

Challenges to the Empirical Investigation of Mass Shootings

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The literature on the psychological consequences of mass shootings has grown rapidly in recent years. Studies have proliferated as independent researchers have addressed acute problems of trauma and recovery following mass shootings in schools, colleges, workplaces, and communities, and we have learned much about how the trauma of a mass shooting affects people (see Lowe & Galea, 2015; Shultz et al., 2014; Wilson, 2014). However, a number of issues and problems have emerged that pose challenges for researchers in this area. In this chapter we examine four core questions that reflect these challenges: What is a mass shooting? What are the outcomes in studies of the psychological effects of mass shootings, and how are they measured? What processes link mass shootings to psychological outcomes? What features of study design pose challenges for theoretical progress in understanding how exposure to mass shootings affects psychological functioning?

What Is a Mass Shooting?

The term *mass shooting* is more a term of convenience than a scientific concept. Both words that make up the term are problematic. How many victims qualify as a *mass*? The word *mass* means a large amount or number of something, but the lower bound for defining a *mass* in studies of *mass shootings* is typically no more than four (e.g., Wilson, 2014; see also Bjelopera, Bagalman, Caldwell, Finklea, & McCallion, 2013), which is not a mass in the conventional sense. The word *shooting* indicates that a firearm has been used to kill or injure victims. Common sense indicates that a *shooting* is experienced as disturbing or traumatic to victims and observers. However, this restriction is limiting if our interest is in events with fatalities and/or injuries that have serious psychological consequences. Similar acts using other means such as explosives, machete and knife attacks, and intentional vehicle homicides are also traumatic and disturbing (Fox & Levin, 2015).

Thus, a focus on shootings may in some ways be too narrow. But without further qualification, it may also be too broad. Assuming that we mean that a mass shooting involves some number of people who have been killed or injured using firearms, do we mean any such incident (Fox & Levin, 2015)? Do we include gang-related violence, robberies, and homicide-suicides that occur in private residences? An additional issue relates to whether our assessment of the magnitude of an event should be based only on the numbers of victims shot fatally. Nekvasil, Cornell, and Huang (2015) reconceptualize the phenomenon as a multiple casualty homicide, and argue that single homicides with more than one victim (i.e., wounded or injured survivors) qualify for our attention as well.

There is no straightforward solution to determining what to include under the mass shooting umbrella. The underlying issue is that the way analysts define a mass shooting largely depends on the function that the concept serves in the project to which it is applied. For example, in their Congressional Research Service Report, Bjelopera and colleagues (2013) define public mass shootings as “incidents occurring in relatively public places, involving four or more deaths – not including the shooter(s) – and gunmen who select victims somewhat indiscriminately. The violence in these cases is not a means to an end such as robbery or terrorism” (p. 4). This definition is in line with the purpose of the report to provide the U.S. Congress with a basis for discussion and debate about a form of violence that may not be adequately addressed by current legislation and policy. The number of fatalities required in this definition of public mass shootings was based on a definition of mass murder that the FBI presented in a report on serial murder (Federal Bureau of Investigation, 2008).¹ Arbitrariness in the number of fatalities in the definition of mass shootings is underscored by recent legislation passed by the U.S. Congress stating that “the term ‘mass killings’ means 3 or more killings in a single incident” (Investigative Assistance for Violent Crimes Act of 2012, 2013, p. 126 STAT. 2435).

Researchers have also been inconsistent and have used several cutoffs from two to four shooting-caused casualties to define mass shootings (Nekvasil et al., 2015). In their study of nearly 19,000 homicide incidents from 2005 to 2010, Nekvasil and colleagues (2015) compare the effectiveness of cutoffs of two, three, four, and five or more victims, concluding: “It seems likely that no specific cutoff for number of victims is sufficient to identify a meaningfully distinct form of homicidal violence” (p. 8).

We can conclude that there is no fixed or universally accepted definition of a mass shooting. Definitions of mass shootings do not vary greatly, but all contain ad hoc and arbitrary elements that may affect research outcomes and thus our understanding of mass shootings prevention, prediction, and intervention innovation. This is also true of the definition used in the present volume: a gun violence incident that results in four or more victim deaths. Is there any rationale for settling, however provisionally, on this definition? We think that there is, and that the rationale has two parts.

