Mass Shootings in the United States

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Summary: There is no standard definition of what constitutes a mass shooting, and different data sources—such as media outlets, academic researchers, and law enforcement agencies—frequently use different definitions when discussing and analyzing mass shootings. For instance, when various organizations measure and report on mass shootings, the criteria they use in counting such events might differ by the minimum threshold for the number of victims, whether the victim count includes those who were not fatally injured, where the shooting occurred, whether the shooting occurred in connection to another crime, and the relationship between the shooter and the victims. These inconsistencies lead to different assessments of how frequently mass shootings occur and whether they are more common now than they were a decade or two ago.

Data show that, regardless of how one defines mass shootings, perpetrators are likely to be men. But several other characteristics that are statistically predictive of perpetration are still uncommon among offenders on an absolute level. The rare nature of mass shootings creates challenges for accurately identifying salient predictors of risk and limits statistical power for detecting which policies may be effective in reducing mass shooting incidence or lethality. Implementing broader violence prevention strategies rather than focusing specifically on the most-extreme forms of such violence may be effective at reducing the occurrence and lethality of mass shootings.

Incidents of mass firearm violence galvanize public attention. There has been extensive media coverage of many incidents in the United States in which individuals have used firearms to kill large numbers of people. These mass public shootings are rare events—they constitute less than 15 percent of all mass killings in the United States and are

responsible for less than 0.5 percent of all homicides (Duwe, 2020)—but they have far-reaching impacts on citizens' mental health, anxiety, and perceptions of safety (Lowe and Galea, 2017).[1] Mass shootings also frequently generate extensive media coverage related to guns, prompt political discussions about legislative initiatives for how better to prevent gun violence, and may lead to substantial state gun policy changes (Schildkraut, Elsass, and Meredith, 2018; Newman and Hartman, 2019; Luca, Malhotra, and Poliquin, 2020).

In this essay, we first describe different approaches for defining a mass shooting and discuss how using different definitions can influence estimates of mass shooting levels and trends. We then summarize findings from the literature regarding the characteristics of mass shootings, including offender characteristics, types of firearm(s) used, and community-level correlates. We conclude with a brief discussion of the substantial methodological challenges for evaluating how gun policies affect mass shootings. Our discussion here is focused on mass shootings in the U.S. context.

What Is a Mass Shooting?

The U.S. government has never defined mass shooting as a separate category of crime, and there is not yet a broadly accepted definition of the term. In the 1980s, the Federal Bureau of Investigation (FBI) defined *mass murderer* as someone who "kills four or more people in a single incident (not including himself), typically in a single location" (Krouse and Richardson, 2015). In 2013, Congress defined *mass killing* as a single incident that leaves three or more people dead (Pub. L. 112-265, 2013). However, both definitions include many incidents that would not be considered mass shootings. Furthermore, neither definition was established for the purpose of data collection or statistical analyses. The FBI classification of mass murderer was established primarily with the aim of clarifying criminal profiling procedures (Ressler, Burgess, and Douglas, 1988), and the congressional definition was intended to clarify statutory authority for the provision of U.S. Department of Justice investigatory assistance requested by state and local agencies (Pub. L. 112-265, 2013). Thus, various news outlets, researchers, and law enforcement agencies often use different definitions when reporting on mass shootings, which can complicate our understanding of mass shooting trends and their relationship to gun policy.[2] Table 1 provides examples of the variation in the criteria set by some of the existing data sources on mass shootings in the United States. Depending on which data source is referenced, there were somewhere between six and 503 mass shootings and between 60 and 628 mass shooting fatalities in 2019.

Table 1. Variation in How Mass Shootings Are Defined and Counted

Data Source	Casualty Threshold (for injuries or deaths by firearm)	Location of Incident	Motivation of Shooter	Number of U.S. Mass Shootings in 2019	Number of Mass Shooting Fatalities in 2019
Mother Jones (see Follman, Aronsen, and Pan, 2020)	Three people fatally injured (excluding shooter)[a]	Public	Indiscriminate (excludes crimes of armed robbery, gang violence, or domestic violence)	10	73
Gun Violence Archive (undated-a)	Four people fatally or nonfatally injured (excluding shooter)	Any	Any	418	465
Mass Shooter Database (The Violence Project, undated)	Four people fatally injured (excluding shooter)	Public	Indiscriminate (excludes crimes of armed robbery, gang violence, or domestic violence)	6	60
AP/USA TODAY/Northeastern University Mass Killings database (see Associated Press and *USA Today*, 2019; Callahan, 2019)	Four people fatally injured (excluding shooter)	Any	Any	33	174
Everytown for Gun Safety Support Fund (2019)	Four people fatally injured (excluding shooter)	Any	Any	19 (in 2018)[b]	112 (in 2018)[b]
Mass Shooting Tracker (undated)	Four people fatally or nonfatally injured (including shooter)	Any	Any	503	628

Data Source	Casualty Threshold (for injuries or deaths by firearm)	Location of Incident	Motivation of Shooter	Number of U.S. Mass Shootings in 2019	Number of Mass Shooting Fatalities in 2019
Mass Shootings in America database (see Stanford Geospatial Center, undated)	Three people fatally or nonfatally injured (excluding shooter)	Any	Not identifiably related to gangs, drugs, or organized crime	62 (in 2015)[c]	202 (in 2015)[c]

[a] Before January 2013, the casualty threshold for the *Mother Jones* data was four people fatally injured (excluding the shooter).

[b] As of this writing, the Everytown for Gun Safety Support Fund's Mass Shootings in America website with interactive map was up to date as of April 28, 2020. However, the group's downloadable data included incidents through 2018 only.

[c] Stanford's Mass Shootings in America database was permanently suspended in mid-2016. In this table, we provide incident and fatality counts for 2015, the last year of complete data collection. For archived data, see Stanford Geospatial Center, 2018.

Although there is no official standard for the casualty threshold that distinguishes a mass shooting from other violent crimes involving a firearm, a common approach in the literature is to set a casualty threshold of four fatalities by firearm, excluding the offender or offenders (Fox and Levin, 1998; Duwe, Kovandzic, and Moody, 2002; Gius, 2015c; Krouse and Richardson, 2015; Fox and Fridel, 2016). Using this criterion helps reduce measurement error in identifying mass shootings because fatalities are captured in administrative data and are frequently included in media reports (Duwe, 2000). However, this categorization is not without controversy. It does not capture incidents in which fewer than four victims were killed but additional victims were nonfatally injured, and it does not include multiple-victim homicides in which fewer than four fatalities resulted from gunshots but additional fatalities occurred by other means. Thus, many have chosen alternative definitions of casualty thresholds for mass shootings. For instance, Lott and Landes (2000) adopted the definition of two or more injured victims, Kleck (2016) used a six-victim casualty threshold, the Gun Violence Archive (undated-a) defined *mass shooting* as an incident in which four or more victims (excluding the shooter) are injured or killed, and the Mass Shooting Tracker (undated) set a criterion of four or more people injured or killed (including the shooter).

Another definitional disagreement is whether to include multiple-victim shooting incidents that occur in connection with some other crime or domestic dispute. Because mass shootings that stem from domestic and gang violence are contextually distinct from high-fatality indiscriminate killings in public venues, some analysts have argued that they should be treated separately. In their analyses of “mass public shootings,” Lott and Landes (2000) excluded any felony-related shooting, and Duwe, Kovandzic, and Moody (2002) excluded incidents where “both the victims and

page is part of RAND's Gun
y in America initiative, one of
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offender(s) were involved in unlawful activities, such as organized crime, gang activity, and drug deals" (p. 276). Similarly, other researchers (e.g., Gius, 2015c; Luca, Malhotra, and Poliquin, 2020) have restricted analyses to events that occurred in a relatively public area and in which victims appeared to have been selected randomly. However, others have claimed that this narrow definition ignores a substantial proportion of gun-related violence from family- or felony-related murder (Fox and Levin, 2015). Furthermore, determinants of whether victims were selected indiscriminately or whether the incidents were gang- or crime-related are, to some degree, subjective. Accurate information about the shooter's motivations or connection to gangs may not have been included in police or news reports of the incidents. In contrast, the Mass Shooting Tracker and the Gun Violence Archive count as mass shootings all incidents that meet their designated casualty threshold, regardless of the circumstances that led to the event or the motivation of the shooter.

