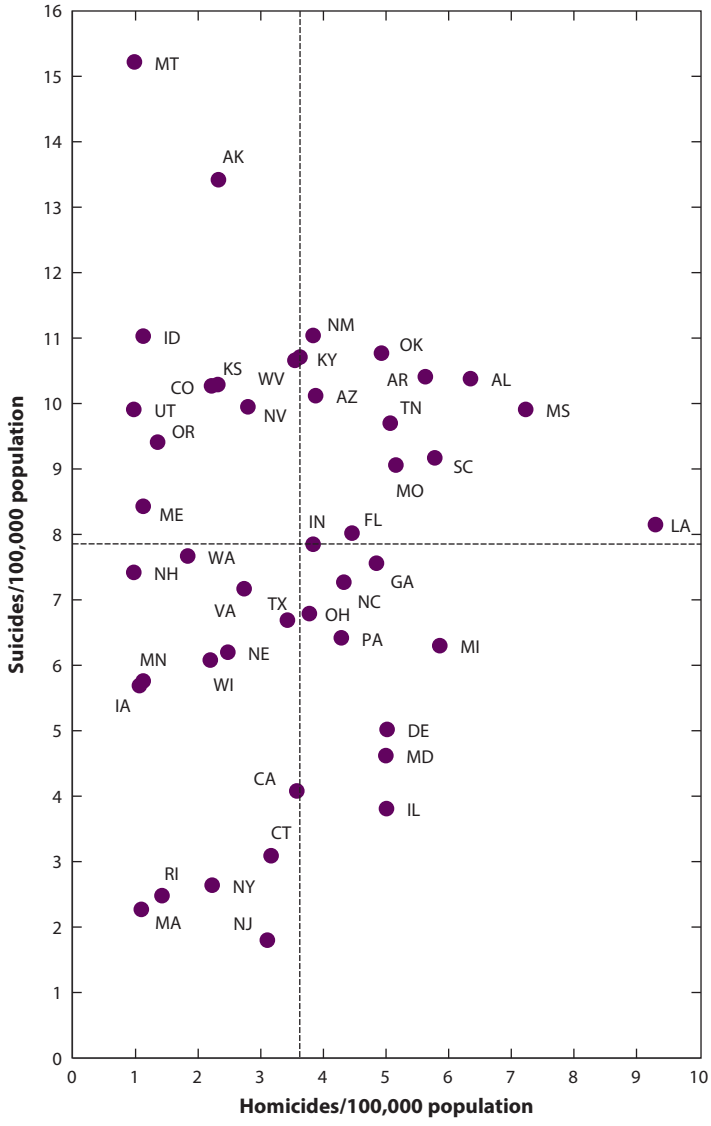

Figure 10

Mortality rates from firearm homicide and firearm suicide by state, 2012. Results were withheld by WISQARS for Hawaii, North Dakota, South Dakota, Vermont, and Wyoming because these states had fewer than 10 deaths from firearm homicide.

firearm violence, for which depression is a major risk factor (53). Focusing on suicide will also require consideration of groups not ordinarily thought to be at high risk for firearm violence, such as current and former members of the military. Suicide has been increasing rapidly in this group (40), and both male and female veterans who commit suicide are more likely than nonveterans to use firearms (30).

Other factors are strongly associated with risk of death from firearm violence and are mentioned briefly. Firearm ownership is probably the most widespread of these. There are more than 50 million firearm owners in the United States; approximately 35% of men and 11% of women

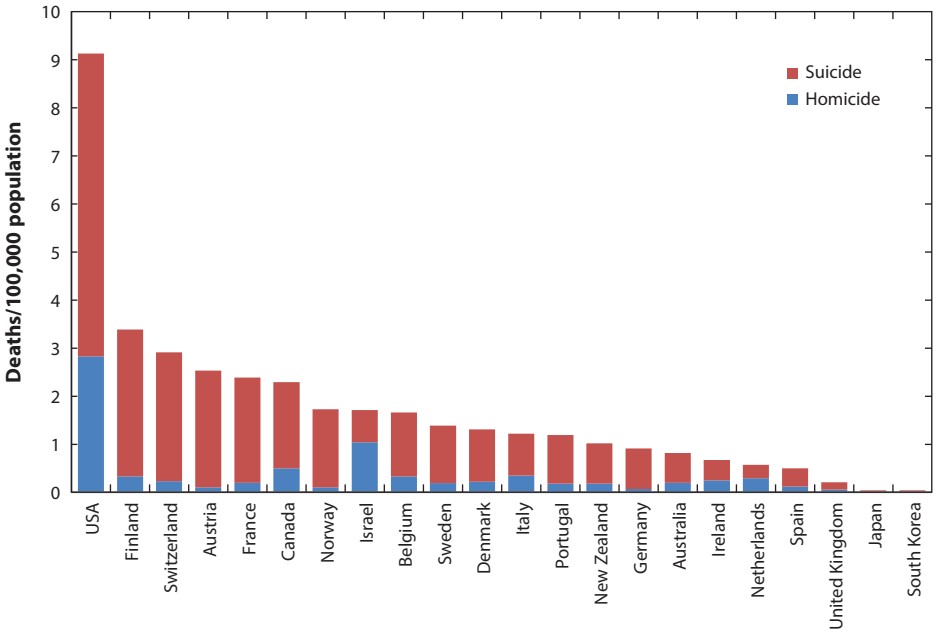

Figure 11

Mortality rates for firearm suicide and homicide for selected members of the Organisation for Economic Co-operation and Development. Data available at the GunPolicy.org website, **http://www.gunpolicy.org** (accessed August 28, 2014).