First, the focus on gun violence captures a large majority of multiple casualty homicides. Recent evidence demonstrates that the primary weapon used in more than four out of five such incidents is a firearm, and as the number of victims increases, the likelihood that a firearm was used increases monotonically (Nekvasil et al., 2015). A firearm was the primary weapon used in nearly 95% of multiple casualty homicides with six or more victims. Because shooting incidents are, by far, the most prevalent form of multiple homicide, they are more available for study than other incidents, and they provide evidence for understanding the vast majority of mass homicides that occur. Nonetheless, it is likely that as this tragic literature grows, studies will address an increasing diversity of research problems and theoretical issues, and researchers should be attentive to hypotheses about whether and how different forms of mass homicide may have different psychological outcomes.

Second, the likelihood that homicide is experienced as traumatic is higher in events involving higher casualty rates (e.g., four or more casualties). The dose-response model (Dohrenwend & Dohrenwend, 1974; March, 1993), to be discussed later in this chapter, predicts that the onset and severity of pathogenesis increases as the severity of the traumatic exposure increases. Accordingly, if researchers wish to study incidents that can be properly characterized as traumatic, then shooting incidents with four victim fatalities are more likely to qualify than incidents involving fewer casualties.

Notwithstanding this dose-response-based logic, it is important for researchers to remember that the cutoff of four fatalities is in common use not because of its potential to be pathogenic, but because it was the previous existing standard (Fox & Levin, 2015) endorsed by the FBI (Bjelopera et al., 2013; Federal Bureau of Investigation, 2008) for use in law enforcement and policy making. While the definition of a mass shooting offered in the present volume (i.e., four or more casualties resulting from gun violence) is useful, there are three reasons for believing that it can distort the knowledge base if applied consistently and rigidly:

- 1 The question remains open as to whether four or more fatalities is a meaningful cutoff to differentiate a traumatizing incident from one that is more benign.
- 2 There is no empirically supported or obvious reason why a fatal attack with a firearm would have more or qualitatively different psychological consequences than a life-threatening attack, fatal or not, with a knife, a machete, a blunt object, an explosive, a vehicle, an airplane, or any other weapon or object capable of inflicting serious injuries.
- 3 Unless we examine life-threatening attacks that result in zero fatalities, we cannot know whether fatal attacks are distinctly traumatogenic.

In short, there is no clear scientific justification for building a literature on traumatic homicides that is largely limited to shooting incidents with four or

more fatalities until research provides convincing evidence that psychological responsiveness is dependent on the numbers of victims, that it matters whether victims have been killed or only injured, and that at least four victims are required in order for an event to be experienced as distinctly traumatic by victims and survivors. Researchers should look beyond the standard definition of mass shootings and, where possible, should define research problems that probe the extent of its usefulness.

What Are the Outcomes in Studies of the Psychological Effects of Mass Shootings?

Most psychological research on those exposed to mass shootings focuses on predicting posttraumatic stress reactions following the events, particularly posttraumatic stress disorder (PTSD) or posttraumatic stress symptoms (PTSS).² Researchers have also examined a number of other outcomes, including psychological distress, depressive symptoms, anxiety symptoms, grief, personal efficacy, and quality of life.

Posttraumatic stress disorder (PTSD)

PTSD is a pattern of symptoms that follows exposure to a traumatic event, differentiated from other psychological disorders by the externally derived nature of its etiology. The diagnostic criteria for PTSD are described in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) published by the American Psychiatric Association. The DSM has gone through five editions and two revisions, including DSM-III (American Psychiatric Association, 1980), DSM-III-R (American Psychiatric Association, 1987), DSM-IV (American Psychiatric Association, 1994), DSM-IV-TR (American Psychiatric Association, 2000), and DSM-5 (American Psychiatric Association, 2013).

Though PTSD has been controversial (McNally, 2003), and the diagnostic criteria have been revised several times since its first inclusion in DSM-III in 1980, the core elements have been relatively consistent across DSM revisions. The original diagnosis required that a person display symptoms from three symptom clusters (i.e., re-experiencing [intrusive recollections], avoidance/numbing, hyper-arousal; McNally, 2003) following exposure to a traumatic event, and that the symptoms cause clinically significant distress or impairment.