These definitions make a substantial difference in which incidents are counted.[3] As noted earlier, depending on which data source is used, there were between six and 503 mass shootings in the United States in 2019 (see Table 1); that amounts to a range of incident rates from approximately one incident per 50 million people in the United States to one incident per 1 million people. More-restrictive definitions (e.g., from *Mother Jones*) focus on the prevalence of higher-profile events motivated by mass murder, but they omit more-common incidents occurring in connection with domestic violence or criminal activity, which make up about 80 percent of mass shooting incidents with four or more fatally injured victims (Krouse and Richardson, 2015). Broader definitions (e.g., from the Gun Violence Archive) provide a more comprehensive depiction of the prevalence of gun violence, but they obscure the variety of circumstances in which these incidents take place and their associated policy implications. Furthermore, if the effects of a firearm policy are expected to affect only mass public shooting incidents, then analyses that include domestic violence mass shootings could obscure identification of the expected effects of the policy. Thus, there is value in having multiple measurements of mass shootings—but only if their definitions are clearly and precisely explained and they are used by researchers in a manner appropriate to the analysis.

Although researchers, policymakers, and reporters may rightly make different decisions about the criteria they wish to use to define what counts as a mass shooting, these decisions fundamentally shape the scope of incidents considered, as well as the potential for measurement error in their data. Data sets that use definitions based solely on objective criteria that are widely available across multiple sources (e.g., fatality counts) likely offer greater reliability compared with data sets that rely on objective criteria that may not be consistently reported across multiple sources (e.g., nonfatal shooting injury counts) or that may be difficult to operationalize (e.g., public location).[4] Data sets that define mass shootings based on relatively subjective criteria (e.g., whether an incident was related to criminal activity or domestic violence) may be particularly difficult to reconcile because underlying sources may disagree or differently report on these factors. *Mother Jones*, the Mass Shooter Database,

and the Mass Shootings in America database are examples of sources that use some subjective criteria. In the absence of a clear conceptual reason for restricting mass shooting incidents of interest based on subjective criteria, evaluations are likely to produce more-reliable and more-replicable results when using data sources that define mass shootings based only on fatality thresholds (see Table 1).

Another fundamental issue in documenting mass shootings, and in reconciling differences across data sets, is that the methods used to collect information on mass shootings also vary across sources. There is no comprehensive, administrative data source that captures mass shootings; however, data from the FBI's Supplementary Homicide Reports (SHR) database provide information from 1976 onward on most homicides in the United States, typically including information on the weapon types, number of victims, and number of offenders involved, which can be used to identify which incidents meet specific definitional thresholds of fatalities (Puzzanchera, Chamberlin, and Kang, 2018).[5] When such details are known, the SHR database also provides information on victim-offender relationships (e.g., husband or wife, stranger, neighbor)[6] and incident circumstances (e.g., "gangland killing," "lovers' triangle," "brawl due to influence of alcohol"), which could be used as indicators of familicides and felony-related killings. However, the SHR database relies on voluntary submissions by thousands of separate law enforcement agencies. It does not capture all incidents (about 90 percent completeness), and this missingness is not random. Sometimes, entire states do not submit data for a year or for part of a year, and in most states and years, at least some law enforcement agencies do not submit complete data (Fox, 2004; Fox and Swatt, 2009). In addition to missingness by jurisdiction, there is a high degree of missingness for data elements, particularly in offender characteristics (e.g., the offender may not be known) and incident characteristics (e.g., circumstances or victim-offender relationship).[7] Some analyses have also compared SHR variables with data in police incident reports in specific jurisdictions and found evidence of misclassification regarding victim-offender relationship and incident circumstances (Pizarro and Zeoli, 2013). Others have cross-referenced SHR incidents with historical news records and found issues of coding errors in the SHR database that could affect identification of mass shooting incidents (e.g., double counting of victims or incidents, misclassifying a nonfatal injury as a fatal injury) (Duwe, 2000). Although researchers have noted that these recording errors are relatively uncommon in the SHR, the errors are still important considerations for using the SHR to assess mass shootings (Duwe, 2000; Fox, 2006). Finally, the SHR provides relatively limited detail on offender or victim characteristics, firearm types, and incident setting.

Given these limitations, most data sources for mass shootings do not derive solely from the SHR. Some sources (e.g., the AP/USA TODAY/Northeastern University Mass Killings database) combine information from both news reports and the SHR, others (e.g., *Mother Jones*) rely on news reports alone, and some (e.g., the Mass Shooter Database) combine information from law enforcement records, social media, court transcripts, news accounts, and other primary and

secondary sources to obtain detailed information on the characteristics of each incident and offender (see Table 2). Differences in data collection strategies, in large part, reflect differences in the mass shooting definitions employed (e.g., sources that count nonfatal shooting injuries in their criteria must rely on sources other than the SHR, which captures only fatal injuries), as well as differences in the proposed purpose of the database.

Table 2. Data Collection Methods and Data Elements Captured Across Mass Shooting Data Sources

Data Source and Year Established	Stated Purpose of the Data Set	Methods for Data Collection	Time Period[a]	Data Elements Captured[b]
Mother Jones Established 2012	To track the "distinct phenomenon" of indiscriminate shooting rampages in public places resulting in four or more victims killed (later, three or more victims killed)	Media reports	1982–present	City, state, latitude, and longitude; date; number of fatalities; number injured; setting; shooter gender, race, and age; prior signs of mental health problems for shooter; method of gun acquisition; gun type
Gun Violence Archive Established 2013	To provide data about gun violence in near real time	Automated queries and manual research of more than 7,500 sources (e.g., local and state police records, media, government reports, existing data aggregates) Each case involves secondary validation and de-duplication.	2014–present	City, state, latitude, and longitude; date; number of fatalities; number injured; victim name, age, and gender; suspect or offender name, age, and gender; incident resolution; summary of incident; weapons involved (gun type, whether stolen)

Data Source and Year Established	Stated Purpose of the Data Set	Methods for Data Collection	Time Period[a]	Data Elements Captured[b]
Mass Shooter Database Established 2017	To study the life histories of mass shooters who shot and killed four or more people in a public place	Primary sources (e.g., social media, correspondence with perpetrators) and secondary sources (e.g., media, court transcripts, journal articles, autopsy reports, medical, school, and law enforcement records) Each case involves independent validation and de-duplication.	1966–2019	City, state; incident setting; perpetrator age and gender; number killed; 100 life-history variables for offender, including mental health history, trauma, interest in past shootings, and situational triggers
AP/USA TODAY/ Northeastern University Mass Killings database Established 2006	To provide a comprehensive repository on every mass murder (four or more people, excluding the killer, killed within a span of 24 hours)	Media reports and the SHR database Further details are not provided. Data are not currently publicly available.	2006–2019	City, state; date; number of victims; method (e.g., shooting); weapon type; incident summary
Everytown for Gun Safety Support Fund mass shootings database[c] Established 2013	To understand mass shootings (four or more killed) and help point lawmakers to strategies to prevent such events	Primarily media reports, supplemented with the SHR database and police and court records	2009–present	City, state; date; number killed (by sex); number injured (by sex); number under age 20 killed; number of law enforcement officer deaths and injuries; setting; gun types; shooter age, sex, prohibited possessor status, outcome; whether shooter displayed dangerous warning signs and had prior history of domestic violence; whether there was high-capacity magazine use; incident summary

Data Source and Year Established	Stated Purpose of the Data Set	Methods for Data Collection	Time Period[a]	Data Elements Captured[b]
Mass Shooting Tracker Established 2013	To track all mass shootings with more than three people shot in a single spree	Crowd-sourced data collection, unknown procedures	2013–present	City, state; number killed; number injured; brief incident name and summary (e.g., offender name, victims)
Mass Shootings in America database Established 2012	To provide a curated set of spatial and temporal data about mass shootings in the United States, taken from online media sources, with the aim of facilitating research on gun violence in the United States	Online media resources In general, a minimum of three corroborating sources are required to add the full record into the data set.	1966–2016	City, state, latitude, and longitude; date, day of week; number of shooters; number of civilian deaths and injuries; number of law enforcement officer deaths and injuries; shooter age, name, sex, and outcome; number (and types) of guns; setting; motive; shooter history of mental illness; shooter military experience; incident summary

[a] In this column, *present* means the beginning of 2021.

[b] This column represents the data elements that the source attempts to capture; in many cases, these fields are missing information.

[c] For this data set and reporting on it, see Everytown for Gun Safety Support Fund, 2019.

However, variation in the sources examined to identify incidents can result in varying degrees of completeness or reliability. Data sets that rely solely on news sources or crowd-sourcing (i.e., *Mother Jones*, the Mass Shooting Tracker, and the Mass Shootings in America database) may systematically miss lower-profile incidents and those involving fewer injuries or fatalities (Duwe, 2000; Schildkraut, Elsass, and Meredith, 2018). Systemic biases in the types of incidents that receive widespread media coverage affect the number of incidents that are counted but might also misrepresent the relative characteristics of offenders, victims, or communities involved (Silva and Capellan, 2019a, 2019b). For example, news reports may be less likely to include the perpetrator's race when he or she is White (Park, Holody, and Zhang, 2012) and may be more likely to include speculation about gang involvement when racial and ethnic minorities are involved (Entman and Gross, 2008). Given media sources' limited capacity to cover all current events, mass shootings that occur during other newsworthy events (e.g., presidential elections) may also be systematically missed, particularly in historical analysis relying on print or television media. Finally, the media landscape has changed dramatically over the past three decades; daily local newspapers have disappeared across much of the United States, and the extent to which news sources are searchable on the internet has also changed (Duwe, 2000).

