

# COPING WITH DISASTERS

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Over the course of their lifetime, a substantial segment of the global population will unfortunately be exposed to a disaster. Disasters have sudden onset, typically affect large geographical areas, and can spread psychological distress to the immediate vicinity and beyond, with potential long-term ramifications for the mental and physical health of the population (Norris et al., 2002).

In this chapter, we discuss different categories of disasters and review common postdisaster psychological sequelae. We examine several risk and protective factors in the aftermath of disasters and consider the evidence base for several intervention strategies that have been designed and tested to assist survivors in coping with disaster exposure. We then present several research challenges to advancing the field beyond the current state. Finally, we conclude with our assessment of the future direction of this inquiry.

## DEFINITION AND DESCRIPTION

Definitions of what constitutes a disaster have varied in the literature and have been categorized according to the damage associated with the event (Baum, 1987), the duration of the event (Bolin, 1985), or the subjective psychological response to the event (Davidson & Baum, 1986). Some researchers have defined disasters as collective traumas (e.g., Pennebaker & Harber, 1993; Seery et al., 2008; Wayment, 2004), which include a wide variety of natural and manmade adversities that affect large segments of the population. Events such as natural disasters,

mass shootings, or terrorist attacks all qualify as disasters (Galea, Nandi, & Vlahov, 2005).

Disasters can be conceptualized according to four broad categories: natural (e.g., hurricane); human-perpetrated (e.g., terrorist attack); technological (e.g., nuclear power plant breach); and complex, in which an initial event, such as an earthquake, initiates a cascade of natural and manmade events. Exposure to these four types of disasters—both directly and indirectly via the media—is the primary focus of this chapter.

## Natural Disasters

A sizable portion of the world's population has been exposed to natural disasters such as earthquakes, tsunamis, floods, wildfires, hurricanes, mudslides, and tornadoes (Briere & Elliott, 2000). These events frequently result in severe physical destruction to infrastructure, with both psychological and economic consequences (Norris et al., 2002). For example, in 2011, 820 natural disasters caused 27,000 fatalities and approximately \$380 billion in loss and damages worldwide (Munich Re, 2012). In 2014 alone, the United States experienced eight weather- and climate-related disaster events that generated losses of more than \$1 billion per event and resulted in 53 deaths (National Centers for Environmental Information, 2015), with correspondingly high costs to human well-being (McMichael, Woodruff, & Hales, 2006).

## Human-Perpetrated Events

Human-perpetrated disasters, such as terrorist attacks and mass shootings, are uncontrollable, unpredictable

events carried out by individuals with a variety of malevolent goals. These violent events injure innocent and defenseless victims indiscriminately and brutally, often by shocking means. A 2012 Academic Consensus defined terrorism as a fear-generating tactic implemented for propagandistic and psychological motives (Schmid, 2012), frequently with political or ideological undertones, although not uniformly (Silver & Matthew, 2008). In 2013, it was estimated that there were almost 10,000 terrorist attacks worldwide, resulting in almost 18,000 deaths (Statista, n.d.). Similar to terrorist attacks, mass shooters typically and malevolently target innocent victims, although motives are often either for personal reasons or largely unknown. Estimates of mass shootings in the United States in 2014 totaled almost 300 (Shootingtracker, 2015) and, like terrorist attacks, they have been linked with posttraumatic stress (PTS) symptomatology and other psychological maladies in survivors (North, Smith, & Spitznagel, 1994).

### Technological Disasters

Like human-perpetrated malevolent events, technological disasters are human-caused, although they are typically a function of negligence or accident rather than a result of purposive pernicious intent. Examples of technological disasters include the Exxon Valdez oil spill and the nuclear breaches at Three Mile Island and Chernobyl; exposure to these events has been associated with a number of deleterious physical and mental health problems (Baum, Gatchel, & Schaeffer, 1983). For example, community-wide exposure to the Exxon Valdez oil spill was linked to increased substance use, health problems, anxiety, and symptoms of posttraumatic stress disorder (PTSD; Palinkas et al., 1993). A 20-year review of the effect of the Chernobyl nuclear disaster found a variety of adverse psychological consequences associated with exposure, including suicide and elevated symptoms of depression, anxiety, and PTS (Bromet & Havenaar, 2007).