PTSD is most reliably diagnosed through the administration of structured diagnostic interviews conducted by trained interviewers, such as the Anxiety Disorders Interview Schedule IV (Brown & Barlow, 2014) and the Clinician-Administered PTSD Scale for DSM-5 (Weathers et al., 2013). Such an approach allows the probing of answers and clinical judgment by a trained interviewer,

both of which increase the reliability of diagnoses. Self-report measures of PTSD that are administered by questionnaire have also been developed (e.g., Davidson et al., 1997; Foa, Cashman, Jaycox, & Perry, 1997; Kilpatrick, Resnick, Saunders, & Best, 1989; Norris & Hamblen, 2004; see Orsillo, 2001). These measures mimic a clinical interview in that the respondent is asked survey questions, either by a lay interviewer or in paper and pencil format, that tap the criteria that make up the PTSD diagnosis.

Posttraumatic stress symptoms (PTSS)

Diagnosing respondents by clinical interview in large studies is time-consuming and costly. In order to mitigate these problems, researchers have developed PTSS indices consisting of items that tap symptoms in some or all PTSD symptom clusters (e.g., Brewin et al., 2002; Foa, Riggs, Dancu, & Rothbaum, 1993; Kubany, Leisen, Kaplan, & Kelly, 2000; see also Norris & Hamblen, 2004; Orsillo, 2001). Most studies of the psychological consequences of mass shootings have used PTSS as the primary outcome. Data using these indices can be analyzed as dimensional measures (i.e., continuous variables) or, with the addition of a cutoff point defining a high level of posttraumatic stress (e.g., Hughes et al., 2011), as a dichotomy. However they are administered and operationalized, PTSS indices measure severity of symptoms on a continuum. They are not indicators of PTSD. Making a PTSD diagnosis requires not a particular number of symptoms, but a particular combination of symptoms from each symptom cluster, along with clinical significance.

PTSD diagnostic measures and PTSS continuous measures differ in several important ways. First, PTSS indices measure self-reported symptoms of post-traumatic stress, rather than whether a respondent meets the clinical criteria for PTSD. Second, dimensional indicators typically tap symptoms whether or not they are clinically significant (i.e., cause distress or impairment). Third, diagnostic interviews administered by trained mental health professionals in standardized format allow for clinical judgment that includes probes to clarify the meaning of answers, whereas dimensional assessments, which are typically administered in self-report questionnaire format, do not. Fourth, establishing a cutoff point on a continuous indicator of PTSS to define PTSD cases is not equivalent to a diagnosis of PTSD by a trained clinician. When research subjects evaluated for PTSD using cutoff points on a dimensional indicator are also separately diagnosed by clinical interviewers, there are often respondents with PTSD in clinical interviews who score below the cutoff point on the dimensional measure (false-negative), and there are respondents without PTSD in the clinical interview who score above the cutoff on the dimensional measure (false-positive). Those who have developed these dimensional assessments have worked to keep these errors in an acceptable range (e.g., Brewin et al., 2002; Foa et al., 1997), but they have

not eliminated them, and the results of studies using PTSS measures should always be interpreted with these limitations in mind.

Psychological distress, depression, and anxiety

Less commonly, mass shootings researchers have examined outcomes other than PTSD and PTSS that can occur in the wake of traumatic events, including distress (e.g., Smith, Donlon, Anderson, Hughes, & Jones, 2015), depression (e.g., Vicary & Fraley, 2010), anxiety (e.g., Grills-Taquechel, Littleton, & Aksom, 2011), and grief (e.g., Smith, Abeyta, Hughes, & Jones, 2015). As is the case with measures of PTSS discussed above, distress, depression, and anxiety indices provide measures of symptom severity rather than clinical diagnoses. Whereas clinical cut-offs/norms for determining levels of severity for depression (Beck, Steer, & Brown, 1996) and distress (Kessler et al., 2002) are available, as measures of psychopathology, these measures share the same strengths and limitations as reviewed above for PTSS compared to PTSD.