Thus, any comparison over time in the number or characteristics of mass shootings necessarily involves comparisons across different media sources with different coverage areas, intended audiences, and editorial practices. Data sources that combine information across media reports and law enforcement administrative data—for example, the Gun Violence Archive, the Mass Shooter Database, the Everytown for Gun Safety Support Fund mass shootings database, and the AP/USA TODAY/Northeastern University Mass Killings database—are likely to be more complete, particularly in measuring incidents over a longer historical time frame. However, it is a challenging effort to ensure that different sources of information about the same incident are properly linked (i.e., without a unique incident identifier, researchers must make linkages based on similarities in date, location, and incident information, which may not be identical across different reports of the same incident) so that multiple reports are not counted as separate incidents. Thus, data sets that triangulate across multiple underlying sources (e.g., the Mass Shooter Database and the Gun Violence Archive) require additional effort toward de-duplication and validation.

And even when data sources use the same definition of what constitutes a mass shooting, variation in data collection methods can result in different estimates of mass shooting prevalence. As an example of this issue, Duwe (2020) triangulated information from the SHR, online newspaper databases, and unpublished mass shooting data sets and found that the *Mother Jones* database missed more than 40 percent of mass shootings that met the source's own criteria between 1982 and 2013. Greater missingness occurred for incidents further back in time, likely because of greater challenges with accessing comprehensive news accounts prior to widespread use of digital media for news reporting. Comparing four data sources for mass shootings (the Everytown for Gun Safety Support Fund's mass shootings database, the Gun Violence Archive, the *Mother Jones* database, and the FBI's SHR database), and applying the same definition of mass shooting to each (four or more fatalities, excluding the shooter), Booty et al. (2019) found that estimates of the number of mass shootings in 2017 ranged from five (*Mother Jones*) to 24 (Gun Violence Archive). When triangulating across data sets, the researchers identified 32 unique mass shooting incidents, but only two incidents (6.3 percent) were common to all four data sources. For further discussion, see Booty et al. (2019), Duwe (2000, 2020), and Huff-Corzine and Corzine (2020), which contain a more comprehensive discussion of data collection efforts and their limitations.

Are Mass Shootings on the Rise?

In 2014, the FBI released a study showing that "active shooting incidents" had increased at an average annual rate of 16 percent between 2000 and 2013 (Blair and Schweit, 2014).[8] In contrast to the varied definitions for mass shootings, there is an agreed-upon definition among government agencies for *active shooter*: "an individual actively engaged in killing or attempting to kill people in a confined and populated area; in most cases, active shooters use firearm(s) and there is no pattern or method to their selection of victims" (U.S. Department of

Homeland Security, 2008, p. 2). Using a modified version of this definition to include incidents that had multiple offenders or occurred in confined spaces, Blair and Schweit (2014) found that active shootings had increased from only one incident in 2000 to 17 in 2013. The FBI active shooting reports, which are now produced annually, identified 20 active shooter incidents in 2016, 30 incidents in 2017, 27 incidents in 2018, and 28 incidents in 2019 (FBI, 2018g, 2019g, 2020).

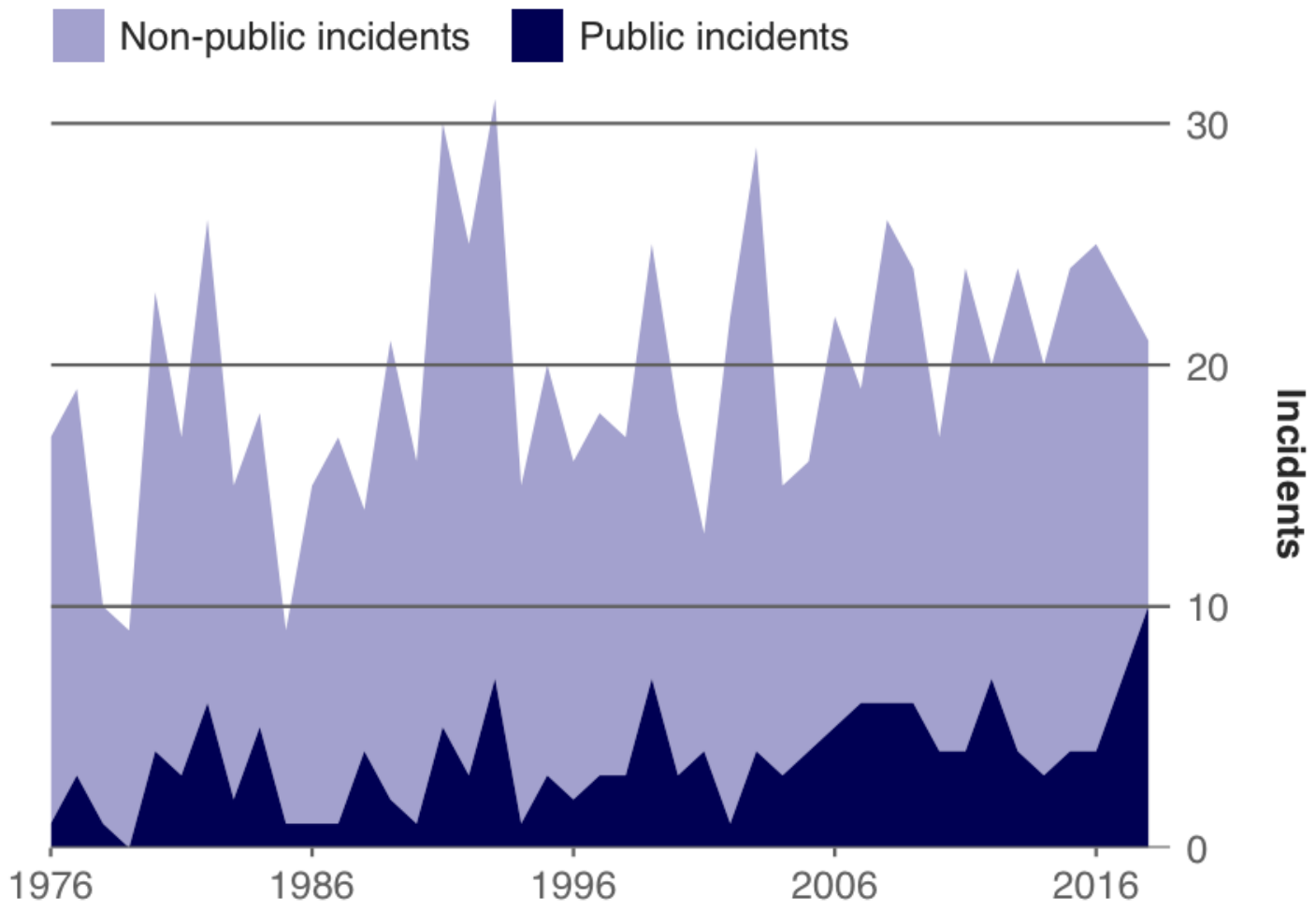
Although Blair and Schweit (2014) explicitly stated that their original FBI active shooter study was "not a study of mass killings or mass shootings" (p. 5), extensive media coverage cited the study as evidence of a sharp rise in mass shootings and mass shooting fatalities (Lott, 2015). However, Blair and Schweit (2014)'s definition of an active shooter incident includes some incidents that would be excluded under any of the commonly used criteria for mass public shootings (see Table 1) because it does not set any casualty threshold. For example, Blair and Schweit's definition includes some incidents in which no people were injured or in which one person was killed and no others were wounded. Setting a threshold of zero victims increases the potential for measurement error, because shooting incidents with no casualties are more difficult to identify from police records and are less likely to receive media coverage (Duwe, Kovandzic, and Moody, 2002). Additionally, because it should be relatively easier to identify more-recent shootings with few fatalities, a low casualty threshold will tend to systematically bias estimates of the number of shootings upward over time.[9] Even when using a higher-fatality threshold, mass shooting data sources that rely solely on news reports to identify cases also appear to systematically undercount incidents from earlier periods (see previous section and Duwe, 2020).