### Complex Disasters

Modern disasters rarely occur in isolation: Typically, one event precipitates a cascade of manmade and natural events. These complex disasters can result in exponential psychological harm to those

exposed. For example, the 2011 Tohoku earthquake and tsunami in Japan led to a number of accidents at the Fukushima nuclear power plant. Independent of earthquake exposure, geographic proximity to the power plant was positively correlated with psychological distress such as PTS (Kyutoku et al., 2012). The 2010 8.8 magnitude Bio-Bio earthquake in Chile resulted in a tsunami and flooding that killed hundreds of people as a result of the government's failure to provide adequate warning, as well as days of subsequent looting in the regions closest to the epicenter. After the earthquake, those exposed to multiple events—particularly the tsunami—reported more symptoms of PTS, global distress, and functional impairment (Garfin, Silver, Ugalde, et al., 2014). Disasters such as these highlight the need to consider the potential compound effects of complex disasters.

### Indirect Exposure via the Media

Although collective traumas can have deleterious physical and psychological ramifications for those directly exposed, research over the past couple decades has demonstrated the important psychological effects of indirect exposure to these events via the media (e.g., Ahern et al., 2002; Holman, Garfin, & Silver, 2014). The effects of indirect, media-based exposure can be long-lasting (Silver et al., 2013) and may have cumulative effects over time (Garfin, Holman, & Silver, 2015). Moreover, in addition to these mental health consequences, media-based exposure to disasters has also been associated with physical health problems, such as cardiovascular disease (Holman et al., 2008). The effects of indirect exposure can be striking and far-reaching: After the September 11, 2001 (9/11), terrorist attacks, PTS symptoms were reported in representative samples of Americans across the country (Schlenger et al., 2002; Silver et al., 2002); 9/11-related PTS symptomatology was reported by school children as far away as London, England (Holmes, Creswell, & O'Connor, 2007).

### INCIDENCE AND PREVALENCE

It has been estimated that, “on average, a disaster occurs somewhere in the world each day” (Norris et al., 2002, p. 207), although it is impossible to

estimate the proportion of the population who will be directly exposed over a lifetime, given geographic differences in susceptibility to natural and technological disasters and the inherent unpredictability of human-perpetrated events. Moreover, estimates of the prevalence of postdisaster psychopathology and subthreshold symptoms of distress vary greatly as a function of the type and severity of the disaster, time since event, participant recruitment methodology and representativeness of the sample studied, measurement tool used, outcome variables assessed, and so on. In general, studies of responses to disasters tend to focus on several psychological outcomes: PTSD, acute stress disorder (ASD), depression, and anxiety. More important, although many symptoms of psychological distress abate over time, longitudinal studies have suggested that a minority of survivors experience distress for months and years after the event (e.g., McFarlane & Van Hooff, 2009).

### **Posttraumatic Stress Disorder and Posttraumatic Stress Symptomatology**

The most commonly studied postdisaster outcome is PTSD (Green et al., 1992). In addition to analyzing whether disaster survivors meet full diagnostic criteria for PTSD, many researchers have assessed partial or subthreshold PTSD (Lai et al., 2004) or have used continuous measures of PTS symptoms (Garfin, Silver, Ugalde, et al., 2014). Because self-report instruments such as the Posttraumatic Stress Disorder Checklist (Weathers et al., 1993) can calculate both probable-PTSD diagnoses and continuous measures of symptom severity, they have particular utility for postdisaster settings in which it may be necessary to capture a wide range of responses exhibited by an exposed population.

Despite the marked variability in PTSD prevalence rates, a substantial body of literature has found robust links between disaster exposure and posttraumatic stress symptomatology. For example, 18 months after the 2005 earthquake in Pakistan and Kashmir, a study of tent-dwelling individuals (who were likely highly exposed individuals who lost their homes) reported that 55% of women and 33% of men had PTSD (Naeem et al., 2011). A randomly selected sample of adults exhibited lower prevalence

rates (between 10% and 19%) after the 1999 Taiwanese earthquake (Lai et al., 2004), although a 60% response rate limits inferences because those either more or less distressed may have been differentially inclined to participate. More stringent survey techniques were used by obtaining a stratified random sample of participants 2 months after the 2004 Sumatra earthquake; results revealed lower PTSD prevalence rates: 12% of displaced and 7% of nondisplaced people met criteria for probable-PTSD (van Griensven et al., 2006).

