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A Comparative Analysis of Attempted and Completed School-Based Mass Murder Attacks

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Abstract "School shootings" are rarely studied quantitatively due to the fact that they are relatively rare, albeit powerful events. Therefore, prior research on "school shootings" typically relies on case study methodologies, or involves the use of typologies based on perpetrators' motivations, their relationships to victims, and/or the total number of victims killed. However, not all cases of multiple-victim homicide attacks that take place in schools involve the use of firearms, and not all school-based multiple-victim homicide attacks result in multiple fatalities, as many such cases are either thwarted in advance by police or fail to result in the *intended* number of victims due to a variety of factors. The present study compares attempted and completed mass murder and rampage style attacks that have taken place at schools, and further compares incidents involving firearms to those that involve other deadly weapons. Utilizing a database of 282 identified cases of mass murder incidents in schools across 38 nations, incidents' date and location, the demographic characteristics of perpetrators, weapons used, number of victims, and school contexts are examined and compared.

Keywords School shootings · School violence · Mass murder · Comparative · Rampage shootings

Recent decades have seen an unprecedented trend worldwide, a sharp rise in multiple-victim homicides taking place at schools, mostly in developed, Western nations (see Agnich, 2010; Böckler, Seeger, Sitzer, & Heitmeyer, 2013). Commonly referred to as "school shootings," these events elicit the fear of students, parents, teachers, and school administrators (Elliott, Hamburg, & Williams, 1998; Fox, 1996; Muschert, 2007), and these fears have risen over the past several years (Addington, 2003, Altheide, 2009). Random events such as the December 14, 2012 murder of 20 children at Sandy Hook Elementary School in Newtown, Connecticut undermine the goal of education and disrupt the teaching/learning process for students everywhere who fear that their

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classroom or school may be targeted next (e.g. Cornell, 2006; Borum, Cornell, Modzeleski, & Jimerson, 2010).

Despite the rise of these incidents, and their implications for the safety and perceptions of safety of students worldwide, very little research has systematically examined the characteristics of both attempted and completed multiple-victim homicides carried out in schools to identify key commonalities and differences using quantitative methods. Instead, most research on these high profile mass murders utilizes case study analyses (for example, see Harding, Fox, & Mehta, 2002; Leary, Kowalski, Smith, & Phillips, 2003; Newman, Fox, Roth, Mehta, & Harding, 2004, O'Toole, 1999; Vossekuil, Fein, Reddy, Borum, & Modzeleski, 2002). While case studies have yielded a great deal of useful information about high profile school shootings, the increasing numbers of these events means that researchers can begin to study larger samples. In addition, we can begin to quantitatively compare the characteristics of attempted and completed events, and those that used firearms and other deadly weapons.

It is important to note that not all school-based mass murder or "rampage-style" attacks are carried out with firearms, making the term "school shootings" problematic. A recent attack at Lone Star College in Cypress, Texas highlights the problematic nature of this terminology. The alleged perpetrator Dylan Andrew Quick stabbed and injured 12 fellow classmates on the campus using a razor-type knife (Plushnick-Masti & Lozano, 2013). This incident highlights another problem with terminology. This particular incident, while constituting a rampage style attack, resulted in no deaths and therefore cannot be considered a type of mass murder. According to the F.B.I.'s Behavioral Analysis Unit, a mass murder is defined as four or more murders that occur during the same incident with "no distinctive time period between the murders" (Morton, 2008). Instead, such an incident could be classified as an "attempted mass killing" since the perpetrator intended to inflict widespread harm with a deadly weapon, despite not killing anyone. Further, several cases of attempted mass homicides have been thwarted prior to being carried out, such as the recent incident at the Ronald E. McNair Discovery Learning Academy outside Atlanta, Georgia on August 20, 2013, where Michael Brandon Hill allegedly entered an elementary school with an AK-47 style rifle and 500 rounds of ammunition, exchanging gunfire with police before surrendering (Lucas, 2013). In another recent case outside Portland, Oregon, 17-year old Grant Acord was arrested for planning a "Columbine-style" attack, and was found to be in possession of various types of explosives in addition to checklists and plans (Brumfield, Carpenter, & Stapleton, 2013). Both examples constitute potential attempts to carry out mass murder.

These high profile incidents have spurred debates and policy changes regarding school security (see Addington, 2009), gun control, and since the Sandy Hook incident, the possibility of arming teachers (see Crews, Crews, & Burton, 2013). Given the rise in both attempted and completed mass murder incidents, a quantitative comparative analysis can shed light on the characteristics of schools and perpetrators that are associated with a higher number of each type of incident, and can inform school security policies as well as policymaking around gun control. Not only does most research on mass murder incidents in schools focus on mass shootings that have been carried out with guns, most subsequent policy discussions focus on whether or not to limit access to purchasing or otherwise obtaining firearms, and how to limit such access. A narrow focus on gun control policies overlooks the problematic increase in

multiple-victim school-based attacks that do not involve guns. Further, comparing completed to attempted attacks can shed light on differences across incidents among perpetrators and school contexts that can inform school security policymaking and law enforcement efforts so that fewer attacks are successfully carried out in the future. Finally, a major strength of the present study is the utilization of a cross-national database, since multiple-victim homicides have taken place in schools worldwide.

The present study provides a quantitative comparative analysis of attempted and completed mass murder incidents in schools to ascertain key differences and similarities between incident types. Utilizing a database of 282 identified cases of mass murder incidents in schools involving 345 perpetrators across 38 nations between July 26, 1764 and August 20, 2013, the incidents' date and location, the demographic characteristics of perpetrators, weapons used, number of victims, and school contexts are examined and compared. The data were drawn from news reports, published interviews, television news transcripts, publicly available police records, the U.S. Census Bureau, and National Center for Education Statistics.

Literature Review

The 1990's saw an increase in random shootings, as well as increases in violence in suburban, middle class, and rural schools (Agnich, 2010; Gorski & Pilotto, 1993), which in turn increased the fear of youth violence throughout the general population (Elliott et al., 1998; Fox, 1996). Accordingly, the fear of school violence among parents, students, and teachers rose nationwide throughout the 1990's (Children's Institute International, 1996; Harris and Associates, 1993; Maguire & Pastore, 1995; Walker et al., 1996). In fact, criminologists in the mid-1990's predicted a new "breed" of teenage male superpredators that would instigate a crime wave of record proportions (DiIulio Jr, 1995; Wilson, 1995; Fox, 1996). This new breed of youth was described as "stone cold," incapable of reason and morally impoverished (DiIulio Jr, 1995). These predictions were based on the homicide rate, which rapidly increased during the mid-1980's primarily due to the dynamics of crack-cocaine markets in America's inner cities (Blumstein, 1995). The overall homicide rate began to drop in 1991, but the rate of homicide committed by youth ages 14–17 rose from the late 1980's to the mid-1990's, when it declined substantially by the late 1990's. Although the youth homicide rate did decline, refuting the notion of a new breed of young superpredators, the gap between younger and older adult offenders has widened over the past decade (Fox & Levin, 2001). The stereotype of the young, black, urban male "superpredator," associated with the crack-cocaine market does not fit the vast majority of "school shootings" in the U.S., however, which are primarily perpetrated by white males, and appear to occur most often in rural and suburban settings (see Kimmel & Mahler, 2003).