Even when a more restrictive casualty threshold of four or more fatally injured victims (excluding the shooter) is imposed, empirical evidence on trends in these incidents varies depending on whether the motivation of the shooter is included as a criterion for considering an event a mass shooting. In their analysis of mass shooting trends from 1999 to 2013, Krouse and Richardson (2015) distinguished among mass shootings occurring in public locations that are indiscriminate in nature ("mass public shootings"), mass shootings in which the majority of victims are members of the offender's family and that are not attributable to other criminal activity ("familicide mass shootings"), and mass shootings that occur in connection to some other criminal activity ("other felony mass shootings"). Duwe (2020) adopted similar distinctions in his analysis of mass shootings over the longer time frame of 1976 to 2018.

Figures 1 and 2 show trends in mass shooting incidents and mass shooting fatalities, using the data provided by Duwe (2020), who created his own data set aggregating across several of the sources described in this essay. Using Krouse and Richardson (2015)'s definition of "mass public shootings," Duwe (2020) found that such events constituted about 19 percent of all mass shooting incidents and 27 percent of all mass shooting fatalities from 1976 to 2018. The data from multiple studies suggest a slight increase in the incidence rate of mass public shootings over the past four decades (Cohen, Azrael, and Miller, 2014; Krouse and Richardson, 2015; Duwe, 2020). From 2016 to 2018, the annual rate of mass public shooting incidents was about one

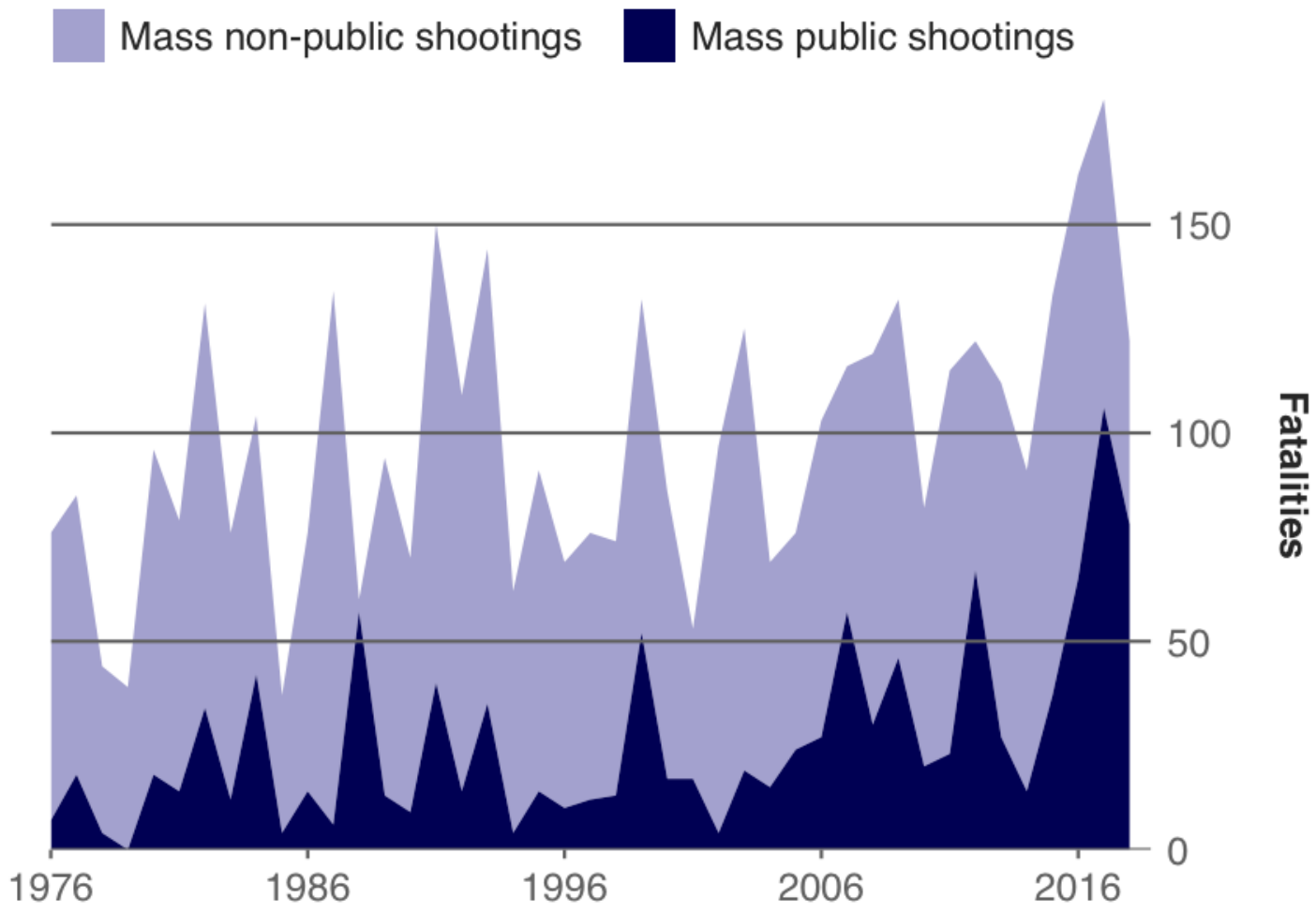
incident per 50 million people in the United States (Duwe, 2020). Considering the number of fatalities in these shootings, this corresponds to approximately 0.4 percent of all homicides, or approximately 0.2 percent of all firearm deaths, over that period. However, using an expanded definition of mass shootings that includes domestic- or felony-related killings, there is little evidence to suggest that mass shooting incidents or fatalities have increased (Cohen, Azrael, and Miller, 2014; Krouse and Richardson, 2015; Fox and Fridel, 2016). Adjusted for changes in the size of the U.S. population, the incidence of all mass shootings (four or more fatally injured victims, excluding the offender, regardless of shooter motivation or circumstances) was highest in the late 1980s and early 1990s, averaging one incident per 10 million people from 1989 to 1993 (Duwe, 2020). More recently, between 2016 and 2018, the annual rate of all mass shooting incidents was about one incident per 14 million people (Duwe, 2020). Considering the number of fatalities in these mass shootings, this corresponds to approximately 0.8 percent of all homicides, or approximately 0.4 percent of all firearm deaths, over that period. Thus, different choices about how to define a mass shooting result in different findings for both the prevalence of these events at a given time and whether their frequency has changed over time.

Figure 1. Trends in Mass Shooting Incidents, 1976–2018



SOURCE: Author analysis of data from Duwe, 2020.

Figure 2. Trends in Mass Shooting Fatalities, 1976–2018



SOURCE: Author analysis of data from Duwe, 2020.