### **Acute Stress Disorder**

ASD, which by definition occurs within the first month after a trigger event (American Psychiatric Association, 2013), is a frequent precursor to PTSD yet has been studied far less frequently because of the logistical challenges in conducting assessments soon after a community disaster. ASD may serve as a marker for subsequent PTSD and other forms of psychological distress (Bryant et al., 2012), although the utility of ASD to predict PTSD after traumatic events has been questioned (Bryant, 2007). Nevertheless, in postdisaster settings in which a large segment of the population is exposed to a traumatic event but not all will go on to develop PTSD, the presence of ASD may provide an indication of who should be observed over time for the development of longer-term problems and who should possibly be referred for specialized care. Although retrospective reports of ASD have been linked with postdisaster PTSD (Soldatos et al., 2006), unfortunately few disaster studies have implemented prospective designs using representative samples with assessments that occur within the required timeframe for ASD diagnosis. A study that began 9 days after the 9/11 terrorist attacks found that more than 12% of a nationally representative sample of individuals outside New York reported symptoms consistent with ASD (Silver et al., 2002). Another study that assessed acute stress symptomatology within 1 month of the Boston Marathon bombings among a nationally representative sample of Americans found that 4.46% of the sample reported acute stress symptoms; geographic proximity to the bombings was not a statistically significant predictor of outcomes (Holman et al., 2014).

## Depression

Studies have consistently found elevated rates of depression after natural (Norris et al., 2002) and human-caused (Ahern & Galea, 2006) disasters, as well as increases in related symptoms such as suicidal ideation and feelings of remorse (Warheit et al., 1996). Depressive symptoms can be evaluated using diagnostic criteria for major depressive disorder or through continuous measurement of symptom severity (Norris, 2006). After the 1988 Armenian earthquake, one study found that 22% of treatment-seeking individuals met criteria for major depressive disorder (Goenjian, 1993), although another study estimated a 52% prevalence rate (Armenian et al., 2002) after the same disaster. Differences in assessment instrument—the former study used clinical interviews and the latter used a questionnaire—illustrate the inherent difficulty in making cross-study comparisons given divergent assessment tools. This is especially concerning because some screening instruments have demonstrated low concordance rates in epidemiological studies (e.g., Eaton et al., 2000).

## Generalized Anxiety

Generalized anxiety is another commonly studied postdisaster outcome and is included in the literature both as a continuous measurement of symptomatology and less often as a full *Diagnostic and Statistical Manual of Mental Disorders* diagnosis of generalized anxiety disorder. High levels of anxiety have been observed among individuals exposed to many events, including after natural (Goenjian et al., 2000), technological (Loganovsky et al., 2008), and human-perpetrated (Ghafoori et al., 2009) disasters. Nonetheless, high anxiety does not necessitate a diagnosis of PTSD (van Griensven et al., 2006), so it is important for clinicians to consider postdisaster anxiety in addition to PTSD when evaluating and treating postdisaster outcomes. This may be especially relevant for symptoms of anxiety that do not meet full diagnostic criteria: Similar to depressive symptomatology, subthreshold symptoms of anxiety may nonetheless be problematic for disaster survivors, particularly in the early postdisaster period.

## RISK AND PROTECTIVE FACTORS AND MAJOR INTERVENTIONS

Research has indicated that characteristics of the individual (e.g., demographic indicators) and the event (e.g., manmade vs. natural disasters) can help explain variability in postdisaster responses. Once identified, these indicators can be used to inform targeted intervention efforts at both the individual and community levels. Evidence-based postdisaster interventions have evolved over time: at present, screen-and-treat community-based approaches that capitalize on extant structures (e.g., schools) and expanding technologies (e.g., smartphones) are particularly promising. In the sections that follow, we review key findings regarding these risk and protective factors and discuss the major interventions in this area.