Case study research on school shootings has revealed some insights that are useful to practitioners, particularly regarding the impact of strain and bullying (e.g. O'Toole, 1999; Levin & Madfis, 2009), and campus security behavioral threat assessment (see Cornell, 2009; Meloy & O'Toole, 2011; Randazzo & Plummer, 2009). However, these in-depth studies adopt a narrow framework and/or definition of what constitutes an incident, and therefore rely on in-depth examination of a small number of cases (e.g. Harding et al., 2002; Langman, 2009; Leary et al., 2003; Newman et al., 2004,

O'Toole, 1999; Vossekuil et al., 2002). In addition, studies commissioned by the Secret Service (Vossekuil et al., 2002) and the F.B.I. (O'Toole, 1999) found there is no psychological profile, or a set list of personality and character traits that can be used to predict who will become a perpetrator. While some of the perpetrators exhibited outward signs of psychological distress, many did not. Furthermore, Fox and Levin (2001) point out that the time and energy perpetrators put into planning school-based mass murder incidents often far exceeds the amount of time they had been known to be depressed, or treated with therapeutic drugs. In addition, the occurrence of mass murders in schools prior to the popularization of the use of psychoactive medications and widespread diagnoses of mental disorders points to the need to examine social, rather than psychological factors that contribute to the recent rise of school-based multiple-victim homicide incidents (see Rocque, 2012).

Violent media, ranging from movies and television to violent video and internet games, has often been cited as a cause or at least a significant factor that contributes to school shootings (Cornell, 2006; Fox & Levin, 2001, 2005). But, while violent media consumption has steadily increased, the overall rate of school violence has been decreasing since 1980 (U.S. Department of Justice, 2011), and youth homicide involving guns has decreased since 1994 (CDC, 2013). The increasing number of high school shootings has been explained further as the result of a "copycat effect," where individuals in remote places are inspired by television reports of school massacres to attain the power and notoriety of shooters who become negative role models (e.g. Coleman, 2004; Larkin, 2007; Sullivan & Guerett, 2003). Social learning theory (Akers, 1973) can provide insight into how the media could potentially provide people with ideas for the execution of crimes, and with motives to attain notoriety through modeling behavior. Indeed, there has been an increase in "school shootings" since the Columbine attacks in 1999, and several subsequent perpetrators have referenced the Columbine perpetrators in artifacts and writings (for example, see Larkin, 2009). However, the copycat effect is difficult to pin down; there is no set time-frame within which researchers have defined acts subsequent to a highly publicized act are copycat attacks, and virtually all Americans consume violent media images without committing school massacres.

Violence, bullying and alienation experienced at school have received widespread attention with regard to school shooters, particularly because most perpetrators do not come from typically "broken" homes characterized by drugs and abuse (e.g. Vossekuil et al., 2002). Furthermore, case studies of high school shooters reveal that many were bullied, teased, or felt a sense of injustice due to their experiences in their schools (Kimmel & Mahler, 2003; Leary et al., 2003; O'Toole, 1999; Vossekuil et al., 2002). Popular news accounts often point to the shooters' experiences of alienation, or characterize them as "loners," and anti-social as a result of their treatment by fellow classmates. However, Cullen (2009) discussed the framing of Eric Harris and Dylan Klebold, the perpetrators of the Columbine mass murder as loners in media accounts whereas the boys were actually quite social, and called on their social networks to obtain the equipment, including firearms, that they needed to carry out their attack. By contrast, Seung-Hui Cho, the perpetrator of the Virginia Tech incident, was by all accounts a social outcast and had few, if any, friends (Virginia Tech Review Panel, 2007; Roy, 2009). Some research has suggested that perpetrators of "school shootings" exhibited traits of narcissistic personality disorder, making them more vulnerable

experiencing social isolation, rejection, and other social mortifications (McGee & DeBernardo, 1999; Twenge & Campbell, 2009). In addition, psychological research suggests that after experiencing social rejection, narcissists are more likely to be angry and aggressive not only toward the people they feel have wronged them, but toward innocent third parties as well (Twenge & Campbell, 2003). However, an overall reliance on case study research and lack of quantitative data collection and analysis in the area of school-based mass murder has stifled the field of study in this important area (see Muschert, 2007). Furthermore, despite their occurrence worldwide, these incidents are rarely studied outside of the U.S. (for exceptions see Böckler et al., 2013; Bondü, 2012; Neuner, Hübner-Liebermann, Hajak, & Hausner, 2009; Nurmi, 2012; Oksanen, Räsänen, Nurmi, & Lindström, 2010; Räsänen, Näsi, & Sarpila, 2012).

Despite the overall lack of quantitative research on school shootings, some patterns have emerged, albeit mostly regarding the study of these incidents within the U.S. For example, school shootings are most prevalent in the Southern states (Brown, Osterman, & Barnes, 2009), which is largely unsurprising as the South has the highest homicide rates in the U.S. (F.B.I. UCR, 2012). Brown et al. (2009) found that students in "culture of honor" states in the Southern and Western United States were more likely to carry a weapon to school, and that these states were significantly more likely than Northeastern and Mid-western states to have had a school shooting in the past 20 years. "Culture of honor" states had twice as many school shootings per capita than non-culture of honor states. Theoretically, the "culture of honor" thesis proposes that school violence results from threats to students', mostly males', social identities resulting in retaliatory acts of aggression, and that a culture that promotes this aggression is more likely to be present in Southern and Western states due to their particular history (Brown et al., 2009; Nisbett, 1993; Nisbett & Cohen, 1996).

Research in the area of high-profile multiple-victim school-based attacks will greatly benefit from utilizing a definition inclusive of multiple types of attacks—including those that involve firearms (and thus constitute the typical "school shooting") as well as those that involve the use of other weapons. In addition, comparing attempted and completed attacks can generate much-needed data for practitioners and lawmakers at multiple levels ranging from schools to localities, states, and nations. Finally, examining school-based multiple-victim homicide incidents across nations will lend insight into attacks that have been occurring with increasing frequency outside of the U.S. The present study seeks to address these gaps in the literature.

