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School shootings: A narrative review

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ABSTRACT

This narrative review of recent literature on school shootings includes studies suggesting that the three salient predictors of school shootings include mental illness that is untreated, estrangement from friends, families and classmates and accessibility to guns. Other issues in this literature include the communication of an intent to harm suggesting a “cry for help” and contagiousness of school shootings. Several studies document the relationship between the lack of gun control and school shootings. The mental health of those exposed to school shootings has been the subject of research suggesting that those especially who had close exposure to the shooting or had a relationship with the shooter have experienced psychiatric problems including depression, anxiety, PTSD and suicidal ideation. Extremely high prevalence figures have been reported for exposure to violence by students at 42% witnessing a shooting, 18% a murder and 54% a murder of someone who is close. And as many as 21% have experienced depression, 46% lifetime PTSD and 27% current PTSD. Although a significant number of students have been injured during school shootings, no attention has been given to those students. This review highlights the mental health issues experienced not only by the shooters but by those who have been exposed to the shootings and the need for interventions as well as more effective gun legislation.

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A study by the Washington Post entitled “More than 311,000 kids experienced gun violence at school since Columbine” (May 27, 2002) included 331 schools with significant numbers of students affected in the following examples: Columbine – 1820 youth, Sandy Hook – 420, Marjory Stoneman Douglas – 2930 and Rob elementary – 500. Forty-two mass school shootings occurred in 2021 and 24 thus far in 2022. Seven of the 10 shooters were less than 18-years-old with the median age of 16. Other instances of young kids as killers included “a six-year-old who killed a classmate saying he didn’t like her and a 15-year-old girl who did the same to a friend for rejecting her romantic overtures” (Washington Post, May 27, 2002).

This narrative review involved entering the terms school shootings and the last five years into PubMed and PsycINFO. The search yielded 74 papers but following exclusion criteria including case studies and non-English papers, this review summarizes the research reported in 32 papers. Most of this literature has focused on profiling the shooters and assessing the mental health effects on those students who were exposed to the shootings.

Predictors of School Shootings

Some have raised the question of whether school shootings are random and senseless violence (Madfis et al, 2012). These authors concluded that violence was rarely random and that there were observable patterns and discernible motives and causes. The observable patterns and discernible motives and causes apparently have not been clear for the past 23 years for so many school shootings to have happened unpredictably. Fortunately, research on the predictors of school shootings has continued.

Some have called school shootings “rampage shootings” and have suggested that they’ve been around since the early 1900s and they are increasing (Rocque et al, 2018). This historical marker seems inconsistent with another one that suggests a history that dates back to ancient

origins. School shootings have been an ancient form of suicidal assault called “devotio” (Preti et al, 2008). These were widespread across the Mediterranean in Roman, Greek and Hebrew cultures. School shootings have been considered suicide with hostile intent. These spree killings are typically preceded by messages with a hostile intent to kill (Preti et al, 2008). Rampage shootings are not usually associated with any other crime or terrorism, but they have been associated with maleness, mental illness, contagion effects and accessibility to guns (Rocque et al, 2018). (see table 1).

Multiple predictors

In one of the most comprehensive reports in the literature (prepared for the National Science Foundation), several variables were noted (Bushman et al, 2016). School shootings typically occurred in a small rural town or suburb. The shooters have frequently been white adolescent males with no history of disciplinary problems and average to high intelligence and academic achievement. Usually, the boys have been marginalized and often described as geeks or wannabes or they hung out with either a disliked or a fringe group. Although most had not received psychiatric treatment, a variety of mental illness symptoms have been noted including depression and suicidality. The shooters were typically influenced or encouraged by others but were not reported, as the shooter was typically viewed by his peers as engaging in “fantasy talk”. Most have had a history of weapon use during hunting and had procured their guns from their parents. Most of the school shooters have killed themselves which has suggested that this may be a way of “achieving fame and notoriety as their final statement” (Bushman et al, 2016). And, the shootings may be a “symbolic event directed at the schools rather than specific individuals” (Bushman et al, 2016). The shooters typically did not know anyone who had killed before.