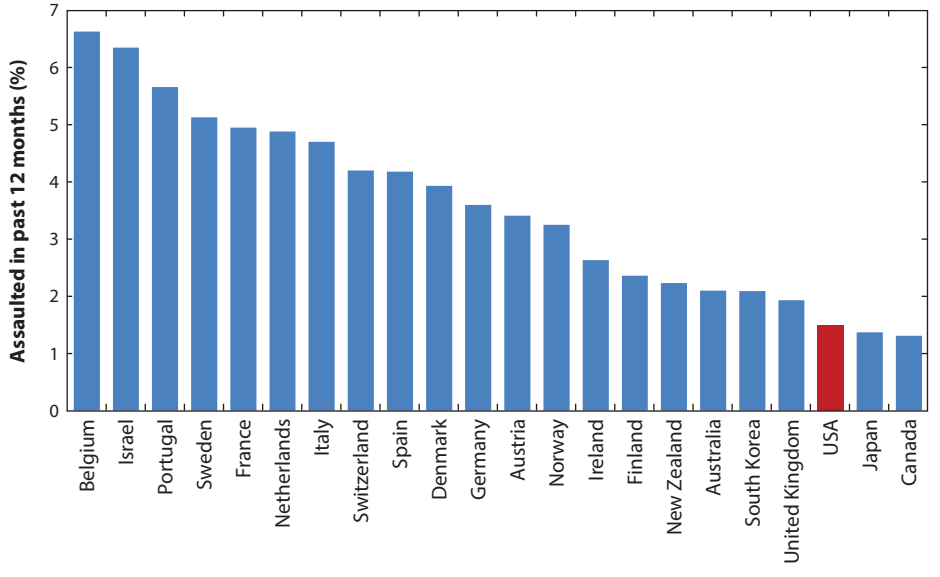

Figure 12

Percentage of the adult population reporting having been assaulted in the preceding 12 months for selected members of the Organisation for Economic Co-operation and Development. Data available at the OECD website, **http://www.oecdbetterlifeindex.org/topics/safety/** (accessed August 28, 2014).

report owning firearms (28). Many studies, only a few of which are cited here, have found associations between firearm ownership and firearm homicide or suicide whether measured at the population level (17, 44–46, 51, 52), the household level (6, 24, 36, 37), or the individual level (69). This association is strong enough that it interferes with efforts to quantify the effect of firearm violence prevention policies (65).

Some risk factors are suitable for focused interventions that may have broad impacts. Alcohol and controlled substance abuse are important predictors of future risk for violence, including firearm violence, whether directed at others (3, 25, 29, 34, 38) or at oneself (8, 14, 16, 32, 33) and whether or not mental illness is also present (21, 26). There is widespread support—among the general public (11), firearm owners (11), firearm retailers (67), and experts in the field (1, 22)—for policies that would prohibit the purchase and possession of firearms by persons with multiple criminal convictions related to alcohol abuse. A prior history of violence is strongly predictive of future violence (12, 23, 39, 43, 56, 57), including specifically among firearm owners (68, 71, 72). Prohibitions on the purchase of firearms by persons convicted of violent misdemeanor crimes such as assault and battery have been effective (71) and are also widely supported (1, 11, 22, 67). Finally, a comprehensive requirement that firearm sales and transfers of other types involve a background check on the recipient would help prevent prohibited persons from acquiring firearms anonymously and illegally from private parties, including via the Internet. Background checks are effective (54, 58, 60, 63, 64) and, again, widely supported (1, 11, 19, 22, 49, 67).

Further research on the nature and prevention of firearm violence is sorely needed. Fortunately, President Obama has directed the Centers for Disease Control and Prevention to resume its work in the field (61). The National Institute of Justice and, for the first time in its history, the National Institutes of Health have grant programs for research specifically on firearm violence. Evidence-based interventions may lead to substantial reductions in death and disability from this important public health problem.

SUMMARY POINTS

1. The overall fatality rate from firearm violence has not changed in more than a decade.
2. Suicide is the most common form of fatal firearm violence (64.0% of deaths in 2012) and is increasing. Homicide is decreasing.
3. Homicide risk is concentrated to a remarkable degree among Black males through much of the life span. Mortality rates from firearm violence are very high and unchanged in this group.
4. Suicide risk is highest among White males beginning in adolescence. They also account for most fatalities from firearm violence and have increasing mortality rates.
5. As compared with other industrialized nations, the United States has low rates of assaultive violence but uniquely high mortality rates from firearm homicide and suicide.

DISCLOSURE STATEMENT

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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