Grief reactions

Grief is a normal psychological outcome that is likely to occur among people who were involved in social relationships with those killed in mass shootings. Feelings of loss, yearning, heartache, anger, and depression, along with disruptions in self-concept and confusion about one's place in the world are typical grief reactions. Normal grief subsides within a few weeks or months, but sometimes grief is persistent, causes significant distress, and is disabling. Complicated grief (Prigerson et al., 1995) and prolonged grief (Prigerson et al., 2009) are two similar ways this has been conceptualized. Using dimensional indices of grief symptoms, researchers have found prolonged grief among children (Nader, Pynoos, Fairbanks, & Frederick, 1990) and college students (Smith, Abeyta, et al., 2015) in the aftermath of mass shootings. Pathological grief has never been defined as a mental disorder in the DSM, but the recent DSM-5 (American Psychiatric Association, 2013) includes proposed criteria for persistent complex bereavement disorder, a prolonged and debilitating pattern of grief, in an appendix as a condition for further study.

Recent innovations in grief theory beyond the uni-dimensional and pathology-based complicated grief literature should be considered in future mass shootings studies and interventions. Specifically, multidimensional grief theory proposes that adaptive and maladaptive grief reactions may occur along three underlying, interrelated dimensions, including separation distress, existential/identity distress, and circumstance-related distress (Kaplow, Layne, Saltzman, Cozza, & Pynoos, 2013). The first two dimensions (i.e., separation-related distress, existential/identity-related distress) share some similarities with prior conceptualizations of grief.

Circumstance-related distress, on the other hand, is a reaction to traumatogenic elements embedded within the circumstances of a death, which are often violent and gruesome, involve human agency (e.g., malicious intent or negligence) or may involve intense pain, suffering, or progressive physical deterioration (Kaplow et al., 2013). Because of their very nature, mass shootings are theorized to contain causal risk factors (Layne, Steinberg, & Steinberg, 2014) for circumstance-related distress, particularly among people who were emotionally close to those who were killed (Pynoos, 1992). Under these conditions, circumstance-related distress may center on such aspects as the potential preventability of the event, malicious intent of the shooter(s), last moments (e.g., terror and suffering among victims; being unable to care for the victims in their last moments), gruesome injuries, and/or desires for revenge (Kaplow et al., 2013). Given that many of the reactions extend beyond the formal DSM-5 PTSD criteria, future research on mass shootings may consider multidimensional grief as a useful framework for understanding the broad spectrum of personal reactions to losses often consequent to mass shootings, including dual sets of reactions (e.g., traumatic stress and grief) arising from the interplay of traumatic stress exposure and bereavement (Pynoos, 1992).

What Processes Link Mass Shootings to Outcomes?

Most perspectives on how mass shootings affect psychological functioning are grounded in the dose-response model (Dohrenwend & Dohrenwend, 1974; McNally, 2003; Wilson, 2014). According to the model, the greater the exposure to traumatic conditions, the worse the psychological impact will be. The dose-response model provides the basis for the diagnosis of PTSD through the assumption that exposure to a traumatic event produces the symptom patterns characteristic of the disorder. The dose-response model adds the simple notion that as exposure increases, so too does the negative response.

Exposure

The literature on mass shootings generally assumes that greater direct or indirect exposure to a mass shooting influences the onset and severity of psychopathology (Norris, 2007; Wilson, 2014). Less clear are the kinds of exposures that lead to negative outcomes. Exposure characteristics that define the initial requirements for a PTSD diagnosis (i.e., Criterion A) have been altered in each edition of the DSM, an evolution that demonstrates how the field of traumatic stress has wrestled with the question: “What qualifies as traumatic exposure?” DSM-III considered traumatic exposure as “a recognizable stressor that would evoke significant symptoms of distress in almost anyone” (American Psychiatric Association, 1980, p. 238). DSM-III-R indicated that a traumatic event is

“outside the range of usual human experience” and “markedly distressing to everyone” (American Psychiatric Association, 1987, p. 250). DSM-IV required that the “person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury or a threat to the physical integrity of self or others” and that the reaction “involved intense fear, helplessness, or horror” (American Psychiatric Association, 1994, 427–428³).

