

Mass Casualty Shooting Venues, Types of Firearms, and Age of Perpetrators in the United States, 1982–2018

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Objectives. To evaluate the association between mass casualty shooting venues, types of firearms, and the age of perpetrators in the United States.

Methods. We analyzed data on mass casualty (≥ 3 fatalities) shootings for August 1982 through February 14, 2018. We describe data overall, specifically by school venues and the weapons used. We categorized perpetrators by ages of younger than 18 years, 18 to 20 years, and 21 years and older. We described the number of victims (fatalities plus injuries) by medians and average per event.

Results. Of 97 events, the median perpetrator age was 35 years and 21 years for school shootings. Four of 16 school events were committed by those aged 18 to 20 years, and all of those events included long guns. Victims of perpetrators aged 18 to 20 years made up 9.0% of all victims and 31.1% of victims of school shootings.

Conclusions. Persons aged 18 to 20 years perpetrated about 1 in 8 shootings, accounting for about 1 in 3 victims of school shootings.

Public Health Implications. Legislation to prevent mass casualty events must be multifaceted, including age restrictions, restrictions on certain types of firearms, and improved resources for mental health, with particular emphasis on mental health and firearm restrictions for young adults. (*Am J Public Health.* 2018;108:1385–1387. doi: 10.2105/AJPH.2018.304584)

Spurred by a recent school shooting in Parkland, Florida, where 17 people were killed by a gunman aged 19 years, several states have proposed legislation to raise the minimum age to purchase long gun firearms from 18 to 21 years as a solution to prevent such events. Federal legislation restricting the age for handgun purchases to 21 years and older has already been enacted, yet the federal minimum age restriction on long gun firearm sales remains 18 years. “Long guns” refer to any firearm not considered to be a handgun, including shotguns, hunting rifles, and assault rifles. As of March 2018, 3 states (Florida, Hawaii, Illinois) have enacted restrictions on long gun firearm purchases by individuals younger than 21 years, with several other states currently debating such legislation.¹

Researchers have limited tools available to evaluate the effects of changing firearm policies, such as age to purchase restrictions, because of limited firearm violence surveillance coupled

with scant opportunities for National Institutes of Health funding.² In a descriptive analysis, we explored the relationship between age of firearm violence perpetrators and mass casualty shootings to identify the proportion of fatalities and injuries that could potentially be prevented with regulations restricting long gun firearm purchases to individuals aged 21 years and older.

METHODS

We collected data on mass shootings (≥ 3 victims killed) from *Mother Jones*³ for August 1982 to February 14, 2018. We derived this

definition of mass shooting from the law enacted to investigate such events.⁴ Data included the number of fatalities, injured, and total victims, with descriptions of weapons used, mental health status of perpetrators, and venue.

The data classified a person as having mental health issues if news reports were available for any of the following indicators: civilian or military medical records containing a history of mental illness diagnoses or treatment, court determinations of competency, or family testimony to police regarding mental health diagnoses or history of treatment. In instances in which testimony from acquaintances or family was reported by news outlets detailing worrisome behavior or assumptions about mental illness, we classified mental health issues as “unclear.”

We report descriptive statistics for data overall, by venue, and by weapons used, with stratification of events by firearm type. We calculated and compared percentages of all victims killed or injured by perpetrators aged younger than 18 years, 18 to 20 years (i.e., perpetrators who would be affected by legislation), and 21 years and older.

RESULTS

There were 97 mass casualty shootings during the period. The median age of perpetrators was 35 years, which decreased from 39.5 years for handgun-only events ($n = 44$) to 31 years for assault rifle–related events ($n = 31$) and 21 years for shootings at school venues ($n = 16$). Of the 16 school shootings,