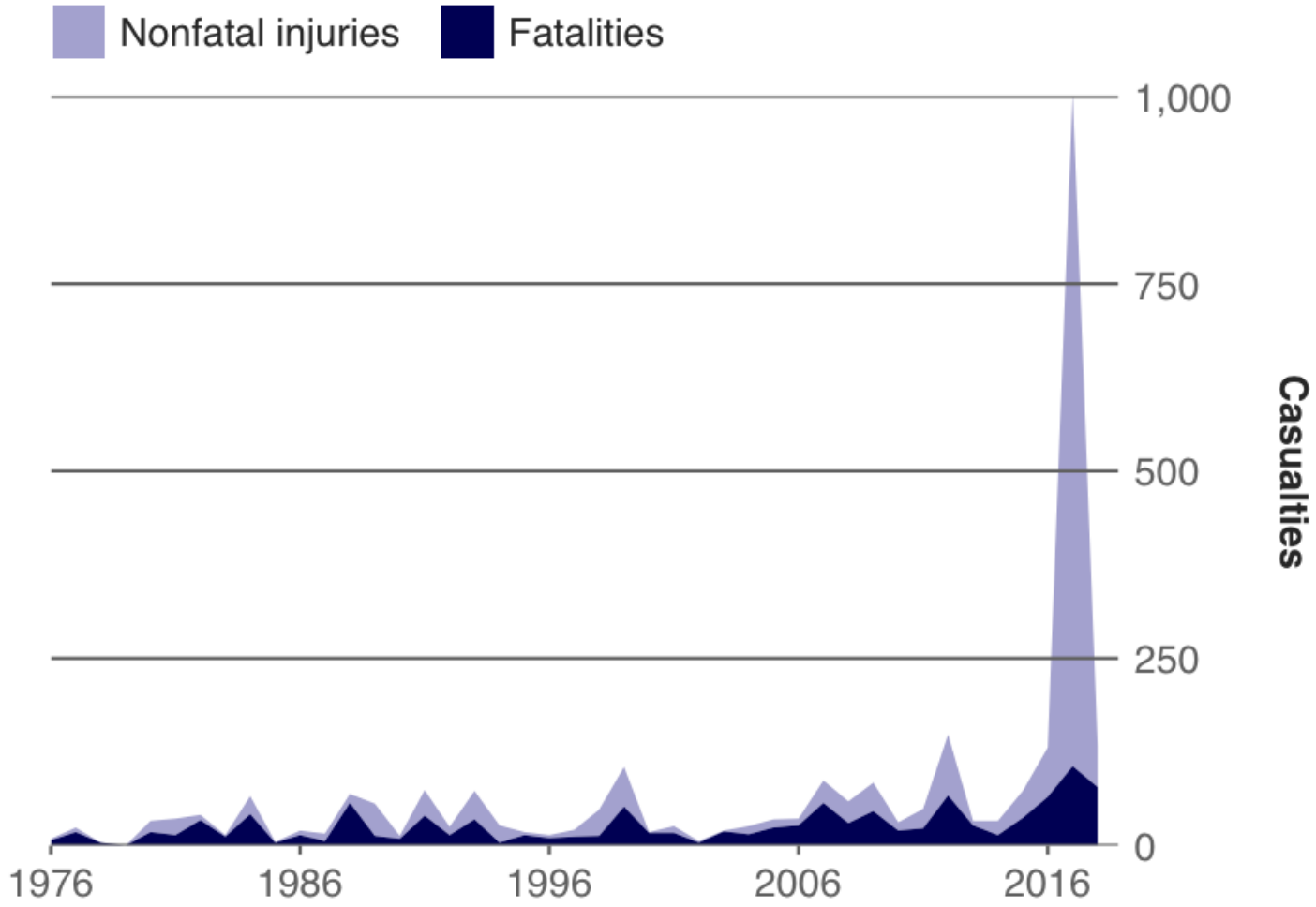
Even if we set aside the facts that reliance on different data sources over time complicates measurement and that findings can depend on how mass shootings are defined, the relative rarity of mass shooting events makes analysis of trends particularly difficult. Chance variability in the annual number of mass shooting incidents makes it hard to discern a clear trend in the risk of such incidents, and trend estimates are sensitive to outliers and to the time frame chosen for analysis (Fox and DeLateur, 2014). For example, although Krouse and Richardson (2015) found evidence of an upward trend in mass public shootings from 1999 to 2013, they noted that the increase was driven largely by events in 2012, in which there was an unusually high number of mass public shooting incidents. Additionally, Lott (2015) suggested that the FBI study's estimate of a dramatic increase in active shooter incidents was largely driven by the choice of 2000 as the starting date, because that year had an unusually low number of shooting incidents. Conducting his own analysis to cover 1977 through 2014, and adjusting the data to exclude events with fewer than two fatalities, Lott (2015) found a much

smaller and statistically insignificant increase (less than 1 percent annually) in mass shooting fatalities over time. However, when other researchers extended the time frame to cover more-recent years and used a four-fatality threshold for mass public shootings, their findings suggested a significant increase in the incidence and lethality of these events over time (Sanders and Lei, 2018; Duwe, 2020; Lankford and Silver, 2020).

The leverage of extreme incidents is even clearer when examining trends in the number of casualties from mass public shootings over time (Figure 3). The data on deaths and injuries from 2017 mass public shootings are particularly striking: Just one of the seven incidents that occurred (the Las Vegas shooting in October 2017) accounted for more than half of all mass public shooting fatalities and nonfatal injuries in that year.[10] However, even when we exclude the Las Vegas incident, 2008 through 2018 saw the highest average rate of casualties from mass public shootings since the 1970s. In 2018, mass public shootings were responsible for approximately one death per 4 million people in the United States (Duwe, 2020), representing fewer than one of every 200 homicides in that year.

Although different choices about how to define a mass shooting and the period over which to calculate mass shooting trends have resulted in disagreement about whether the frequency of mass shootings has risen, there is clear evidence that the media's use of the term *mass shooting* has increased significantly in recent decades (Roeder, 2016). Unfortunately, the trends one finds in measuring mass shootings over time depend heavily on how the term is defined and the precise period over which the trend is observed, and these trends are likely to be biased by changes in the completeness of the underlying data sources over time. This ambiguity makes it difficult to draw firm conclusions about how these incidents have changed over time or how that information should be used as we try to understand the determinants, costs, and policy implications of mass shootings.

Figure 3. Trends in Mass Public Shooting Casualties, 1976–2018



SOURCE: Author analysis of data from Duwe, 2020.

Characteristics of Mass Public Shootings

Several studies, largely focused on mass public shootings, have sought to describe the characteristics of individuals who perpetrate mass shootings, evaluate characteristics of each mass shooting incident, and identify the behaviors and motivations that preceded each incident. Most of these studies are purely descriptive, not comparative, and thus should not be interpreted as providing evidence of whether specific individual-level or community-level characteristics are predictive of someone perpetrating a mass shooting.

According to this literature (see, for example, Capellan et al., 2019; Duwe, 2020), the perpetrators of mass public shootings in the United States have been overwhelmingly male (98 percent) and are most commonly non-Hispanic White (61 percent). In addition, they are most commonly younger than age 45 (82 percent); more specifically, 26 percent of mass public shooters from 1976 to 2018 were younger than age 25, 27 percent were aged 25 to 34, and 29 percent were aged 35 to 44. Relative to the overall U.S. population, mass public shooting offenders are much more likely to be male and are somewhat younger; relative to other homicide offenders, males and non-Hispanic Whites are overrepresented among mass public shooters, and mass public shooters are older. For comparison, of the overall U.S. population in 2019, approximately 49

percent was male, 60 percent was younger than age 45, and 60 percent was non-Hispanic White (U.S. Census Bureau, 2020). Of murderers in 2018 with known offender characteristics, 88 percent were men, 84 percent were younger than age 45 (38 percent younger than 25, 31 percent aged 25 to 34, and 16 percent aged 35 to 44), and 42 percent were White (Hispanic ethnicity information was not provided) (FBI, 2019f).

Media coverage often links mass public shootings with serious mental illness (McGinty et al., 2014, 2016), but estimates of the prevalence of mental illness among mass public shooting offenders vary widely depending on the types of incidents considered and the methods used to define and identify mental illness. Rates of formal diagnoses of psychotic disorders (including diagnoses made post-incident, which may be affected by the incident itself) among mass public shooters are estimated to be about 15 to 17 percent (Stone, 2015; Fox and Fridel, 2016).[11] Studies that use a broader definition of mental illness and consider informal evidence indicative of mental health problems (e.g., statements by law enforcement or family before or after the incident) have found prevalence rates ranging from 30 to 60 percent (Taylor, 2018; Capellan et al., 2019; Duwe, 2020). This informal evidence, which is often obtained subsequent to the incident, is invariably affected by the act of mass violence itself (Skeem and Mulvey, 2020). It does not suggest that mental illness is useful for predicting a subsequent mass shooting. Of note, a study of 106 perpetrators of mass public shootings in the United States between 1990 and 2014 found that less than 5 percent of offenders (n = 5) had a history of involuntary commitment or adjudication of dangerousness that would have prohibited them from purchasing a firearm following the federal mental health background check (Silver, Fisher, and Horgan, 2018). Although most research supports that, overall, people with serious mental illness are overrepresented among mass public shooters (Duwe, 2020; Skeem and Mulvey, 2020), this does not imply that serious mental illness *causes* mass shootings, just as we cannot conclude that being a young man causes mass shootings.

Other researchers and analysts have noted that many mass shooters have a history of domestic violence. Using three mass shooting databases (whose underlying data sources include media reports, court records, and police records) and their own search of criminal records, Zeoli and Paruk (2020) analyzed 89 individuals who perpetrated a mass shooting (involving four or more fatalities, excluding the offender) between 2014 and 2017. Of the 89 individuals, 28 (31 percent) had a history of suspected domestic violence. The authors identified that, of those 28, 17 (61 percent) had prior interaction with the criminal justice system related to domestic violence, and six individuals had a felony or misdemeanor conviction for domestic violence. Using a different definition of mass shooting (involving four or more casualties, including the perpetrator, and excluding felony-related mass shootings), Gu (2020) found that 36 percent of mass shooting incidents from 2014 to 2019 involved an offender with a history of domestic violence or violence against women. Of note, both of these studies

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included mass shooting familicides, which represent the modal type of mass shooting. Given that intimate partner homicides are commonly preceded by prior incidents of nonfatal domestic violence (Campbell et al., 2007), it may be expected that perpetrators of mass shooting familicides commonly have prior histories of domestic violence. In a study of mass murders from 2006 to 2016 (74 percent of which were shootings), Fridel (2017) found that 30 percent of familicides, 7 percent of mass public killings, and 3 percent of felony-related killings involved an offender with a known history of domestic violence.[12] But because we do not know the rate of domestic violence in the general population based on comparable definitions and data sources, it is not clear the precise extent to which prior domestic violence represents a risk factor for perpetrating a mass shooting.