Psychiatric Problems

In a study on the psychiatric diagnoses of mass shooters (defined as more than four people killed with a firearm), the Mother Jones database from 1988 to 2019 (N =115 deaths) was explored (Glick et al, 2021). Twenty-eight of the 35 shooters had psychiatric diagnoses with eighteen being schizophrenic, three bipolar, two delusional, two personality disorder (one paranoia, one borderline), two substance-abuse and one PTSD. None of these individuals were

medicated or treated. These psychiatric problems have been prevalent among youth, but fortunately the vast majority have not engaged in school shootings. And, surprisingly, in contrast to the prevalence of psychiatric problems in the Mother Jones database, in a sample from Australia on 14 mass shootings, no documented mental illness was noted, although acute stress or chronic strain was reported (McPhedran et al, 2020).

Table 1. Predictors of school shootings (and first authors).

Predictors	First authors
White adolescent male	Bushman, Rocque
High intelligence and achievement	Bushman
Marginalized	Bushman, Kowalski, Cerfallo
Psychiatric symptoms	Bushman, Cerfallo, Glick, Kowalski, McPhedran, Lankford, Rocque
Intent to do harm	Peterson, Preti
Contagiousness	Boyd, Towers, Rocque
Fascination with guns and death	Kowalski
Accessibility to weapons	Bushman, Rocque, Reeping, Callcutt, Kolbe, Liu, Rees
Suicide	Bushman

Table 2. Mental health effects on the exposed (and first authors).

Effects	First authors
PTSD	Cimolai, Gollub, Shultz
Anxiety	Cimolai, Schultz
Depression	Cimolai, Gollub, Shultz, Rocsin-Slater
Suicide	Cimolai

Table 3. Buffers and interventions (and first authors).

Buffers	First authors
Resilience	Vieselmeier, Travers
Gratitude	Vieselmeier
Post traumatic growth	Wozniak
Deliberate rumination	Wozniak
Mental health anti-stigma curriculum	DuPont-Reyes

In a paper entitled “the timing of opportunities to prevent mass shootings”, the authors addressed the timing of mass shootings that have occurred since Columbine (N=14) (Lankford et al, 2021). They suggested that the perpetrators’ mental health contacts occurred more than a decade before the mass shootings and often ended more than a year before their attacks. Mental illness was suggested to be a constant in their life. Work and school problems began long before their mass shootings, and firearm acquisition occurred during the final stages. They suggested that red flag laws preventing sales to dangerous individuals could decrease the prevalence of attacks.

Troublesome Behaviors

Although researchers have focused on psychiatric problems, rejection by peers and disturbed family relations for school shooter profiles, research has rarely focused on the troublesome behaviors shown by the shooters far in advance of the shootings. These individuals have been noted as “strange” but have not appeared on the radar as potentially dangerous. In retrospect, many of the behaviors of the shooters have appeared troublesome. An example is given by the description provided on the recent Uvalde school shooting shooter quoted below.

“Missed warnings signs” is what Zach Despart of the Texas Tribune called it on July 17 about the Uvalde shooting. As he said, “The gunman, Salvador Ramos, displayed signs he was unstable and possibly planning a violent attack, yet none of the these warning signs reached authorities.

A year before the massacre, he had earned the nickname “school shooter” on social media platforms because of violent threats he would make against other users. With few, if any, friends and a strained relationship with his parents, the report describes him as a high school dropout and social outcast who eventually concluded that spectacular violence could bring him “notoriety and fame”.

Online, the committee found, he became interested in gore and violent sex, sometimes sharing videos and images of suicides and beheadings. His Internet search history suggested he questioned whether he was a sociopath.

In real life, he was fired from two fast food jobs at Whatburger, he harassed a female employee and at Wendy's he would not talk with any coworkers, except one occasion where he attempted to start a conversation about guns.