### Risk and Protective Factors

To identify and treat survivors of disasters, studies using epidemiological, community, and clinical or convenience samples have sought to clarify factors that predispose people to increased distress in the postdisaster environment. This body of research has provided fruitful information on who may be more at risk for what kinds of problems after which disaster exposures.

**Demographic characteristics.** Demographic characteristics have been extensively studied as predictors of postdisaster outcomes: Lower socioeconomic status (e.g., Armenian et al., 2002; Caldera et al., 2001) and prior mental health difficulties (e.g., Silver et al., 2002) are relatively consistent predictors of negative postdisaster responses; ethnic differences have sometimes been obtained (Chu et al., 2006). In general, female disaster survivors report more severe symptoms than male survivors (Norris et al., 2002). One explanation for women's poorer outcomes is that women may interpret traumatic events differently than men (Norris et al., 2002) and may either experience events as more distressing or be more likely to endorse symptoms of distress when probed. Such effects may be especially prominent in cultures in which predisaster gender differences are more pronounced, a particularly

relevant consideration in international contexts. Nonetheless, gender differences are not universally indicated across all outcomes of maladjustment, and some differences do not favor men. For example, men are more likely to abuse alcohol after a disaster than are women (e.g., Dooley & Gunn, 1995).

Findings regarding demographic characteristics such as age and marital status have been less consistent. Three years after the 1999 Taiwanese earthquake, married individuals reported better quality of life than individuals who were not married (Wu et al., 2006), and 2 months after the 1987 Ecuadorian earthquake, single, separated, or widowed individuals were most likely to be distressed (Lima et al., 1989). Marital quality may be a likely factor contributing to these contradictory results (Norris & Uhl, 1993). Findings regarding age have also been mixed. In general, middle-aged adults exhibit worse outcomes than do younger or older adults, and older adults tend to be more resilient than younger ones (Thompson et al., 1993), although not definitively (Knight et al., 2000), and this may depend on the specific post-disaster outcome assessed (Scott, Poulin, & Silver, 2013).

**Event-exposure characteristics.** Distress responses are frequently correlated with severity of disaster exposure (e.g., Kiliç & Ulusoy, 2003; Phifer, 1990). It may be that subsequent stressors, which may occur either as a result of the disaster (e.g., relocation) or because of other factors in the individual's life (e.g., loss of a loved one to an unrelated illness), may be the mechanism whereby disaster experiences are intensified. Property loss (Chen et al., 2007), financial loss (Bland et al., 2005), and personal injury (Green et al., 1994) have all been correlated with adverse outcomes and may have cumulative effects over time (Garfin, Silver, Ugalde, et al., 2014). Events perpetrated or worsened by human negligence or failures may be more likely to elicit negative outcomes (Baum, 1987; Garfin, Silver, Ugalde, et al., 2014) because there may be a responsible party to blame, and blameworthiness has been identified as a factor that may exacerbate distress after negative life events (Hickling et al., 1999).

Nonetheless, linear relationships are not always observed. For example, shortly after the Boston

Marathon bombings, the amount of media exposure to the bombings was a stronger predictor of acute stress responses than was personal direct exposure to the attack (Holman et al., 2014). This variability highlights the empirically supported position that there is not one universal process for coping with undesirable life events (Wortman & Silver, 1989).

## Major Interventions

After a disaster, governments, humanitarian organizations, and concerned citizens often seek to help survivors cope with the physical and psychological damage associated with exposure to the event. Identifying evidence-based practices for promoting long-term recovery and adaptation that account for the wide variability in response to disasters has evolved over the past several decades, leading to improved treatments (Shalev, 2000).

**Early postdisaster interventions.** Debriefings, initially used in military settings to promote morale, involved having troops discuss their combat exposure (Shalev et al., 1998). In the early 1980s, as posttrauma distress gained increased attention, debriefing-type processes were used with a larger variety of populations exposed to traumatic events (Rose et al., 2009). The most prominent forms of debriefings were iterations of Critical Incident Stress Debriefing (Mitchell, 1983), which was originally designed to help first-responders and others routinely exposed to traumas through their work. In the 1990s, the Critical Incident Stress Debriefing method was expanded to encompass a wider framework referred to as Critical Incident Stress Management, which involves pre-incident preparations (e.g., educating those likely to be exposed about potential stressors), individual crisis support, distribution of information in the postdisaster environment, small-group interventions (in which participants discuss the traumatic event and their cognitive and emotional reactions), family support, and referrals to outside specialists for future assistance (Everly & Mitchell, 1999).