Methods

Sample

For the purposes of the present study, a school-based mass murder incident is defined as an actual or attempted first-degree multiple homicide involving two or more victims in a school or on school grounds. While the F.B.I. defines a mass murder as having four or more homicide victims (Morton, 2008), many criminologists have questioned why four homicide victims, a seemingly arbitrary number, is the cutoff (e.g. Deitz, 1986; Holmes & Holmes, 2001; Petee, Padgett, & York, 1997). In an attempt to be as inclusive as possible of all attempted and completed mass murder and rampage-style attacks, the

database examined in the present study includes cases that were attempted multiple-victim homicide attacks that result in zero homicides, as well as multiple-victim attacks that resulted in one or more homicide victims. The database only includes incidents that occur on school grounds and planned attacks on schools, and does not include single homicides, off-campus homicides, killings caused by government actions, militaries, terrorists, or militants, nor are cases included that involve gang-motivated or gang-related homicides (including drug cartels and other extra-legal "gang-like" groupings).

Only cases that have been reported in newspapers were identified for inclusion, including "local," U.S. papers (such as the Hartford Courant), national, and international (i.e. outside of the U.S.) publications. News articles were systematically identified using LexisNexis, Google News Archive, and the New York Times index, and only news articles that were originally published in English, or translated to English, were included. The researcher identified cases for inclusion in the dataset by searching the aforementioned databases using Boolean "AND" operators, such as: "school shooting," "school massacre," "school mass murder," "school stabbing" "school bombing" "school mass violence," "school homicide," and "school multiple victim." Once a universe of cases was identified that met the criteria for inclusion defined above, the researcher compiled data from published interviews, television news transcripts, publicly available police records, the U.S. Census Bureau, and National Center for Education Statistics, to collect general information about the incidents and information about the number of victims, the demographic and incident-related behaviors of perpetrators and school contexts where the incidents occurred. The data collected on each incident were, straightforward measures of information related to each case, coded according to the pre-defined criteria outlined below.

Measures

Dependent Variables

The dependent variables, incident types, were dummy coded as falling into one of the following categories. First, a *completed mass shooting* is defined as an event carried out with firearm(s) involving two or more victims, with at least one homicide victim. An *attempted mass shooting* is defined as an event with no homicide victims, which was intended to result in multiple deaths to be carried out with firearm(s). This category includes incidents that result in no fatalities, but are "cleared" either by arrest or exceptional means. That is, the perpetrator(s) were identified, arrested, charged, and the case was sent to proceed in court, or the offender(s) were identified, but fled or died prior to being arrested (see F.B.I., 2011). A *completed mass killing* is defined as an event carried out with weapons other than firearm(s), involving two or more victims, with at least one homicide victim; and an *attempted mass killing* is defined as an event with no homicide victims intended to result in multiple deaths to be carried out with weapons other than firearm(s), following the same qualifications of clearance as the attempted mass shooting category. A total of 282 incidents that fall into these four categories are analyzed; 126 completed mass shootings, 91 attempted mass shootings, 35 mass killings, and 30 attempted mass killings. In all, 217 incidents (77 %) of the total 282 cases examined involved the use of firearms. Of these, 30 attempted shootings and 5 attempted killings were foiled or averted by police before they occurred. The

remaining 61 attempted mass shootings and all 30 attempted mass killings were attacks carried out at schools that did not result in any homicide victims.

Independent Variables

Incident Date and Location The date of each incident was coded for the month, day, and year in which it occurred. The incidents' locations were coded for the nation, and if in the U.S., the state in which it occurred. U.S. states were further coded into the four major regions of the country used by the U.S. Census (see U.S. Census Bureau, 2010). A list of states by U.S. region can be found in the Appendix. Each case was further coded into world regions according to the macro-geographical (continental) region in which a nation that contained a school-based mass murder incident or multiple incidents was located as defined by the United Nations (UN Department of Economic and Social Affairs, 2013). European nations were sub-divided into Eastern and Western divisions (with the Eastern division including Southern European nations, and Western division including Northern European nations) based on the number of cases that occurred on the continent of Europe. And, while Azerbaijan, Israel, and Yemen are considered Western Asian nations according to the U.N.'s classifications, these nations are defined as "Middle Eastern" for the present study based on The World Bank classifications and Azerbaijan's proximity to Iran (The World Bank, 2013).

The world region, *North America*, includes Canada and the United States. While several incidents involving drug cartel-related shootings have occurred in Mexico, these incidents did not meet the inclusion criteria for the present study. The *Latin America and the Caribbean* region includes Argentina, Brazil, Guatemala, and Trinidad and Tobago. *Eastern Europe* includes Hungary, Austria-Hungary (to include an incident that occurred in 1902), Bosnia-Herzegovina, Latvia, Poland, Bulgaria, and the Russian Federation. *Western Europe* includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Northern Ireland, Italy, the Netherlands, Norway, Scotland, and England. The African region includes Kenya, South Africa, and Swaziland. The *Asian* region includes Japan, China, South Korea, Thailand, and India. The *Middle East* includes Azerbaijan, Israel, and Yemen. The *Oceana* region includes Australia.

Weapons The number of weapons associated with each incident was coded, and ranged from 0 to 7. Twelve attempted shooting incidents involved credible threats to school safety regarding the use of firearms, but police did not uncover any weapons. In other cases, police found weapons but were able to arrest the perpetrator(s) prior to their carrying out an attack. The weapons used or associated with each incident were coded individually, for a total of 437 weapons in the 282 incidents examined. Each weapon was coded as falling into one of the following categories: *sword/knife* (including razor blades and machetes), *handguns*, which includes revolvers, pistols, and other types of single-shot or semiautomatic handheld firearms, *long guns*, which includes rifles, shotguns, and semi-automatic and automatic rifles, *explosives* including bombs and incendiary devices, and *other* weapons which include cars, poison, pellet guns, a lance, and a mace.

Perpetrators A total of 345 perpetrators were coded individually for their demographic characteristics and incident-related behaviors. Of these, 138 were involved in mass shootings, 45 in mass killings, 128 in attempted mass shootings, and 34 in attempted

mass killings. Perpetrators' demographic characteristics including gender, age, and race were coded using news reports, published interviews, and publicly available police reports and arrest records. Perpetrators' gender was dummy coded (male=1). Approximately 96 %, or 330 of the perpetrators were male, and 15 perpetrators were female. Perpetrators' age was coded as their age in years at the time of the incident. When this data was not publicly available, it was coded as missing. Age at the time of the incident was established for 320 of the total 345 perpetrators. Race/ethnicity was dummy coded as White/Non-White (White=1), with the White category including White or Caucasian perpetrators in the U.S., Canada, Europe, and Australia. The Non-White category includes Black, Asian (including Indian and Southeast Asian), Hispanic, Native American, Middle Eastern, and Indo-Canadian. Perpetrators' racial backgrounds were definitively established using news reports and publicly available arrest records in 283 of the 345 cases.