The definition of a traumatic event in the DSM-5 is considerably more restrictive, defining a traumatic event as “exposure to actual or threatened death, serious injury, or sexual violence in one (or more) of the following ways: (1) Directly experiencing the traumatic event(s), (2) witnessing in-person the event(s) as it occurred to others, (3) learning that the traumatic event(s) occurred to a close family member or close friend (in cases of actual or threatened death of a family member or friend, event(s) must have been violent or accidental), or (4) experiencing repeated or extreme exposure to aversive details of the traumatic event(s)” (American Psychiatric Association, 2013, p. 271). The DSM-5 specifically excludes previously considered forms of exposure through media (e.g., TV, radio, movies, pictures) unless such exposure is work related.

Direct and indirect exposure

The majority of the research on mass shootings has been done using the more expansive trauma definitions in the DSM-III, DSM-III-R, and DSM-IV, allowing investigators to look across a range of exposures in testing the dose-response model and to examine both direct and indirect exposure (e.g., DSM-5 excluded media exposure; Fallahi & Lesik, 2009; Haravuori, Suomalainen, Berg, Kiviruusu, & Marttunen, 2011). Direct exposure is experiencing an event first-hand by being a victim or by observing the event in person (e.g., being wounded, seeing others being killed or wounded, or observing the physical consequences and human suffering of others in the event aftermath; for a more in-depth understanding of direct exposure see Chapter 11 in this volume). Indirect exposure is experiencing consequences, depictions, and other elements of the event without being physically present at the site of the traumatic event (e.g., knowing someone who was killed or injured in a shooting, observing activities that unfold during or after a shooting [SWAT team response], or experiencing the event through media).

Research has sought to examine the impacts of both kinds of exposure on outcomes. For example, early research conducted following sniper attacks at an elementary school in 1984 examined associations between two exposure parameters – physical proximity to the shooting epicenter (i.e., direct exposure) and social proximity (e.g., closeness) to the deceased (i.e., indirect exposure) – and

outcomes. This research revealed a dose-response relationship between physical proximity to the shooting epicenter (interpreted as increasing direct life threat) and PTSS symptoms both cross-sectionally (Pynoos, Frederick, et al., 1987) and longitudinally (Nader et al., 1990), as well as a dose-response relation between social proximity to the deceased child and longitudinal grief reactions (Nader et al., 1990; Pynoos, Nader, Frederick, Gonda, & Stuber, 1987). Subsequent mass shootings research has also made distinctions between direct and indirect exposure (e.g., Littleton, Axsom, & Grills-Taquechel, 2009). Review of the broad mass-disaster literature suggests that both direct and indirect forms of exposure are relevant to the study of mental health outcomes (see Neria, Nandi, & Galea, 2008).

Mediators and moderators

While influential early studies of traumatic stress straightforwardly applied the dose-response model (Nader et al., 1990; Pynoos, Frederick, et al., 1987; Pynoos, Nader, et al., 1987), more recent research emphasizes pre- and posttraumatic factors that may moderate or mediate the dose-response relationship (see Brewin, Andrews, & Valentine, 2000; Layne, Warren, Watson, & Shalev, 2007; Ozer, Best, Lipsey, & Weiss, 2003; Silverman & La Greca, 2002). If an association between two variables depends on the level of a third variable, that third variable is a moderator. If the effect of one variable on another is due to a third variable that intervenes between them, then that third variable is a mediator (Baron & Kenny, 1986; see also Wheaton, 1985).

Studies of mass shootings do not usually examine moderation and/or mediation of events themselves, as suggested by Baron and Kenny (1986), because most studies of mass shootings collect data only from those who were exposed to the shooting, and thus exposure to the event is a constant. Studies limited to those exposed to traumatic conditions can provide suggestive evidence that can be interpreted by the logic of mediation or moderation (e.g., Bomyea, Risbrough, & Lang, 2012; Littleton, Grills-Taquechel, & Axsom, 2009; Schwarz & Kowalski, 1992). In addition, studies of those exposed to shootings can examine whether event characteristics (e.g., event type, exposure severity) are mediated or moderated by other factors (Brewin et al., 2000; Ozer et al., 2003). However, it is important to understand that in order to establish whether the effect of exposure itself is mediated or moderated by other factors, one must first estimate the effect of exposure, and that requires a sample of people who have not been exposed. Because most studies of mass shootings include data only from exposed respondents, and not from a comparison group, control group, or group of otherwise unexposed respondents, the ability of researchers to examine mediation and moderation of exposure is often seriously limited.