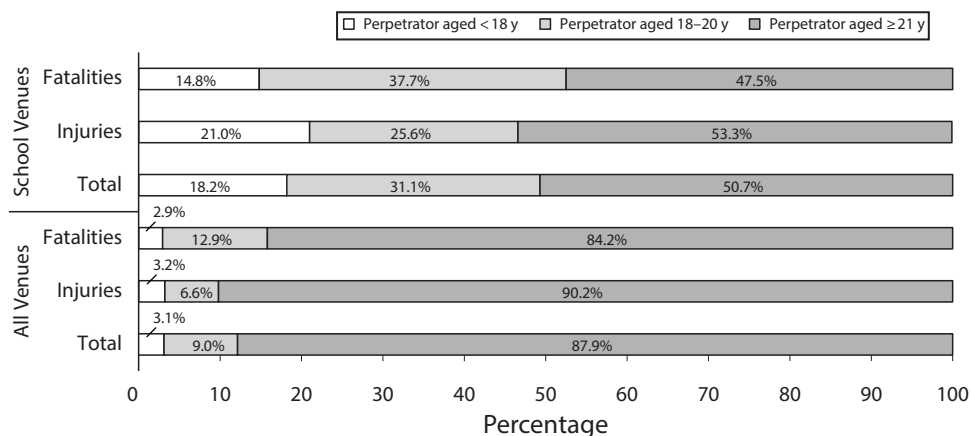
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Note. Perpetrators aged 18–20 years would hypothetically be affected by new legislation restricting long gun firearm purchases for that age group.

FIGURE 1—Distribution of Firearm Injuries and Fatalities by Age of Perpetrator and Event Venue: United States, August 1982–February 14, 2018

4 were committed by perpetrators younger than 18 years, 4 by those aged 18 to 20 years, and 8 by those aged 21 years and older. Of the 4 committed by those aged 18 to 20 years, 3 used assault-style long guns and the other used 1 or more semiautomatic rifle-style long guns. Female perpetrators were associated with 3 of the 97 events analyzed, and mental health problems were associated with 53.6% of perpetrators.

These mass casualty shootings resulted in 816 fatalities and 1275 injuries, with a median of 6 fatalities per event. There was an average of 7.5 fatalities per event in events with handguns and 11.6 fatalities per event in shootings involving assault rifle long guns. Median injuries ranged from 3 per event (average 7.7 per event) for hand guns up to a median of 9 per event (average 29.9 per event) for assault rifle long guns. Mass casualty events perpetrated at school venues averaged 10.1 fatalities per event and 12.2 injuries per event.

Victims (those injured or killed) of perpetrators aged 18 to 20 years made up 9.0% of all mass casualty victims and represented about 1 of every 8 deaths (12.9%), whereas 87.9% of all injuries and fatalities were attributable to perpetrators aged 21 years or older (Figure 1). School mass casualty victims comprised 17.1% (n = 357) of the total mass casualty victims. Shooters aged 18 to 20 years were associated with 31.1% of all school mass casualty victims and 37.7% of all school mass casualty fatalities.

DISCUSSION

Persistent public outcry after a number of high casualty events has led to demand for new laws to prevent further gun violence. On the basis of this definition of a mass casualty shooting, 17.1% of all mass casualty firearm victims were in schools, and, of these, 31.1% were injured or killed by perpetrators in the age group targeted by newly proposed legislation to raise long gun purchase age to 21 years. In all US mass shootings over the past 36 years, about 1 of every 8 victims was injured or killed by a perpetrator aged between 18 and 20 years. Comparatively, assault rifle-style long guns were associated with 44.1% of all fatalities and 61.5% of total victims. Perpetrators with identified mental illness, many of whom had a history of domestic abuse or assault, were associated with more than one half of events and 42.6% of all victims.


It should be noted that mass casualty events make up a small proportion of firearm-related deaths in the United States overall, where an astounding 32 288 firearm deaths from suicide or homicide have been reported in just a single year (2012)⁵ compared with 97 events resulting in 816 fatalities from mass casualty events from 1982 through 2018. Additionally, victims are operationalized in this analysis as those injured or killed in the event, but emerging evidence suggests that there are traumatic implications for those who witness this type of violence as well.⁶ Public health practitioners, researchers, and policymakers

should consider expanding the definition of victims in future efforts to study mass casualty events.