In the final months of his life, he was determined to acquire guns a desire the report says family and friends were aware of. Because he lived with his grandmother and had no expenses, he was able to use his money for this effort. While he was still 17, the shooter asked at least two people to purchase guns for him, but they refused. Instead, he focused on purchasing accessories, including a gun sight, rifle sling and body armor carrier. He turned 18, the legal age to buy guns in Texas, on May 16. Over the course of the next week he spent more than \$3000 on two AR-15 style rifles from an online retailer, which shipped the weapons to a Uvalde gun shop. Because he had no license and did not know how to drive, an uncle transported him to the gun store twice. He said the first time he didn't know he was going to pick up a rifle, since the store is also a popular restaurant in town and his nephew said he was hungry. But he returned with a narrow box and no food. The owner of the gun store remembered him and described him to investigators as an average customer with no “red flags”. Other store patrons told the FBI they thought he was “very nervous looking” and “appeared odd and looked like one of those school shooters”.

The report details no attempt by anyone who interacted with the gunman to alert authorities about his troubling behavior”. In a quote from a related story “A year before Uvalde shooting, gunman had threatened women, carried around a dead cat and been nicknamed “school shooter”.

It is not clear why if these are early predictors and profiles can be formulated that individuals cannot be identified at school-age for intervention. Instead, school shootings continue to be unpredictable. As some students have suggested, public profiling may help this problem. Unfortunately, this research and the legislation that has been suggested has become highly politicized. For example, in a study on mass shootings, mental illness and gun control, the authors suggested that the politicians on the conservative side consider this issue one of mental illness whereas the liberal progressives consider that the issue is gun control (Philpott-Jones et al, 2018).

In a retrospective observational study on the Mother Jones database, 115 mass shootings involving 55 shooters were identified for the years 1982 to 2019 (Cerfolio et al, 2022). Thirty-five of the surviving shooters were interviewed by psychiatrists who found that 88% of the shooters had been misdiagnosed and incorrectly treated or undiagnosed and untreated. Most had experienced estrangement from friends, families and classmates. And, online radicalization fostered their violence. It would be interesting to know how these surviving shooters differed from those who committed suicide.

History of Rejection

A broader set of social problems have been noted in school shooters. For example, in a study on antecedents of school shootings, five were noted including a history of rejection, history of psychological problems, fascination with death, and with violence and guns (Kowalski et al, 2021). This included a comparison of studies on K through 12 shootings versus university shootings in which the K through 12 shooters had a greater history of rejection. Two questions that could be further addressed based on these data are differences in the motives of the K-12 and university shooters and the origins of fascination with death which may require more qualitative research interviewing shooters who have survived as well

as acquaintances and family members of those shooters who did not survive.

Intent-to-do-harm

Another issue has been the communication of intent-to-do-harm known as “leakage” and whether this is a form of fame-seeking or a cry for help (Peterson et al, 2021). In this study on 170 mass shooters, 47% leaked their plans, and of those, 44% leaked specific plans. The leakage was associated with counseling and suicidality, suggesting that the form of communication of intent was a cry for help. It is not clear why leaked specific plans which are so prevalent (44%) have not been reported in advance of shootings by those aware of those plans including peers, family and counselors. Interviews on this question might be conducted retrospectively to contribute to the formation of profiles that could be used to identify potential school shooters needing therapy.

Contagion

The contagiousness of mass shootings (now defined by the federal government as resulting in greater than three deaths) has been reported as an effect that varies over both time and number of victims (Boyd et al, 2021). This contagion effect, also called the “copycat” effect, has been documented based on both parametric and nonparametric models. Although this effect has been documented, and has probably been exacerbated by social media, it is not clear why it occurs and how to identify “copycats” preemptively.

Contagion has been studied for both mass killings and school shootings. In a study on school shootings, K-12 school shootings were contagious for an average of 13 days and incited an average of at least .22 new incidents (Towers et al, 2015). School shootings on average have occurred one time per month. The state prevalence of firearm ownership has been significantly associated with the state incidence of school shootings. This provides a strong argument for state legislation.