Challenges in Research Design and Theoretical Development

A number of theoretical frameworks have been applied to explain the effects of mass shootings, but little progress has been made in developing an integrative theory for how mass shootings cause psychological outcomes in survivors. Recent meta-analytic findings highlight the problem of lack of replication and the difficulty estimating aggregate effect-sizes in the current mass shootings literature (see Wilson, 2014). Most researchers studying mass shootings have focused on specific theoretical or applied questions, but they have not typically investigated alternate hypotheses in ways that could lead to a more comprehensive understanding of how traumatic experiences lead to pathogenic outcomes. The result is a collection of well-executed but theoretically disconnected studies that emphasize, for example, (1) peritraumatic processes (Kumpula, Orcutt, Bardeen, & Varkovitzky, 2011); (2) conservation of resources (Littleton, Axsom, et al., 2009); (3) social network interactions and coping appraisals (Smith, Donlon, et al., 2015); (4) emotion regulation (Bardeen, Kumpula, & Orcutt, 2013); (5) core belief alterations (Grills-Taquechel et al., 2011; Smith, Abeyta, et al., 2015); (6) gene-environment interaction influence on postshootings PTSS (Mercer et al., 2012).

Five other factors limit theoretical innovation and development in the mass shootings literature. First, sampling problems limit the generalizability of the findings in mass shooting studies. Specifically, mass shootings survivor samples are typically composed of respondents within a limited age range (e.g., children, adolescents, or emerging adults in the wake of shootings in schools or colleges). There have been some studies of shootings in places other than schools (e.g., Cafeteria shootings in Killeen, TX; North, Smith, & Spitznagel, 1994, 1997), allowing for examination of the effects of shootings on people at different points in the life course. However, because studies are not typically based on systematically collected and theoretically relevant data from adequate numbers of people of different ages, researchers who would like to consider developmental differences must make interpretations based on studies of different events, in different contexts, with different variables, and demographically different respondents.

Second is the related problem of there being few longitudinal studies of the psychological consequences of mass shootings. Without long-term follow-up research, and without consideration of developmental timing of events on long-term functioning, the effects of mass shootings cannot be fully known. For example, without following up with respondents who experience shootings during their college years, it is unclear whether such traumatic experiences impair the development of intimate relationships across the lifespan as argued on the basis of cross-sectional studies (e.g., Layne, Pynoos, & Cardenas, 2001). One notable strength in the mass shootings literature is the prospective studies

made possible by ongoing research studies started prior to shooting events that have allowed researchers to add a focus on pre- to postshooting functioning changes (e.g., Bardeen et al., 2013; Littleton, Axsom, et al., 2009).

Third, although some early psychological research on the effects of shootings employed clinical interviews (Pynoos, Nader, et al., 1987), the majority of studies in this literature rely solely on the use of self-reports of symptom inventories that provide continuous measures of PTSS, distress, depression, anxiety, and/or grief reactions. As a result, our knowledge of how trauma affects psychological outcomes is shaped to an unknown degree by problems of response bias and other measurement errors known to affect self-report measures (e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Reasons for this measurement strategy are based largely on challenges that are involved in conducting postshooting research: clinical interviews are expensive, time-consuming, and intrusive during a sensitive posttraumatic time in communities affected by mass shootings, compared to cheaper, less intrusive, easier-to-administer self-report surveys. Nonetheless, without more studies that employ clinical interviews, and more studies that include explicit validation of self-report measures, our knowledge of how traumatic events affect psychological functioning is and will remain limited.

Fourth, due to the dominance of the dose-response model, studies in the mass shootings literature typically include some form of exposure (e.g., physical proximity to shootings, social proximity to shootings, direct vs. indirect exposure, perceived peritraumatic threat) as part of model testing. However, many different operational definitions of exposure have been used in studies of mass shootings. In addition, it is not always clear why certain exposure features have been selected by researchers and others ignored. Research is needed to develop an empirically supported typology of exposure to guide researchers to design studies with comparable measures. Shootings and exposure contexts vary across a number of dimensions, as do the characteristics, backgrounds, social networks, and life circumstances of survivors and bystanders. It is unlikely that exposure has the same effects in every case, and thus, as noted above, it is important to investigate how shooting characteristics and victim characteristics moderate and/or mediate various kinds of exposure. We will be unable to understand these processes in a theoretically coherent way unless there is some consistency in the operational definitions of exposure.