Incident-Related Behaviors Several measures of perpetrators' incident-related behaviors and a measure of potential motive are examined. The number of victims killed and wounded was determined by news reports and verified whenever possible using publicly available police records. In most cases the number of victims was easily established. In certain cases, the researcher made decisions erring on the side of a greater number of victims. For example, in the case of Charles Whitman's infamous University of Texas at Austin "clock tower shooting" in 1966, the first victim to be wounded, 18-year old Claire Wilson, was shot through the abdomen while 8 months pregnant, causing the fatality of the unborn child (Heide, 2008). For the present analysis, the fetus was considered an additional fatality in this case, although some sources do not classify Wilson's child as such (e.g. Barr, 2013). Another example is the number of wounded after the April 16, 2007 shooting at Virginia Tech. While 17 students were injured as a result of being shot by perpetrator Seung-Hui Cho, an additional 6 were injured jumping out of second story windows to escape the shootings at Norris Hall, and 4 others were injured during the incident from other causes (Virginia Tech Review Panel, 2007). This incident was coded as having a total of 27 wounded victims in order to be as inclusive of victims as possible.

If the incident involved a hostage situation, occurring on or off campus, that was associated with the school-based multiple victim homicide incident (whether attempted or completed), this incident-related behavior was coded as 1 for the *hostage situation* variable. If the perpetrator committed suicide during or immediately following the incident, the perpetrator was coded as 1 for the *suicide* variable. If news reports of an incident mentioned bullying or school violence victimization as a potential motive at least once, the incident was coded as 1 for the *bullying* variable. It should be noted that this variable was coded based on news reports rather than an actual determination by police. This is an important distinction, as the Columbine case involved numerous reports that perpetrators Eric Harris and Dylan Klebold were bullied, out to "get" the jocks, and part of the "Trenchcoat Mafia," all of which proved to be false reports over time (see Cullen, 2009). However, for the purposes of the present study, this case was coded as 1 for the bullying variable, since it is based only on the news reports of the potential perpetrators' motive. Finally, the number of co-perpetrators was coded ranging from 0 to 5; having 0 co-perpetrators means the perpetrator acted alone, while one incident in North Pole, Alaska had a total of 6 perpetrators involved in an attempted

mass shooting that was foiled by police in advance (see Johnson, 2006). Table 1 displays the descriptive statistics for perpetrators' demographics and incident-related behaviors.

School Context Schools' contexts are examined in terms of their educational level and location. Schools' educational levels were dummy coded as falling into one of the following categories: *elementary school* (typically including grades K through 6), *middle school* (typically encompassing grades 7 and 8, although sometimes including grades 6 through 9), *high school* (typically grades 9 through 12), and *other* (including one-room schoolhouses, a nursery school, a high school/college hybrid, and a training institute inside another building). The category to which a school's educational level was assigned was based on the school's own definition of its level, rather than the grades contained therein. For example, if "Middle School" or "Intermediate School" appeared in the school's name, it was coded as a middle school whether it contained students in grades 6 through 8, 7 and 8, or 7 through 9.

Schools' locations were dummy coded as *rural, suburban*, or *urban*. For incidents in the U.S., National Center for Education Statistics (NCES) "locale codes," cross-referenced with news articles and other publicly available information about the school's location at the time of the incident were used to make the determination. NCES locale codes are based on schools' locations in proximity to densely populated urban areas, and consist of four major types: city, suburban, town, and rural (NCES, 2013). Schools with rural locale codes were coded as rural, cities were coded as urban, and suburban schools were coded accordingly. Small and large sized towns were examined closely and cross-referenced with other available information, with schools in small towns typically classified as "rural," and those in large towns either classified as rural or suburban, depending on the other contextual features of the area at the time of the incident. For schools located outside the U.S., several strategies were used. In general, publicly available information about the school's location at the time of the incident including published reports and news coverage were used to glean descriptions of the school's surrounding context. For example, 14 women were killed in a 1989 shooting at L'Ecole Polytechnique, a university in Montreal, Quebec, Canada (see the Coroner's Report by Sourour, 1991). Publicly available information about the university and the city of

Table 1 Perpetrators' demographics and incident-related behaviors

	Range	Mean	SD
Gender	0–1	0.96	0.20
Age	11–70	22.43	10.69
White	0–1	0.64	0.48
Bullying reported as motive	0–1	0.14	0.35
Number of weapons in incident	0–7	1.50	1.35
Number of victims killed	0–67	2.54	6.66
Number of victims wounded	0–79	4.52	9.02
Incident involved hostage situation	0–1	0.05	0.22
Committed suicide	0–1	0.19	0.39
Number of co-perpetrators	0–5	0.59	1.12

N=345 perpetrators for all variables except age and White, for which there was data available for N=320 and N=283 perpetrators, respectively

Montreal in Quebec, Canada revealed that the university was located in an urban area at the time of the incident.

Analytic Strategy

As the present study utilizes a unique dataset containing multiple types of school-based multiple-victim incidents, both completed and attempted, the primary goal of this research is to compare the four types—attempted and completed incidents carried out with and without firearms. As such, Figs. 1, 2, 3, and 4 depict comparisons between the four types of incidents by year, month, the number of incidents by world region, and by U.S. region. Figure 5 depicts the total number of each type of weapon used to carry out the 282 incidents studied. In addition, a bivariate analysis is conducted using chi-square tests to determine statistically significant relationships between schools' locations and grade levels within each type of incident. Further, analysis of variance (ANOVA) is employed to determine statistically significant mean differences between incident types for perpetrators' demographics and incident-related behaviors, and Bonferroni comparisons are employed to specify the differences in means across incident types.

Results

Figure 1 displays the numbers of each of the four types of incidents by decade between 1900 and 2010. While all four types of incidents have increased sharply over the past three decades, completed mass shootings have not risen as sharply as the number of attempted mass shootings, and attempted and completed mass killings. This implies that while occurring with an increasing frequency overall, an increasing number of mass murder and rampage-style attacks are potentially being thwarted by police in advance, or that would-be mass murders do not result in multiple homicide victims due to a variety of factors such as police interventions that should be examined in future research.