Lack of gun control

School shootings have been attributed to these larger societal problems like gun control. For example, in a study on school shootings during the years 2013 to 2015, data from LexisNexis, newspaper and broadcast media databases suggested correlates of the 154 shootings (35, 55, 64 shootings per each of these years) (Kalesan et al, 2017). The school shootings were correlated with background checks, mental health and education expenditures and urbanicity (greater percent of urban population). Although governments have addressed these problems in some states like California, it is not clear that state legislation has been effective. The federal government has recently proposed increasing these expenditures, but how those allocations are received by the states is not clear given that the legislation is highly politicized.

In another interesting data collection approach for risk factors for shootings, 282 articles were analyzed from 10 most trusted news sources (Rees et al, 2019). As was noted by these authors, a small proportion of childhood deaths are accounted for by school shootings, but a disproportionate share of media attention has been given to school shootings. In these authors' analysis, 356 factors were noted which were then categorized as policy-level factors including inadequate legislation controlling firearm purchase and ownership which was the most contributing policy-level factor. Mental illness was the most commonly cited person-level factor and the environmental factors, not surprisingly, were access to firearms in the home and availability of large-capacity firearms. Others using newspaper sources have also noted more permissive firearm laws and greater gun ownership associated with school shootings including a Washington Post study on K-12 shootings (Reeping et al, 2021).

Further evidence of the relationship between the lack of gun control and school shootings comes from a study on 36 school shootings that occurred in California for the years 1996 to 2015 with a mean of five deaths and a range of 0 to 33 for deaths and a range of 1 to 25 for injuries

(Callcut et al, 2019). In the years 2012 to 2015 the school shootings were averaging three per year versus 1.4 per year in the previous 17 years. Starting in 2011, the gun sales exceeded the 95% predicted upper control limit every month. A spike in sales occurred in the months immediately following the mass shootings. Although gun control laws increased every year, gun sales increased immediately preceding the enactment of laws each January. That would suggest that there should be more gun checks in the month of January.

Slightly different figures were given in another paper called school gun violence (Kolbe et al, 2020). These authors reported 1373 K-12 school gun incidents since 1970 that had injured 1403 and killed 728 students (Kolbe et al, 2020). That the injury rate in this research was twice the death rate is a rare statistic, although research on the injured has been non-existent compared to that on the shooters and those students who have been exposed to the shootings.

Still another paper points to the relationship between school shootings and gun sales (Liu et al, 2019). In this time series analysis, shootings were associated with a 21% increase in gun sales as well as a surprising 18% decrease. High-fatality shootings and extensive media coverage has led to increases in gun sales. But, it would be interesting to know if these increased and decreased gun sales were happening along political lines with the increase being associated with conservative buyers and the decrease associated with more liberal buyers

The conservative/ liberal split can clearly be seen in both the recent Supreme Court decision and in the senate passage of gun legislation. These events were highlighted in the New York Times on June 24, 2022. In a six to three ruling, the conservative Supreme Court struck down the New York law requiring people to demonstrate a need to carry a concealed handgun in public. This action is expected to lead to more gun accessibility. On the same day, the Senate passed the gun safety bill with 15 Republicans joining Democrats in a provision

that includes hundreds of millions of dollars “to train medical workers and school personnel to respond to mental health crises and funding for school safety programs and school resource officer services”. Another provision made it harder for people under 25 to purchase guns by requiring law enforcement to check their juvenile and mental health records. Still another provision would set aside 700 million dollars to implement red flag laws which let judges temporarily confiscate guns from people who are a threat to themselves or others.

Mental health effects on the exposed

The mental health effects of mass shootings have received less attention in the literature as research has been more focused on identifying profiles of the school shooters versus researching the victims and/or those who have been exposed (see table 2). In a study entitled “Multiple vantage points on the mental health effects of mass shootings”, those in the U.S. have outnumbered those in Europe, and virtually none have occurred in Latin America, which ironically has the highest firearms homicide rates (Shultz et al, 2014). The mental health effects identified in that study included psychological distress and significantly elevated PTSD, depression and anxiety. These, in turn, have been related to the degree of physical exposure and social proximity to the shooting. For example, in a study that was called “The mental health consequences of school shootings” that is a review of 49 peer-reviewed studies on 15 mass shootings, the article is more focused on risk factors (Lowe-Draucher et al, 2020). Those included not only proximity of the attack but also being acquaintances of the deceased.