It is challenging to make broad generalizations about the individual-level motivations of mass shootings. When mass shootings are broadly defined to include familicides, felony-related killings, and mass public shootings, the events include heterogeneous incident types that vary in terms of victim, offender, and incident characteristics (Fridel, 2017; Taylor, 2018). Felony-related killings exhibit particular differences from familicides and mass public shootings. They are, by definition, criminally motivated (in contrast to familicides and mass public shootings, which are more commonly motivated by relationship problems, group grievances, or ideological extremist beliefs); result in significantly fewer deaths; and are significantly less likely to conclude with the death of the perpetrator (Fridel, 2017; Capellan et al., 2019).[13] The etiology of felony-related mass shootings thus, unsurprisingly, bears a stronger resemblance to firearm homicides more broadly. In contrast, familicides and mass public shootings show stronger similarities in terms of offender characteristics and motivations (Fridel, 2017).

Even the subset of mass public shootings seems to encompass a variety of offender types, and some researchers have suggested that the relative prevalence of these offender typologies has changed over time (Capellan et al., 2019).[14] When Capellan and colleagues considered incidents in which an offender used a firearm to kill or "attempt to kill" four or more victims in a public setting, they found that school shootings constituted the majority of mass public shooting incidents in the 1960s and 1970s, and workplace shootings became increasingly prevalent in the 1980s to 2000s (Capellan and Gomez, 2018; Capellan et al., 2019).[15] The past decade has seen an increase in the percentage of mass public shootings that are posited to relate to fame-seeking on behalf of the individual or on behalf of a broader ideology (Capellan et al., 2019; Lankford and Silver, 2020). Some researchers have suggested that this rise in fame- and attention-seeking motivations among mass public shooters has contributed to an escalation in the lethality of these incidents (Langman, 2018; Lankford and Silver, 2020).

Although there are some noted differences across different types of mass public shootings (Capellan and Anisin, 2018; Capellan et al., 2019), an overarching commonality is that most incidents are preceded by some level of planning by the shooter. Among active shooting cases from 2000 to 2013 for which sufficient information was available, 62 percent of offenders planned the attack for more than one month, and 9 percent planned for more than one year

(Silver, Simons, and Craun, 2018). Focusing on incidents involving eight or more fatally injured victims, Lankford and Silver (2020) found that at least half of the 18 high-fatality mass public shootings between 2010 and 2019 involved a planning period of one year or longer. About 40 percent of mass public shooters make some form of verbal or written threat (e.g., threats made in front of family or friends or posted to social media) prior to the incident (Duwe, 2020).

Another strand of research has described the types of firearms used in mass shooting incidents and the extent to which variation in weapon choice relates to the lethality of the incident. There are noted challenges to conducting such analyses, partly because of the absence of any official data source that provides complete information on the types of firearms or associated equipment (e.g., ammunition, magazines, scopes) used in shootings (for further discussion, see Koper, 2020). It is common for multiple firearms to be involved in public shootings: Various studies have indicated that multiple firearms were involved in an estimated 34 percent of active shooting incidents across 2000–2017 (de Jager et al., 2018), 42 percent of mass public shooting incidents across 1999–2013 (Krouse and Richardson, 2015), and 79 percent of mass public shooting incidents that resulted in eight or more fatalities across 1966–2019 (Lankford and Silver, 2020). In an analysis of mass public shootings in which shooters *attempted* to kill at least four individuals, Capellan and Jiao (2019) found that 80 percent of offenders had prior access to a firearm, although 41 percent of those individuals obtained additional firearms for the incident.

As shown in Table 3, handguns are the firearm most commonly involved in active shootings and mass shootings; semiautomatic rifles or "assault-style" weapons are used in an estimated 10 to 36 percent of active shootings and mass shootings.[16] The use of large-capacity magazines (LCMs) is more common in mass public shootings and high-fatality mass shooting incidents than it is in firearm crimes overall. The estimated prevalence of LCM involvement in mass shootings ranges from 20 to 60 percent, or from 45 to 60 percent when restricting the denominator to mass public shootings or high-fatality mass shootings (Table 3). For comparison, LCM-equipped firearms are estimated to constitute 22 to 36 percent of crime guns recovered by police in most urban jurisdictions (Koper et al., 2018). The estimated prevalence of LCM-equipped firearms in the overall stock of civilian-owned firearms is about 15 to 20 percent, although these estimates come from survey data from 1994, and the prevalence has likely increased since then (Cook and Ludwig, 1996; Kleck, 2020).

Table 3. Percentage of Mass Shooting Incidents Involving the Use of a Firearm with a Large-Capacity Magazine or the Use of a Semiautomatic Rifle or Assault Weapon

Data Source	Mass Shooting Definition	Period of Study and Number of incidents	Firearm with an LCM[a] (%)	Semiautomatic Rifle or Assault Weapon[b] (%)
Everytown for Gun Safety Support Fund (2018)	Four or more people fatally injured	2009–2017, *n* = 173	20–58	NR
Koper et al. (2018)	Four or more people fatally injured	2009–2015, *n* = 145	19–57	10–36
Krouse and Richardson (2015)	Four or more people fatally injured	1999–2013, *n* = 317	NR	10
Klarevas (2016)	Six or more people fatally injured	1966–2015, *n* = 111	47	26
Krouse and Richardson (2015)	Public, did not involve other crimes, four or more people fatally injured	1999–2013, *n* = 66	NR	27
Follman, Aronsen, and Pan (2020)	Public, did not involve other crimes, four or more people fatally injured	1982–Jan 2019, *n* = 92	45–61 (or higher)	NR
Capellan and Jiao (2019)	Public, did not involve other crimes, attempted to kill four or more people	1966–2017, *n* = 318	NR	10–34
Klarevas (2019)	Public, did not involve other crimes, four or more people fatally injured	1966–2017, *n* = 43	NR	30
Lankford and Silver (2020)	Public, did not involve other crimes, eight or more people fatally injured	1966–2019, *n* = 34	NR	44
de Jager et al. (2018)	Active shooting	2000–2017, *n* = 248	NR	25
Blau, Gorry, and Wade (2016)[c]	Mass shooting, spree shooting, or active shooting	1982–2014, *n* = 184	37	34

SOURCE: Information obtained from Blau, Gorry, and Wade (2016), de Jager et al. (2018), Capellan and Jiao (2019), Klarevas (2019), Koper (2020), and Lankford and Silver (2020).

NOTE: NR = not reported.

[a] An LCM is considered to be an ammunition feeding device capable of holding more than ten rounds of ammunition. Koper et al. (2018) includes incidents that involved gun models commonly sold with an LCM, even if the magazine recovered was not reported.

[b] There is no agreed-upon definition of assault weapon, and studies differed in how such rifles or weapons were defined. Most studies considered specific firearms based on federal definitions (Krouse and Richardson, 2015) or a combination of state and federal definitions (Klarevas, 2016, 2019; Koper et al., 2018); some studies (de Jager et al., 2018; Koper et al., 2018; Capellan and Jiao, 2019) considered upper bounds based on a broader definition to include all semiautomatic rifles. The exact definition used was unclear in some studies (Blau, Gorry, and Wade, 2016; Lankford and Silver, 2020).

[c] The criteria for incident inclusion used by Blau, Gorry, and Wade (2016) are somewhat unclear, but the authors appear to consider mass public shootings with four or more fatalities, public spree shootings with two or more fatalities, and active shooter incidents identified by the FBI.

Finally, a few 2018 and 2019 studies have described community-level characteristics associated with mass shooting incidence. County-level analyses of mass shootings (excluding felony-related mass shootings) from 1990 to 2015 show a higher incidence rate of mass shootings occurring in counties with higher levels of or increasing trends in income inequality (Cabrera and Kwon, 2018; Kwon and Cabrera, 2019a, 2019c), higher population density (Cabrera and Kwon, 2018; Kwon and Cabrera, 2019b, 2019c), higher levels of residential instability (Kwon and Cabrera, 2019b), and lower levels of civic engagement (Kwon and Cabrera, 2019b). However, these findings may simply reflect the fact that mass shootings are more likely to occur in more-populous urban areas where larger gatherings of people are likely to be found; these estimated associations do not clearly show a causal effect of economic or sociocultural conditions on mass shootings.