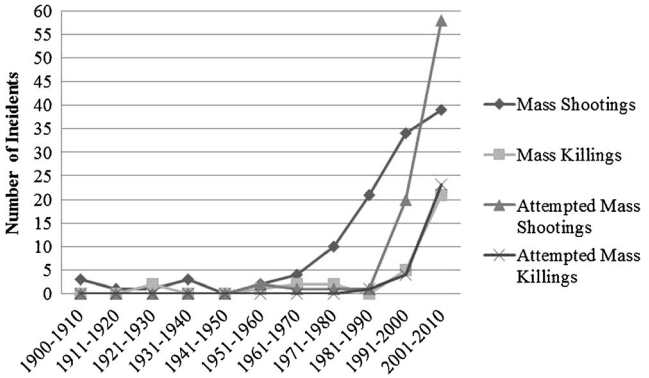

Fig. 1 School-based incident types 1900–2010. *Note*. This figure displays the number of each type of incident by decade, between 1900 and 2010, although the data examined in the present study spans July 26, 1764 to August 20, 2013. A total of 23 incidents are not included in this figure; 5 incidents that occurred before 1900 and 18 that occurred between January 1, 2011 and August 20, 2013

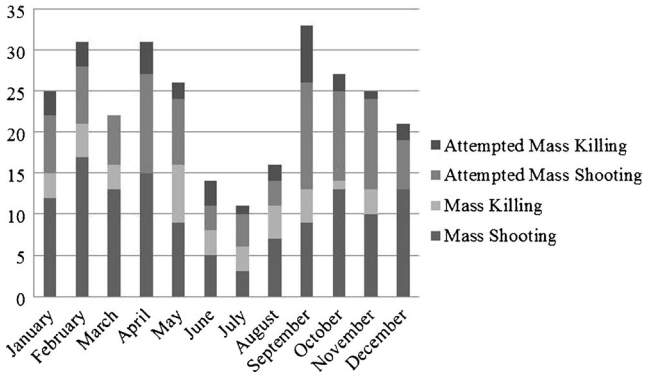

Fig. 2 Incident types by month

Figure 2 shows the types of incidents that have occurred cross-nationally by month. The mode month in which any type of incident occurred is September, and the summer months of June, July, and August have the lowest numbers of incidents. This is expected as schools in the U.S. and some other nations in the Northern Hemisphere (such as the United States) do not hold classes in the summer months, despite criticisms regarding "learning loss" during this break (for example see Downey, von Hippel, & Broh, 2004). Across nations, February has the highest number of mass shootings, and April and September have the highest number of attempted mass shootings and killings. May has a higher number of mass killings, and no mass killings examined in the present study have occurred in the month of December.

The United States had by far the greatest number of incidents, 196 total (69.5 %). Of these, 90 were mass shootings, 7 were mass killings, 84 were attempted mass shootings, and 15 were attempted mass killings. Figure 3 depicts the number of each type of school-based multiple-victim incident by world region. While the North American region has higher numbers of mass shootings and attempted mass shootings and killings, the Asian region has a higher number of mass killings than any other world region.

Within the U.S., the highest number of incidents (27) occurred in California (9.6 %), followed by New York (14, 5 %), and Pennsylvania (12, 4.3 %). Figure 4 shows the

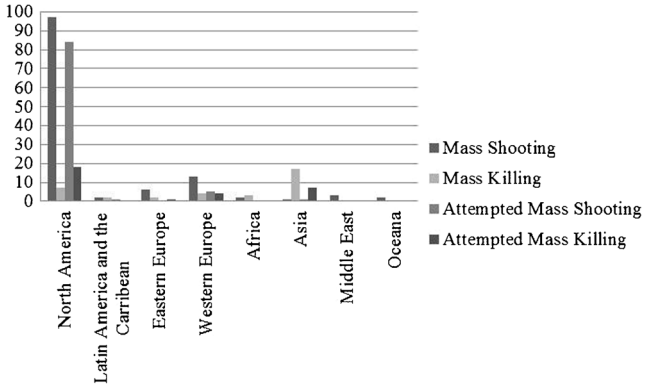

Fig. 3 Number of incidents by world region

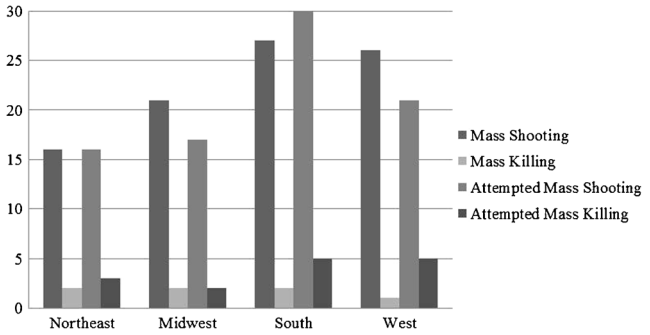

Fig. 4 Number of incidents by U.S. region. *Note.* N=230 U.S. incidents

number of each type of incident by U.S. region. Consistent with a higher number of homicides in general (see F.B.I. UCR, 2012), the South has higher numbers of mass shootings, attempted mass shootings, and attempted mass killings than any other region. The numbers of mass killings that have been completed, however, are consistently low across U.S. regions. The South, Midwest, and Northeast have each had two such incidents, and the West has had one. Again, the number of mass killings is largely driven by Asian nations, as Asia has the highest number of mass killings compared to any other world region.

Of the total 437 weapons used or associated with the 282 incidents examined, 306 (70 %) of the weapons were firearms—including 202 handguns/pistols, and 104 long guns. Incidents involved the use of 53 explosives, which are much deadlier than firearms when they are used to carry out school-based multiple victim homicides. The average number of victims killed is much higher for mass killings than mass shootings, and this mean difference is statistically significant ($p<0.01$).