Fifth, publication of null findings are nonexistent in the mass shootings literature, and thus, there is little systematic knowledge about variables and interventions that *do not* work (see Hopewell, Loudon, Clarke, Oxman, & Dickersin, 2009). This problem is linked to the issue of consistent operational definitions. Unless researchers can be fairly certain that they are investigating the same kinds of exposure as others have, then the meaning of a null result is ambiguous. A null finding could be theoretically significant and mean that some form of exposure has no impact in certain situations or among certain

kinds of victims, but it could just as well have little or no theoretical significance and simply mean that different operational definitions of exposure lead to different findings in different studies.

Conclusions

Our review of challenges in the study of mass shootings leads to three broad conclusions. First, previously applied definitions and frameworks may be too limiting and may stunt progress in understanding how shootings affect outcomes. Defining a mass shooting as a gun violence incident with four or more fatalities is clearly useful, but until we know that the restrictions built into the definition are meaningful in defining an incident that is distinctively traumatogenic, researchers should be wary of applying it in a rigid way. Similarly, defining psychopathological outcomes in terms of the DSM-5 definition of PTSD severely limits researchers to a narrow range of exposure, and in addition, restricts the definition of psychopathology to a single monotonic response. As an outcome, it is important that PTSD is understood for epidemiological, clinical policy and planning, and legal purposes. But unless it can be shown that exposures that violate PTSD Criterion A are truly not associated with negative psychological outcomes, and that subclinical symptomatology has little or no impact on psychological adjustment following a trauma, researchers interested in developing a full understanding of the impact of mass shootings should avoid the strict application of the PTSD diagnosis in their research designs.

Second, unless there is some consistency in the theoretical and operational definitions of key concepts, it will be difficult to make any theoretical progress. Although there seems to be some consensus on the meaning and operational definitions of the key outcomes in mass shootings research, the same cannot be said for exposure. Without an empirically grounded consensus on how to conceptualize and measure exposure, it will be difficult to build a body of findings that promotes the development and testing of theoretically productive hypotheses. This is also true of key factors hypothesized to mediate and moderate the effects of exposure. If each researcher conceptualizes and measures these factors differently, the results may be interesting and provocative without being theoretically informative.

Third, most studies of mass shootings have been designed quickly in the aftermath of events that no one could have predicted. With little time to plan, researchers have used procedures that could be implemented in a short period of time, have relied on samples that were relatively easy to collect in schools and colleges, and have employed data collection instruments with measures that were close at hand. In addition, while there have been prospective studies done with respondents already recruited for studies with another purpose,

there have been few longitudinal studies that could investigate issues of how traumatic events affect people going through different developmental stages in the life course. Researchers need to broaden the scope of their studies to examine more kinds of victims over longer periods of time. In addition, in view of the likelihood of future traumatic shooting incidents, some researchers should do prospective planning so that they are ready and able to do theoretically productive study when the opportunity arises.

Considering the frequency of mass shootings over the past three decades (Bjelopera et al., 2013), it is an unfortunate reality that the incidence of mass shootings is unlikely to significantly decline. Thus, social scientists will have opportunities to investigate these future traumatic shooting incidents and to add to a growing body of empirical evidence on how they affect the psychological adjustment among victims, bystanders, and those in their social networks. Although replication is important, it is also critical to generate knowledge that takes us beyond what we already know, and to do so in ways that facilitate the development of theoretical approaches that can complement and build upon one another in the service of promoting individual and community recovery.

Notes

- 1 The FBI (Federal Bureau of Investigation, 2008) defined mass murder as “(a) number of murders (four or more) occurring during the same incident, with no distinctive time period between the murders. These events typically involved a single location, where the killer murdered a number of victims in an ongoing incident” (p. 8).
- 2 For an overview of measures and issues in the assessment of PTSD and PTSS see <http://www.ptsd.va.gov/professional/assessment/overview/index.asp>
- 3 Criterion A is the same in the two versions of the DSM-IV.

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