Research on Policies That Might Reduce Mass Shootings

The nature of mass shootings creates serious challenges for developing policies that will effectively prevent their occurrence. For instance, their rarity makes it difficult to extract generalizable information to identify useful predictors of risk. The low base rates of these events also ensure that policies targeting individuals based on risk factors would result in an extremely high rate of false positives; even the best available risk factors can identify only a subpopulation in which the risk of committing a mass shooting is on the order of one in a million. Finally, because individuals who perpetrate mass shootings often die by suicide (or expect to be killed by someone trying to stop the shooting), standard deterrence strategies used in crime prevention are unlikely to work; increasing the certainty or severity of punishments seems unlikely to be effective when the perpetrator already expects to die in the mass shooting.[17]

The relative rarity of mass shooting incidents, and particularly mass public shooting incidents, also makes it challenging to empirically assess whether existing policies are effective in preventing them. Since 2015, there has been an increase in published research that takes causal inference methods commonly used to evaluate policy effects on other forms of gun violence and applies these methods to study the effects of state firearm policies on mass shooting incidence or mass shooting fatalities.[18] However, mass shootings are sufficiently rare that the statistical assumptions of these methods rarely hold, threatening the validity of the effect estimates and statistical inference and potentially resulting in spurious effects (Xue et al., 2017).[19] In some cases, modeling rare outcome data with a large number of covariates can result in quasi- or complete separation, whereby one or more of the covariates perfectly predicts the outcome (Albert and Anderson, 1984).[20] Even if models do converge, the

sparseness of these outcome data risk model overfitting and biased estimates. These issues are likely exacerbated in studies that adopt narrower definitions of mass shootings—for example, restricting the definition to mass public shootings or to mass public shootings involving a higher threshold of fatalities.

Even in studies that use models more appropriate for the distributional characteristics of mass shooting outcomes, the high degree of variability in mass shooting prevalence, injuries, and fatalities makes analyses of the effects of state policies on mass shooting outcomes subject to extremely low statistical power. Even if a state passed a policy that had large effects on mass public shootings (e.g., it cut the probability of such incidents in half), it is still unlikely that a study of that policy using appropriate statistical methods would find it to have a statistically significant effect. This occurs because most states already have zero mass public shootings in any given year, and, when the rate in the pre-period was already at, or very close to, zero, it is not possible to detect a decline in the risk of such shootings that is due to the policy—no matter how large that effect may be. This pervasive lack of statistical power can result in a published literature characterized by exaggerated effect sizes for any effects that are found to be statistically significant, and these significant estimates, in many cases, may misidentify the direction of the true effect (Gelman and Carlin, 2014).

Further complicating identification of the causal effects of policies on mass shootings is the potential issue of *reciprocal causation*; that is, high-profile mass shooting incidents may themselves prompt legislative changes. Luca, Malhotra, and Poliquin (2020) evaluated the association of mass public shooting occurrence in states with subsequent legislative activity related to firearms. Using data from 1989 to 2014, they found a 15-percent increase in the number of state firearm bills introduced in the year following a mass shooting; states with Democratic-controlled legislatures did not show significant effects of firearm laws enacted, while states with Republican-controlled legislatures were significantly more likely to enact more-permissive gun laws subsequent to a mass public shooting incident in the state. If mass public shootings are a cause rather than (or in addition to) a consequence of firearm policy, models that fail to appropriately account for this reciprocal relationship may produce biased and misleading estimates of the effects of laws on mass shootings.

Given statistical challenges with accurately estimating the causal effects of a policy on mass shootings, we may be able to learn more about the potential for effective prevention strategies through detailed analyses of the characteristics of mass shootings (ideally for both incidents that occurred and incidents that are believed to have been averted) or through detailed review of how specific policies are being implemented in an effort to prevent mass shootings. Descriptive evidence that mass shootings involving firearms equipped with LCMs result in significantly higher injury and fatality rates may suggest potential benefits of restricting access to LCMs (Koper, 2020), although it may be that the choice to use LCMs reflects more-lethal intentions of the shooter (Kleck, 2016).[21] Similarly, evidence that many mass shooters have a history of domestic violence has led some to suggest potential benefits of stronger

implementation of firearm prohibitions related to domestic violence (Zeoli and Paruk, 2020). Finally, although extreme risk protection orders are most commonly requested because of concerns about self-harm (Parker, 2015; Swanson et al., 2017, 2019), a detailed review of case records from 159 such orders issued in California found that 21 (13.2 percent) involved an individual who had access to or was planning to access firearms and expressed or exhibited behavior suggesting intent to perpetrate a mass shooting (Wintemute et al., 2019). These analyses do not directly assess the causal effect of policies on mass shooting outcomes, but they can still provide important insights for crafting and implementing policies.

Conclusions

It is difficult to make accurate generalizations about mass shootings. These challenges occur, in part, because (1) there are many different definitions for mass shootings, each of which may be useful for a somewhat different purpose; (2) we have incomplete data sources that do not track these events in a consistent manner over time, likely include a biased sample of incidents, and lack the full range of individual and incident characteristics researchers are interested in; and (3) there are statistical limitations inherent in trying to draw inferences from rare and idiosyncratic events. Using definitions that differ in their thresholds for the number and type of victims or the circumstances around the incident results in vastly different estimates of how often mass shooting events occur, how the rate has changed over time, and incident characteristics. Even across studies with a similar definition of a mass shooting, the different data sources (or combinations of data sources) used sometimes result in different findings. A comprehensive administrative data source that reliably captures mass shooting incidents with sufficient detail does not exist; relying on news reports alone is problematic because of well-established systemic bias in what gets reported. Although these issues create problems for understanding the prevalence and patterns of mass shootings at a given point in time, they are exacerbated when trying to understand how mass shootings have evolved over time; this is because of temporal variation in the completeness of underlying data sources that could be used to identify and classify incidents. There may be fewer concerns regarding incomplete or biased data when adopting a narrower definition of mass shootings that includes only the highest-profile incidents with multiple fatalities, but movement toward a more restrictive definition results in identifying a set of incidents that are increasingly rare and idiosyncratic. Thus, the researcher makes a trade-off that mitigates the serious problems with the underlying data but creates additional statistical problems resulting from a much smaller sample size that will not support accurate generalizations to a broader population of mass shooters.

Greater consensus about the number of mass shootings and how their prevalence has changed over time could likely be achieved by adopting a mass shooting definition based on objective criteria for which data are widely available. Defining incidents based on a threshold of fatalities rather than of nonfatal injuries is likely to produce more-reliable and more-

comparable estimates over time. However, even a definition that includes nonfatal injuries is arguably preferable to one that requires having accurate data on victim-offender relationship, incident circumstances, or perpetrator motivations. These features, though captured in some administrative data sources and potentially identifiable through reviews of news reports or court and police records, are often subjectively determined and are inconsistently available in the underlying data. Relative to the criterion of number of victims, assessment of whether a mass shooting incident was related to criminal activity or whether victims were selected randomly is more likely to be influenced by the perspective of the person reporting or recording the information. Depending on the purpose of the research, it may still be necessary to rely on these more-subjective characteristics. However, researchers may need to consider the extent to which they are studying the characteristics of the events themselves rather than, for instance, how the media covers these incidents.

Even if we did have definitive and complete data sources on the characteristics of all mass shooting incidents, it is still likely to be exceedingly difficult to identify useful predictors of mass shootings. With the exception of male sex, risk factors that appear to be overrepresented among mass shooters relative to the general population are often still uncommon among offenders on an absolute level. Thus, even if one could find a way to prevent individuals with a documented serious mental illness from committing a mass shooting—for example, developing and delivering effective treatments to more than 10 million Americans (Bose et al., 2018) or effectively preventing their access to firearms—most mass shootings would still occur because only a fraction of mass shootings are committed by individuals with a documented history of serious mental illness. Researchers are exploring novel machine learning approaches to using information on domestic violence dispatches or patterns of firearm acquisition for violence risk prediction (Berk and Sorenson, 2020; Laqueur and Wintemute, 2020), although the value of these approaches for predicting mass violence is still unknown. Other approaches focused on reducing the lethality of mass shootings may be effective in mitigating the harms of some incidents, even if the approaches do not prevent the occurrence of such incidents.

Finally, even if states and other jurisdictions developed and implemented policies that prevented mass shootings, there are several statistical challenges that make it unlikely that researchers will be able to demonstrate statistically significant benefits of the effective policies. The assumptions underlying many of the approaches commonly used to evaluate the effects of gun policies are likely not to be met when assessing effects on mass shooting incidence or lethality. The rare nature of mass shootings, and particularly mass public shootings, seriously limits statistical power for detecting policy effects, and studies that find statistically significant associations of policies with mass shootings may greatly overestimate the magnitude of these effects.