Despite their early popularity, debriefings and related interventions have not been consistently correlated with positive outcomes (Carlier, Voerman, & Gersons, 2000; Rose et al., 2009). In fact, reviews of the efficacy of single-session postdisaster

psychological debriefing—focusing on randomized controlled trials—have concluded that debriefings typically exhibit null effects or correlate with an increased risk of PTSD or other adverse outcomes and thus should not be used (McNally, Bryant, & Ehlers, 2003; Rose et al., 2009). The questionable efficacy of these early postdisaster psychological interventions highlights the importance of relying on empirical evidence in administering postdisaster aid rather than myth or intuition. Psychological outreach that uses a one-size-fits-all approach does not consider the marked variability in individual responses to traumatic events; indeed, a uniform prescription for a population may even have harmful effects.

**Intervention guidelines and recommendations.** The years after 9/11 led to a number of advancements in postdisaster psychological interventions (Watson, Brymer, & Bonanno, 2011). Federal agencies and international groups convened expert panels that led to the creation of guidelines for promoting postdisaster mental health. Generally, these recommendations focus on broadly aiding the community with essential services and psychosocial support rather than specific forms of psychological interventions. Key recommendations for promoting psychological health in the aftermath of a disaster include pre-disaster preparation plans, promoting safety and security of individuals and communities, involving the local community to build on preexisting capacities, supporting the community at multiple levels (e.g., social media campaigns, local cultural practices), and providing essential services such as shelter or information (Watson et al., 2011).

More generally, through expert consensus and a synthesis of empirical evidence, a set of five evidence-based principles have been generated to guide the design of early to mid-level postdisaster intervention efforts: (a) promoting a psychological sense of safety, (b) promoting calming, (c) promoting a sense of self-efficacy and collective efficacy over important outcomes, (d) promoting social connectedness, and (e) promoting hope for the future (Hobfoll et al., 2007). For example, providing disaster-related information and nonclinical social support can help survivors cope with the disaster's

immediate aftermath. Concrete assistance in the form of food, blankets, and advice may be especially helpful. It has also been recommended that these principles guide the design of individually targeted interventions as well as those that are community-based. Moreover, given the large number of people likely affected by a disaster, these principles should guide interventions that are available to a broader population than might typically receive psychotherapy in a disaster's aftermath.

Evidence has suggested that intervention efforts should be targeted toward specific populations, identified as at-risk, in temporally appropriate sequences (Watson et al., 2011). In addition, prevention policies that are practical and flexible should be implemented in preparation for a potential disaster. These law- and public-policy-related efforts should help mitigate potential harm from and additional exposure to disasters before they occur (e.g., making sure emergency plans are in place, building structures with appropriate integrity to withstand weather-related events). Secondary prevention is then delivered within days of the disaster.

Psychological First Aid (PFA; Vernberg et al., 2008) is an approach that embodies the aforementioned consensus recommendations. The primary goals of this early intervention are to promote the safety of survivors, reduce distress, focus on practical needs, and connect survivors with available services (Watson et al., 2011). PFA is designed to be delivered in the immediate postdisaster environment and involves tailoring psychosocial support to individual disaster survivors. Although PFA has not yet been rigorously scrutinized in randomized controlled trials, preliminary reports by PFA providers have been promising (e.g., Allen et al., 2010).

**Screen-and-treat approaches.** An ongoing problem for those seeking to promote psychological health in the wake of a disaster is how to identify those in need and match them with appropriate outreach and intervention. Indeed, our own research conducted in the immediate aftermath of the 2010 Chilean earthquake found that few individuals in a nationally representative sample used community-based psychosocial services made available to the general

population by the Chilean government in the post-disaster setting (Garfin, Juth, et al., 2014). If post-disaster services are not targeted to those most likely to need—and use—them, they are an inefficient expenditure of limited resources.