There are several limitations in this analysis: we obtained data from a tertiary source, mental health illness categorization may have been obtained from unverifiable sources, and mental health status data were lacking for several perpetrators. Additionally, the Las Vegas Strip massacre event, which resulted in 58 fatalities and 546 injuries and was perpetrated by a man aged 64 years, may have skewed results toward older perpetrators. When we omitted this event from analysis, 12.0% of all victims resulted from perpetrators aged 18 to 20 years and school mass casualty victims constituted 24.0% of victims overall.

PUBLIC HEALTH IMPLICATIONS

An increase in age restrictions to purchase long gun firearms from 18 to 21 years could have potentially prevented 4 of the 16 school shootings in the past 36 years. Those events were associated with 1 in 3 school shooting victims and 1 in 8 victims of mass shootings overall. Firearms may still be illegally obtained, but the majority of events (71.1%) were perpetrated by those who had legally obtained the firearms. Other classifications of mass shootings on the basis of the number of victims show similar results by age,⁷ which indicates some potential for age restrictions to prevent a large number of mass casualty events.⁸

Additional policies that are more broadly enforceable may be needed to curb this public health crisis, including bans on certain types of weapons.⁹ Additional public awareness of sensible gun storage,¹⁰ resources for finding mental health support, and clearer responsibilities for mental health service referrals are warranted. Public funding of firearm violence research and increased availability of firearm violence surveillance are needed to further guide evidence-based legislation as the public demands action.¹¹ 

and safety of the nation. *Am J Public Health*. 2018;108(2):194–195.

CONTRIBUTORS

J. D. Brown analyzed the data and critically revised the brief. J. D. Brown and A. J. Goodin conceptualized the study and interpreted the data. A. J. Goodin drafted the brief.

HUMAN PARTICIPANT PROTECTION

Institutional review board approval was not needed to analyze these public data.

REFERENCES

- Giffords Law Center. Minimum age to purchase and possess. Available at: <http://lawcenter.giffords.org/gun-laws/policy-areas/who-can-have-a-gun/minimum-age>. Accessed March 26, 2018.
- Rubin R. Tale of 2 agencies: CDC avoids gun violence research but NIH funds it. *JAMA*. 2016;315(16):1689–1691.
- Follman M, Aronsen G, Pan D. US mass shootings, 1982–2018: data from *Mother Jones'* investigation. 2018. Available at: <https://www.motherjones.com/politics/2012/12/mass-shootings-mother-jones-full-data>. Accessed March 5, 2018.
- Investigative Assistance for Violent Crimes Act of 2012. 126 STAT. 2435. Pub L. No. 112–265, HR 2076. 112th Congress (January 14, 2013).
- Wintemute GJ. The epidemiology of firearm violence in the twenty-first century United States. *Annu Rev Public Health*. 2015;36:5–19.
- Hughes M, Brymer M, Chiu WT, et al. Posttraumatic stress among students after the shootings at Virginia Tech. *Psychol Trauma*. 2011;3(4):403–411.
- Bjelopera JP, Bagalman E, Caldwell SW, Finklea KM, McCallion G. Public mass shootings in the United States: selected implications for federal public health and safety policy. 2013. Available at: https://journalistsresource.org/wp-content/uploads/2013/03/MassShootings_CongResServ.pdf. Accessed May 12, 2018.
- Everytown for Gun Safety. Mass shootings in the United States: 2009–2016. 2017. Available at: <https://everytownresearch.org/reports/mass-shootings-analysis>. Accessed March 5, 2018.
- Bauchner H, Rivara FP, Bonow RO, et al. Death by gun violence—a public health crisis. *JAMA Psychiatry*. 2017;74(12):1195–1196.
- Crifasi CK, Doucette ML, McGinty EE, Webster DW, Barry CL. Storage practices of US gun owners in 2016. *Am J Public Health*. 2018;108(4):532–537.
- Rajan S, Branas CC, Hargarten S, Allegrante JP. Funding for gun violence research is key to the health