In another study entitled “Effects of mass shootings on mental health of children and adolescents”, the authors noted similar outcomes including PTSD, suicide, depression, anxiety and substance abuse (Cimolai et al, 2021). The negative effect of depression in particular is highlighted by a study on antidepressants that were prescribed in neighborhoods of those who had experienced

school shootings (Rorsin-Slater et al, 2020). This study covered prescriptions for antidepressants following 44 school shootings that were filled by pharmacies within 5 miles of the shootings compared to those within 10 to 15 miles in the years 2006 to 2015. The number of antidepressants prescribed in the two years following the shootings was greater in the local pharmacies where they increased by 21%. Not surprisingly, this effect was smaller in an area with more mental health facilities. It is noteworthy that antidepressants are so widely used for not only depression but anxiety and PTSD given that their underlying stress hormones operate very differently in these conditions with, for example, cortisol being typically elevated in depression and anxiety but being very low in PTSD. In the case of PTSD and anxiety, antidepressants would appear to have a paradoxical effect, although these three conditions are often comorbid, possibly explaining the effectiveness of antidepressants for all three conditions.

In a study on indirect violence exposure, a broad spectrum of 29 public charter schools and non-community settings were the backdrop for 1548 students exposed to violence (Gollub et al, 2019). In this sample, 42% witnessed a shooting/stabbing/beating, 18% a murder, and 54% a murder of someone who was close. These extremely high percentages suggest a significant prevalence of indirect exposure to violence. In the same sample, 21% experienced depression, 46% lifetime PTSD and 27% current PTSD. Also in this sample, more males experienced shootings and more females experienced the murder of someone close. Risk factors for mental health problems included females experiencing more depression, more lifetime PTSD and current PTSD. Not surprisingly, the strongest risk factors for mental health problems were female sex, the number of indirect exposures and belonging to a school with funded lunch programs.

Other negative effects on the exposed

Although mental health problems are the most frequently reported effects, other negative effects have been reported by students that may be more widespread such as fear and helplessness. For example, the New York Times on June 12 reported expressions by students following the school shooting in Uvalde. A few of these are as follows: "I don't want to be scared anymore". "We try to put bandaids on our invisible wounds". "There's nothing I can do without the right to vote and a pocket full of cash". "School boards across the country need to implement an early warning system where classmates can report peers who reach out about violent behavior". These expressions by students who experienced the Uvalde school shooting would desirably be collected following all school shootings and qualitatively analyzed to identify the immediate negative effects on students that might be addressed in therapies. As some researchers have said, "The harm goes beyond those who are injured or killed because the presumption of security is shattered and the mental and emotional health of the students is threatened" (Reeping et al, 2021).

Risk factors have typically been individually assessed rather than multiple risk factors being entered into a regression model to determine the relative degree to which they are predictive. In a recent review on 49 peer-reviewed articles on mass shootings, for example, several risk factors were identified including femaleness, pre-incident psychiatric symptoms, less emotional regulation and social support (Lowe-Draucher et al, 2020). However, the relative importance of these variables was not determined as, for example, in a multiple regression.

Interventions

Interventions have been few and far between for those exposed to school shootings. Some have reported personality characteristics that have appeared to have buffered the stress (see table 3). For example, in one study, the role of resilience and gratitude were assessed in 359 students four months after a school shooting (Vieselmeyer et al, 2017). PTSD occurred less

frequently and posttraumatic growth occurred more frequently in those individuals noted to have greater resilience and gratitude. It's not clear that students could be taught resilience and gratitude, but some form of education/intervention in that direction might be effective. Other researchers have also reported on resilience (Travers et al, 2018). In this case, surprisingly, the most exposed showed the most resilience. Clinically significant symptoms were associated with proximity to the trauma, traumatic dissociation, posttraumatic emotional regulation difficulties, social support and flexibility of coping styles. These data seem inconsistent as the most exposed showed the most resilience and yet the association with proximity to the trauma was predictive of clinical symptoms.