The bivariate analysis of schools' educational levels and location (rural, suburban, or urban) by incident type reveals some interesting findings with implications for policymakers and practitioners. The results are displayed in Table 2. First, middle schools are targeted for mass shootings less frequently in suburban and urban areas than rural ($p<0.05$), while high schools in rural areas are targeted most frequently ($p<0.05$), and those in urban areas are targeted more frequently than suburban high schools

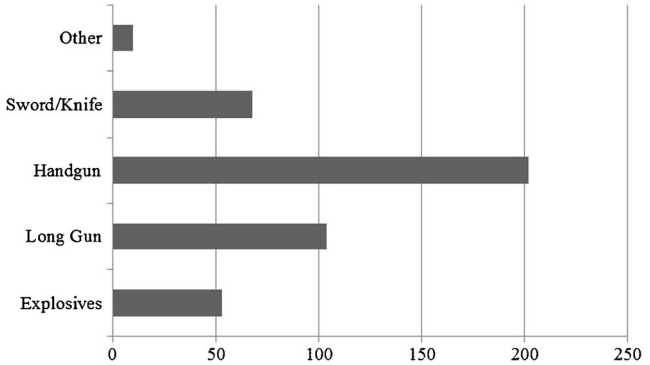

Fig. 5 Number of weapons used by type. *Note.* N=437 weapons

Table 2 Bivariate analysis of schools' educational level and location by incident type

	Elementary school	Middle school	High school	College/ university	Other	Total
Mass shootings						
Rural	6.3 % (8)	4.8 % (6)	19.8 % (25)*	7.1 % (9)**	2.4 % (3)	40.4 % (51)
Suburban	2.4 % (3)	4.0 % (5)*	6.3 % (8)	3.2 % (4)	0 % (0)	15.9 % (20)
Urban	6.3 % (8)	1.6 % (2)*	13.5 % (17)*	22.2 % (28)**	0 % (0)	43.7 % (55)
Total	15.0 % (19)	10.3 % (13)	39.7 % (50)	32.5 % (41)	2.4 % (3)	100 % (126)
Mass killings						
Rural	34.3 % (12)	8.6 % (3)	17.1 % (6)	2.9 % (1)*	2.9 % (1)	65.7 % (23)
Suburban	5.7 % (2)	0 % (0)	0 % (0)	2.9 % (1)	0 % (0)	8.6 % (3)
Urban	14.3 % (5)	0 % (0)	0 % (0)	3.2 % (4)*	0 % (0)	17.5 % (9)
Total	54.3 % (19)	8.6 % (3)	17.1 % (6)	17.1 % (6)	2.9 % (1)	100 % (35)
Attempted mass shootings						
Rural	2.2 % (2)	5.5 % (5)	25.3 % (23)	2.2 % (2)	0 % (0)	35.2 % (32)
Suburban	1.1 % (1)	6.6 % (6)	26.4 % (24)	4.4 % (4)	0 % (0)	38.5 % (35)
Urban	3.3 % (3)	2.2 % (2)	15.4 % (14)	5.5 % (5)	0 % (0)	26.4 % (24)
Total	6.6 % (6)	14.3 % (13)	67.0 % (61)	12.1 % (11)	0 % (0)	100 % (91)
Attempted mass killings						
Rural	27.7 % (8)*	3.3 % (1)	20.0 % (6)	0 % (0)	3.3 % (1)	53.3 % (16)
Suburban	3.3 % (1)	6.7 % (2)	16.7 % (5)	0 % (0)	0 % (0)	2.7 % (8)
Urban	3.3 % (1)	3.3 % (1)	3.3 % (1)	10.0 % (3)**	0 % (0)	20.0 % (6)
Total	33.3 % (10)	13.3 % (4)	40.0 % (12)	10.0 % (3)	3.3 % (1)	100 % (30)

**$p<0.01$; *$p<0.05$

($p<0.05$). Colleges and universities experience mass shootings most frequently in urban areas ($p<0.01$), while rural colleges or universities experience these incidents more frequently than in suburban areas ($p<0.01$). Likewise colleges and universities experience mass killings most frequently in urban areas ($p<0.05$).

More attempted mass shootings (24 incidents) occurred in suburban areas compared to only 8 completed mass shooting incidents, implying that suburban schools may be better equipped to thwart multiple-victim homicide attacks than in rural or urban areas. By contrast, there were 23 attempted mass shootings in rural areas, compared to 25 completed mass shooting attacks, implying that when these incidents occur in rural areas, they may be more likely to result in a higher number of fatalities. Finally, elementary schools experience attempted mass killings more frequently in rural areas ($p<0.05$) than suburban and urban, while attempted mass killings at colleges or universities occur more frequently in urban areas ($p<0.01$). Taken together, these findings generally suggest the need to assess the security of schools and specific motivations for perpetrators in both rural and urban areas worldwide.

The comparison of means for perpetrators' demographic characteristics and incident-related behaviors across incidents reveals several important findings. First, females were more highly represented, on average, among the perpetrators of attempted mass killings compared to other types of incidents ($p<0.05$). Regarding age, the

perpetrators of completed mass killings are, on average, older than the perpetrators of other types of incidents with a mean age of 28.03 ($p<0.01$), and the perpetrators of attempted mass shootings are, on average, younger than the perpetrators of other types of incidents with a mean age of 18.13 ($p<0.01$). Bonferroni comparison tests reveal perpetrators of attempted mass shootings are younger, on average, than perpetrators of all other types of incidents ($p<0.01$). The lowest average number of White perpetrators was 30 % for mass killings ($p<0.01$). Whites, on average, committed more mass shootings, and attempted mass shootings and killings, although the mean difference was only statistically significant for attempted mass shootings compared to other incidents in the ANOVA (mean=0.73; $p<0.05$). The post-hoc analysis revealed that perpetrators of mass killings were non-White more often than perpetrators of all other types of incidents ($p<0.01$).

Bullying was reported as a motive in more news reports covering mass shootings than other types of incidents, with 19 % of mass shooting cases depicted as motivated by bullying ($p<0.01$) compared to no mass killing cases ($p<0.01$), 15 % of attempted mass shootings, and 9 % of attempted mass killings. The post-hoc analysis revealed that perpetrators of mass shootings were more likely than perpetrators of mass killings to be depicted by the media as motivated by bullying ($p<0.01$). Mass shooting incidents involved a higher average number of weapons (1.70; $p<0.05$) compared to other types of incidents, and the Bonferroni comparison showed that mass shootings involved a higher mean number of weapons than attempted mass shootings ($p<0.01$). However, mass killings had a higher average number of fatalities (7.87 per incident; $p<0.01$) compared to an average of 3.77 fatalities in mass shootings ($p<0.01$). The post-hoc analysis revealed mass killings resulted in higher average fatalities compared to all other types of incidents ($p<0.01$), while mass shootings resulted in more fatalities compared to attempted mass shootings ($p<0.01$) and attempted mass killings ($p<0.05$). Mass killings also resulted in a higher average number of wounded victims (7.29 per incident; $p<0.01$), as did attempted mass killings ($p<0.01$) compared to other types of incidents. The Bonferroni comparison revealed that both mass shootings and mass killings resulted in a higher number of wounded victims than attempted mass shootings, and that attempted mass killings resulted in a higher mean number of wounded victims compared to both mass shootings and attempted mass shootings ($p<0.01$). Again, this difference is likely driven by the lethality of explosives compared to firearms.