However, these difficulties should not impede policymakers from trying to develop and implement better policies. Mass shootings are tragic, traumatic, and shocking events. Because

of that, they attract media attention and galvanize public opinion. However, they represent a very small fraction of the homicides in the United States. Precisely because mass shootings are so rare and it is so difficult to predict exactly who will perpetrate them, the overall costs and benefits of any policy to address them are likely to be driven by the policy's effects on a broader set of far more-common outcomes, such as overall homicide, suicide, domestic violence, and population health. Improved treatment for mental health problems or suicidality might reduce certain types of mass shootings, but such policies may also reduce far more-common forms of homicide, suicide, and crime and may also improve economic productivity and social well-being. Similarly, policies aimed at reducing domestic violence or preventing crime are worth pursuing for those benefits, and they may also reduce the incidence of some types of mass shootings (i.e., familicides, felony-related killings). Focusing efforts on implementing public policies that reduce violence more broadly, rather than making policy decisions based only on the most-extreme forms of such violence, may not eliminate mass shootings but may reduce their occurrence and lethality and ultimately save more lives.

Notes

1. Various studies adopt different terminology for mass shooting events that occur in public locations and in which victims are selected indiscriminately. Because most of the studies described in this report use the term *mass public shooting* (as opposed to *public mass shooting*, for example), when referring to these types of events, we use that term. ⮐

2. Similar definitional issues exist in the study of *school shootings*. For further discussion specific to school shootings, see Elsass, Schildkraut, and Stafford (2016) and Levine and McKnight (2020). ⮐

3. There are other definitional issues around what constitutes a mass shooting incident that we do not discuss fully here. Namely, a mass shooting incident and its associated casualties are typically delineated as a shooting of multiple victims simultaneously or over a relatively short period of time and in close geographic proximity. However, in most existing data sets (Table 1), there is ambiguity over what constitutes a relatively short period of time or close geographic proximity. Although the FBI has definitions to distinguish *mass murder* (one event, one location), *spree murder* (one event, two or more locations, without the offender "cooling off" emotionally between murders), and *serial murder* (separate events, with the offender "cooling off" emotionally between homicidal events), it is somewhat unclear the extent to which existing mass shooting databases differ in how they classify or count events based on time frame or geographic distance parameters. For further discussion, see Krouse and Richardson (2015). ⮐

4. As noted by Duwe (2020), some mass shooting incidents involve victims shot in both residential and public settings. ⮐

5. The National Incident-Based Reporting System (NIBRS), though not commonly used in mass shooting studies, also contains information that could be used to assess mass shooting incidents. The NIBRS data feed into the SHR data system but contain substantially more information on incident characteristics. However, NIBRS data are only available starting in 1991 and do not currently have complete coverage of the United States. The number of participating jurisdictions also varies greatly over time, from almost all agencies in only three states in 1991 (Reaves,

1993), to 7,283 agencies in 42 states and Washington, D.C., in 2018 (FBI, 2019e). For a comparison of mass murders as captured by SHR and NIBRS data, see Huff-Corzine et al. (2014). ⮐

6. A noted limitation of the victim-offender relationship item in the SHR is that the variable is coded with respect to only the first victim listed, and the same code is applied to all victims (i.e., the victim-offender relationship is linked to the offender data; the same is true of weapon used and circumstance codes) (Fox and Swatt, 2009; Huff-Corzine et al., 2014). Thus, an incident in which an offender killed three members of his or her family and one stranger might be classified as a familicide or a mass public shooting depending on who is listed as the first victim in the SHR. ⮐

7. Missingness by jurisdiction in the SHR is commonly handled through a weighting process using the ratio of homicide counts in the FBI's Uniform Crime Reports to reported homicide counts in the SHR database in order to produce national or state-level estimates (Fox and Swatt, 2009). Several methods for imputing missing item data in the SHR have been developed and are discussed in detail in Wadsworth and Roberts (2008) and Roberts, Roberts, and Wadsworth (2018). ⮐

8. The stated purpose of the FBI active shooter reports is to provide federal, state, and local law enforcement with data to better understand how to prevent, prepare for, respond to, and recover from active shooter incidents; data collection methods used to inform the reports are described in Blair and Schweit (2014). Data cover the United States and come from multiple sources, including FBI reporting, official law enforcement investigative data, publicly available sources (e.g., governmental agency reports, journal articles), a comprehensive list of incidents developed by the New York City Police Department, and a study of shooting incidents in the United States from 2000 to 2010 conducted by the Advanced Law Enforcement Rapid Response Training Center. ⮐

9. As an example of this issue, the discontinued Stanford Mass Shootings in America database, which relied solely on online media sources to identify mass shooting events, cautioned its users that information in the database spanned a period in which reporting shifted from traditional media to digital media, and thus annual incident counts partially reflect changes in data collection methodology (see Stanford Geospatial Center, undated). Thus, the more than threefold surge in mass shooting incidents from 2014 to 2015 shown in the Stanford data likely reflects increased online reporting and not necessarily a true increase in the rate of mass shootings. ⮐

10. To illustrate how simple linear trend models of mass shootings are influenced by outliers, the estimated slope from a linear trend model of mass public shooting fatalities from 1999 to 2017 is 2.3 (standard error = 0.93); excluding the Las Vegas shooting, this slope is reduced to 1.3 (standard error = 0.73). ⮐

11. For comparison, general population studies tend to find the prevalence of diagnosable psychotic disorders (including schizophrenia, schizoaffective psychosis, bipolar disorder with accompanying delusion, substance-induced psychotic disorder, and delusional disorders) to be less than 1 percent, although the prevalence varies substantially as a function of the method of measurement and the population studied (see Moreno-Küstner, Martín, and Pastor, 2018). There are no benchmarks for prevalence that use the methods of post-incident diagnosis that are used with mass shooters. ⮐

12. The same study identified romantic or family issues (e.g., divorce, child custody dispute) as a potential contributing stressor or triggering event in 46 percent of familicides, 23 percent of mass public killings, and 4 percent of felony-related mass killings (Fridel, 2017). ⮐

13. Compared with homicides overall and with felony-related mass shootings, familicide mass shootings and mass public shootings are significantly more likely to end with the death of the perpetrator by suicide. Although estimates vary depending on the period of analysis, data source, and definitions applied, approximately 40 to 60 percent of mass public shooters died by suicide (Duwe, 2004, 2020; Lankford, 2015; Fridel, 2017). Estimates are comparable for familicide mass shootings or mass killings but are far lower (less than 5 percent) for felony-related mass shootings or mass killings (Duwe, 2004; Fridel, 2017). ⮐

14. There is no official classification of mass public shooting or shooter typologies, but researchers have often distinguished between workplace violence (disgruntled employee violence), school shootings, ideological extremism, and rampage shootings (i.e., generally, the shootings that do not fall in the other categories) (Duwe, 2004; Lankford, 2013; Capellan et al., 2019). ⮐

15. As discussed previously, different definitions of mass public shootings result in different temporal patterns. If mass public shootings are defined more narrowly as incidents with four or more victims killed, school shootings were very rare prior to the 1990s and constituted 11 percent of all mass public shootings from 1976 to 2018 (Duwe, 2020). Under the broader definition used by Capellan et al. (2019), 25 percent of mass public shootings from 1966 to 2017 occurred in schools. ⮌

16. The identification of "assault weapons" in these incidents is not straightforward, partly because the term *assault weapon* is controversial. In state and federal gun laws, the term generally refers to specific semiautomatic firearm models that are designed to fire a high volume of ammunition in a controlled way or that have specified design features, such as folding stocks or pistol grips. For further discussion, see Koper (2020) and Klarevas (2019). ⮌

17. This likely does not apply to felony-related mass shootings, in which the death of the perpetrator is uncommon. ⮌

18. For recent examples, see Klarevas, Conner, and Hemenway (2019) and Webster et al. (2020). ⮌

19. The distributional characteristics of mass shooting incidents are such that standard assumptions of asymptotic consistency and normality for the parameter estimates may not hold, thus threating the validity of effect estimates and associated statistical inferences. ⮌

20. For instance, it is common for studies evaluating the effects of gun policies on the likelihood of a mass shooting occurring to use two-way fixed-effects models that control for year and state fixed effects. In conventional estimation of these models, states that do not experience an incident over the study time frame do not enter the log-likelihood. In some studies of high-fatality mass public shootings, this applies to nearly half of the states in the sample. ⮌

21. There has also been some debate about the extent to which rates of gunfire attained in incidents of LCM use could be similarly attained with use of non-LCM weapons. For a summary of this discussion, see Koper (2020), p. 165, note 19. ⮌

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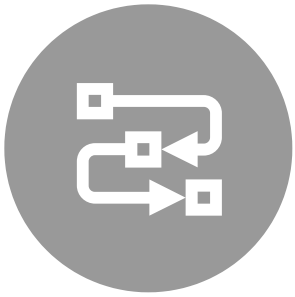

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