Yet another study that assessed posttraumatic growth involved 385 students who were exposed to university shootings and were assessed 4 months later (Wozniak et al, 2020). Emotional proximity was associated with both posttraumatic stress and posttraumatic growth and physical proximity was associated with only posttraumatic stress. Rumination was assessed as another variable and was noted to mediate relationships with posttraumatic stress and posttraumatic growth. Specifically, "intrusive rumination" mediated the relationship between physical proximity and posttraumatic stress and "deliberate rumination" mediated the relationship between emotional proximity and posttraumatic growth. In essence, these results suggest that deliberate rumination could be used as a therapy for helping students exposed to school shootings experience posttraumatic growth.

In one of the only formal interventions, 751 sixth graders from 14 schools in Texas were randomly assigned to a mental health anti-stigma curriculum versus a control group that had contact with two adults with mental illness (DuPont-Reyes et al, 2021). The intervention group showed a reduction in verbal threats and less violence. This was literally the only funded

Intervention that could be found in the recent literature on school shootings.

Limitations of the literature

Several limitations of the existing literature on school shootings include the types of studies that have been conducted and the sources of information. Much of the data have come from public records and news articles that have addressed the demographics of the shooters which have suggested some risk factors including male gender and mean age of 16 years. Limited interview data from friends and families of shooters as well as mental health workers have suggested other risk factors including marginalization and isolation from friends as well as mental health issues and availability of guns. Further interview data are needed not only for profiling potential shooters but for ways of referring them for preventive interventions.

Although leakage has been common, those youth who have been interviewed suggest that it has been difficult to report signs of “crying for help” and threats on social media by friends and acquaintances. Some youth have suggested the need for a public reporting mechanism where peers could anonymously report friends of concern.

The press have focused on honoring the victims and making their personalities known to the public which in itself is important. As the victims appeared to be randomly shot, there has been little purpose in trying to research motives of the shooters for targeting victims. Very little has been revealed in the press about the shooters given the limited information immediately after the mass shootings.

No comparisons could be found between the shooters who suicided versus those who did not. Although timing might have differentiated those shooters in terms of the non-suicidal being caught in advance of shooting themselves, it would be interesting to know whether the profiles of homicidal/suicidal shooters are different from

homicidal shooters, especially for intervention purposes.

It is understandable that significant research has focused on the mental health problems of those who have been exposed to school shootings as they constitute the largest numbers of students affected. Although many may have needed intervention, the thousands who have been exposed have not likely been screened for mental health problems. Only small sample studies have appeared in the literature on the mental health of those youth who have been exposed to school shootings. Large scale screenings could be conducted using brief measures like the PROMIS scale to identify those who have resulting depression, anxiety, PTSD, substance use or other problems.

Another group that has received virtually no attention are the wounded survivors of school shootings. It is not clear why they have not been researched given that they are more likely than the exposed without physical wounds to have severe mental health consequences like posttraumatic stress disorder following recovery from their physical wounds.

The most consistent risk factor appears to be possession, accessibility or purchase of guns. If the average age of school shooters is 16, clearly youth 16 years and younger should not have the ability to purchase guns. However, the new congressional legislation is apparently directed at finding additional funds for school safety and mental health programs without age restrictions for gun purchases and more extensive background checks.

Intervention research has been virtually nonexistent. Educational interventions would certainly need to include signs and symptoms of peers “crying for help” and any leakage on specific plans. Peer therapy groups may be effective not only for addressing problems of potential school shooters but also for related problems including excessive social media exposure and use, bullying, dating violence and drug use. Although shooters have not apparently shown aggression in other situations, the

literature has clearly identified them as being excluded by their peers and having mental health issues.

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