Few incidents involved hostage situations, and ranged from 3 % of attempted mass killings to 9 % of mass killings, although the mean differences were not statistically significant. Fewer perpetrators of attempted mass shootings and attempted mass killings committed suicide, which occurred in 9 % ($p<0.01$) and 6 % ($p<0.01$) of each type of case respectively. By contrast, 31 % of the perpetrators of mass shootings committed suicide ($p<0.05$). Further, perpetrators of mass shootings committed suicide more often, on average, than perpetrators of attempted mass shootings ($p<0.01$), and attempted mass killings ($p<0.05$). Finally, perpetrators of mass shootings had a significantly lower average number of co-perpetrators compared to other incidents, while perpetrators of attempted mass shooting incidents had a higher average number of co-perpetrators ($p<0.01$). The post-hoc analysis showed that perpetrators of mass shootings had fewer co-conspirators compared to mass killings ($p<0.05$) and attempted mass shootings ($p<0.01$), while perpetrators of attempted mass shootings had more co-perpetrators than perpetrators of attempted mass killings ($p<0.01$). This implies that

when a greater number of perpetrators are involved in a planned multiple-victim attack at a school, the attack may be easier to stop in advance. Table 3 exhibits the results of this analysis.

Discussion

While "school shootings" are typically examined using a narrow definition of what constitutes an attack, and case-study methodologies, the present study examines multiple-victim homicide attacks at schools using a quantitative comparative approach. Several important insights have emerged from this analysis with implications for school safety practitioners and lawmakers. First, the bivariate analysis reveals the vulnerability

Table 3 Comparison of means for perpetrators' demographics and incident-related behaviors across incident types

	Mass shooting (*N*=137)	Mass killing (*N*=45)	Attempted mass shooting (*N*=129)	Attempted mass killing (*N*=34)	Bonferroni comparisons
Gender	0.96 (0.21)	0.93 (0.25)	0.98 (0.12)	0.88 (0.33)*	
Age	24.00 (10.82)	28.03 (11.00)**	18.13 (7.89)**	26.06 (13.32)	AMS < MS** AMS < MK** AMS < AMK**
White	0.67 (0.47)	0.30 (0.46)**	0.73 (0.45)*	0.72 (0.45)	MS > MK** AMS > MK** AMK > MK**
Bullying reported as motive	0.19 (0.34)**	0.0 (0.0)**	0.15 (0.36)	0.09 (0.29)	MS > MK**
Number of weapons in incident	1.70 (1.43)*	1.38 (1.07)	1.32 (1.41)	1.59 (0.99)	MS > AMS*
Number of victims killed	3.77 (4.75)**	7.87 (14.83)**	0.03 (0.17)**	0.03 (0.17)*	MS < MK** MS > AMS** MS > AMK* MK > AMS** MK > AMK**
Number of victims wounded	4.71 (6.40)	7.29 (10.14)**	1.44 (2.56)**	11.76 (20.39)**	MS > AMS* MS < AMK** MK > AMS** AMS < AMK**
Incident involved hostage situation	0.07 (0.26)	0.09 (0.28)	0.04 (0.21)	0.03 (0.18)	
Committed suicide	0.31 (0.47)*	0.16 (0.37)	0.09 (0.29)**	0.06 (0.24)**	MS > AMS** MS > AMK*
Number of co-perpetrators	0.23 (0.63)**	0.76 (1.19)	1.01 (1.43)**	0.24 (0.43)	MS < MK* MS < AMS** AMS > AMK**

Standard deviations reported in parentheses

MS mass shooting, *MK* mass killing, *AMS* attempted mass shooting, *AMK* attempted mass killing

**$p<0.01$; *$p<0.05$

of high schools, colleges, and universities in both rural and urban areas to mass shootings. High schools in rural areas in particular face challenges related to school shootings, and regarding the implementation of school policies that result from these incidents. For example, a North Georgia school district considered installing assault-weapon armories in its schools in the event of an attack, following the attempted school shooting that was de-escalated in Decatur in August, 2013 (Jonsson, 2013). Likewise, school districts nationwide are considering arming teachers, or installing armed guards following the shooting at Sandy Hook Elementary School in 2012 (Crews et al., 2013).

Comparing the four incident types, very few school-based mass murder incidents involved hostage situations, with the fewest average number of cases at around 3 % for attempted mass killings. This is significant for further informing police protocol in the event of multiple-victim homicide incidents at schools that are not "active shooter" situations, since they do not involve the use of firearms. After the 1999 "Columbine" school shooting, an event which was first classified by police as a hostage situation (a miscalculation that resulted in a science teacher bleeding to death while awaiting law enforcement to enter the school), active shooter protocols were amended (see Buerger & Buerger, 2010; Cullen, 2009). First, law enforcement sought to implement a lockdown procedure, and neutralize the active shooter rather than wait to determine if a scenario involved hostage-taking (Buerger & Buerger, 2010). More recently, a Department of Homeland Security training titled, "Run, Hide, Fight," targets civilians rather than law enforcement and empowers individuals that may be confronted with an active shooter situation to determine the best course of action for self-defense and preservation during the incident, including potentially confronting the attacker (also see Buerger & Buerger, 2010). In the case of either protocol, active shooter responses have moved beyond determining if a hostage situation is occurring, and the present study confirms that these protocols are evidence-based not only for mass shootings, but for mass killings as well.

Notably, bullying was reported as a motive most often in mass shooting cases, reported in the media in around 19 % of those cases. By contrast no mass killing incidents involved news reports of bullying as a potential motive. This is significant because prior research often links failure, and strain due to bullying as motivating factors in "school shootings" (e.g. Kimmel & Mahler, 2003; Leary et al., 2003; O'Toole, 1999; Vossekuil et al., 2002). While bullying is a major public health concern in its own right, and should not be overlooked in cases of victim–offender overlap whereby victims of bullying perpetrate deadly shootings in schools (see Hazler & Carney, 2000; Leary et al., 2003), it is still a fairly low percentage of cases in which the mass media frames this potential motive. Untreated mental illness and other motivations, therefore, may need to take the forefront of local, state, and national policy concerns surrounding "school shootings," and should be examined in future research.

Several interesting findings regarding perpetrators' demographic characteristics have implications for both policy and future research. First, while the majority of school-based mass murder attacks are perpetrated by males, women also commit these acts, and their presence among this group of perpetrators should not be ignored. The greatest representation of women is found among perpetrators of incidents not involving firearms—particularly among perpetrators of attempted mass killings, which yielded a statistically significant difference by gender compared to other types of incidents. Future research should examine and compare motives and methods used to carry out

school-based mass murder and rampage style attacks that differ by gender to further shed light on this difference.

Interestingly, the results regarding perpetrators' ages reveal that perpetrators of mass killings are, on average, older than perpetrators of other incidents with a mean age of around 28.03 years old at the time of the incident, which is older than the typical depiction of a "school shooter." One of the strengths of the present study is that it recognizes, by definition, that mass violence in schools is a broader social problem than just that of "school shootings," which have often been defined not only by weapon type, but also based on perpetrators relationships to the schools they attack (i.e. that the perpetrators must be students). Future research should examine and compare attacks perpetrated by students of the targeted schools to perpetrators who are "outsiders." By contrast, perpetrators of attempted mass shootings are much younger than the perpetrators of other types of incidents with a mean age of around 18. This implies that younger would-be school shooters may be less methodical in their planning or implementation of school shootings, leading police to uncover their plans quicker as well as resulting in fewer fatalities. Indeed, 33.3 % of attempted shootings were averted by police compared to only 14.3 % of attempted killings. Future research should compare averted and completed attacks to further inform public policy.

Regarding perpetrators' race and ethnicity, prior research has found that the majority of school-based mass murder attacks in the U.S. are perpetrated by young, white, males (e.g. Kimmel & Mahler, 2003; Newman et al., 2004). The present study found that while that is true of mass shootings compared to mass killings, (though not statistically significantly different from other types of incidents); perpetrators of mass killings not involving firearms are significantly less likely to be white. Incidents of mass stabbings in schools in rural China highlight a potentially growing problem of increasing stress, strain, and untreated mental illness in a particular cultural context (see Xinhua, 2010). This finding can move the body of "school shootings" research beyond a narrow focus on access to firearms and rural and suburban U.S. settings to issues of mental health and access to a multitude of weapons in a global context.

Relatedly, perpetrators of mass shootings commit suicide in around 31 % of the cases studied, by far the highest average number of cases compared to other types of multiple-victim homicide attacks, and statistically significantly more often than perpetrators of attempted mass shootings or attempted mass killings. In addition, perpetrators of mass shootings had a much lower mean number of co-perpetrators compared to other types of incidents, while perpetrators of attempted mass shootings had a significantly higher average number of co-perpetrators. Several implications arise from these findings. First, the overlap between suicidal and homicidal ideation should be explored in future research, particularly in relation to gun violence. In addition, multiple-victim homicide attacks appear to be stopped in advance, or fail to result in an intended high number of victims when multiple perpetrators are involved. Therefore, school administrators, faculty, and staff should pay close attention to warning signs that emerge from individual students that may also express suicidal and/or homicidal ideation (see Fein et al., 2002; Kleck, 2009; Redding & Shalf, 2001), and should provide outlets for students to report potential threats. Evidence-based behavioral threat assessment guidelines can provide the framework for schools to implement such outlets (e.g. Cornell, 2009).

With regard to the weapons used to carry out multiple-victim homicide attacks, this study found a greater number of weapons, on average, are used in completed mass shooting incidents compared to attempted mass shootings. However, mass killings carried out with weapons other than firearms (namely explosives) result in a higher average number of fatalities and wounded victims. Therefore, while gun control is certainly a pressing issue, particularly in the U.S., finding ways to control access to materials that can be used to make bombs should also be a priority among lawmakers worldwide.

Based on data from the Centers for Disease Control and Prevention and the National Center for Injury Control and Prevention, the relative strength or weakness of gun laws has been shown to correlate with gun violence, in general (The Violence Policy Center, 2011). However, the availability of guns is a single input into the system that produces school-based mass murder attacks, and gun control legislation is not effective at reducing attacks that involve other weapons. In addition, research on the effectiveness of gun laws on reducing violence in general reveals mixed results (see Hahn et al., 2005 for a thorough review). First, bans on types of guns in the U.S. vary widely from state to state, making it easy for those desiring a firearm that is banned or restricted in one state to go to another state to acquire one. Likewise, licensing and registration laws vary widely by state (U.S. Department of Justice, 2000). Second, in the periods preceding gun control legislation, production and sales of firearms increase (Roth & Koper, 1999), rendering bans and restrictions less effective due to the surplus created prior to the policy's enforcement. For example, following the 2012 shooting at Sandy Hook Elementary School, some U.S. states such as Georgia and Texas experienced ammunition shortages as buyers anticipated the passage of strict gun control policies (Betts, 2013; Diamant, 2013). Third, background checks are difficult to enforce due to a lack of systematic record keeping for individuals in restricted mental health and criminal categories (Government Accounting Office, 2000). Finally, private citizens may sell their guns without a license to do so, for example, at a "gun show." While some states require background checks be conducted for private sales; these sales are not federally regulated (Bureau of Alcohol, Tobacco, and Firearms, 2000).

Since school-based mass murder attacks not involving firearms are under-studied, little empirical evidence on these incidents has been analyzed to date. That the present study finds non-firearm related incidents result in a higher average number of fatalities indicates that further examination of these incidents, moving beyond a sole focus on "school shootings," is warranted and necessary to better inform public policy. Future research should identify and analyze the precise ways in which perpetrators of mass violence in schools obtain weapons to better pin-point exactly how controlling access to multiple types of weapons can potentially prevent future school mass violence incidents.

Conclusion

The present study provides a preliminary analysis comparing attempted and completed multiple-victim homicide attacks on schools involving firearms and other weapons. This analysis, utilizing a unique database of incidents, provides a starting point for

future research that can begin to systematically analyze "school shootings" and attacks carried out with other weapons, particularly explosives. As these incidents are occurring with unprecedented frequency, are highly emotional, and receive widespread media coverage, the need for a systematic, quantitative analysis is greater now than ever before, particularly to identify areas of weakness that pose increasing security threats in schools and regarding legislation. Building on this study, future research should examine other characteristics of incidents, schools, perpetrators, the weapons used, number of victims, school security measures, and criminal justice and gun-regulation policies at local, state, and national levels. In addition, since the U.S, Canada, and other wealthy Western nations have experienced the most school-based multiple victim attacks, future research involving cross-national comparative analyses can shed light on particular features of the nations that are associated with a greater risk of attacks. Finally, examining school-based multiple-victim homicide incidents across incident types and both within and between nations can improve criminological theory testing, as well as inform public administrative preparedness and responses to these incidents.

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Appendix

U.S. States by Region

The *Northeast* region includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; the *Midwest* region includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Nebraska, North Dakota, South Dakota, and Wisconsin; the *South* region includes Alabama, Arkansas, Delaware, the District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and the *West* region includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming (see U.S. Census Bureau, 2010).

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