PFA and other forms of secondary prevention can help facilitate a screen-and-treat model of postdisaster psychosocial outreach, in which those exposed to a disaster are screened for a high likelihood of future distress (e.g., exhibit high acute stress symptomatology) within the first few weeks after the event; those deemed to be at-risk are then administered interventions (Watson et al., 2011). This model has gained increasing evidence in the empirical literature in a number of postdisaster contexts. For example, after 9/11, the Federal Emergency Management Agency allocated funds to Project Liberty in New York, which involved allocating mental health funding to local communities, generating service monitoring reports, creating print and electronic educational materials, and administering media campaigns that promoted the availability of resources. Specialized mental health professionals were also recruited and trained. Project Liberty offered short-term crisis counseling for those who sought it. Those seeking help for more severe problems were then screened and, if necessary, referred to more specialized care (e.g., psychiatrist, psychologist, social worker; Herman, Felton, & Susser, 2002). Follow-up evaluations of Project Liberty suggested general consumer satisfaction with the program (Jackson et al., 2006) and suggested that the screenings were helpful in identifying those in need of services (Donahue et al., 2006).

In the wake of the 2005 London bombings, the London Bombings Trauma Response Programme also implemented a screen-and-treat approach (Brewin et al., 2008, 2010). In this initiative, a screening team provided information to the public about available services and sought to gather information about those directly affected by the bombings. These individuals were then screened for potential psychopathology, and those endorsing potentially relevant symptoms were administered a longer clinical interview. Trauma-focused cognitive-behavioral therapy and eye movement desensitization and reprocessing were offered as

treatments. Research has suggested that the program was more effective at identifying potentially affected individuals than was self-referral alone (Brewin et al., 2008); treatment outcomes also appear to have been positive (Brewin et al., 2010).

Using a more stringent design, a randomized controlled trial conducted with Israeli trauma survivors in Jerusalem and the surrounding areas found the screen-and-treat approach to be effective at reducing PTSD symptoms (Shalev et al., 2012). Survivors were screened for acute stress symptoms, and those who met diagnostic criteria were then assigned to treatment. Cognitive therapy and prolonged exposure therapy were equally beneficial at the 5-month follow-up, and those in a wait-list control group also benefited from subsequent prolonged exposure (at the 9-month follow-up). Of note, this study found that individuals with subthreshold PTSD symptoms responded equally well with or without treatment, highlighting the fact that these PTSD interventions target abnormal—as opposed to normal—distress symptoms and should be administered to those who can best benefit from them.

**School-based interventions.** Although public outreach efforts such as those used in population-based screen-and-treat approaches are useful, reaching everyone in need of services in the aftermath of a disaster is obviously challenging. Using existing resources in a community (e.g., schools, religious centers) may bolster efforts to identify and provide services to those in need. Local schools can serve as a natural platform to administer aid to communities (Berger, Pat-Horenczyk, & Gelkopf, 2007) because they are geographically located within the afflicted community, and families naturally associate schools with safety and security (Kilmer & Gil-Rivas, 2010).

Moreover, preliminary work has suggested that school-based interventions may help alleviate distress in those exposed to a community disaster. For example, Wolmer, Hamiel, and Laor (2011) found that teacher-led interventions were associated with significant reductions in trauma-related symptoms in children exposed to continuous rocket attacks in Israel. After a disaster, it may also be useful to capitalize on preexisting resources within the community and school setting. Work by our research team

found that participation in a non–trauma-focused school-based intervention lessened the severity of psychopathology among elementary school children after the 2010 Chilean earthquake (Garfin, Silver, Gil-Rivas, et al., 2014). These findings suggest that preparing teachers and other education professionals with training in postdisaster screening and treatment might be a feasible and relatively low-cost way to prepare communities for future disasters (Seyle, Widyatmoko, & Silver, 2013).

**Technology as an intervention tool.** As the Internet and mobile devices gain increasing prominence in society, technology-based interventions may help reach larger segments of the population in predisaster and postdisaster environments. Technology might help increase disaster-related communications in a number of ways, for example, by using embedded global positioning in smartphones to communicate critical real-time information (e.g., first-aid practices, availability of shelter) to people in a disaster situation (Aten et al., 2011). Similarly, social networking sites can be used to relay information: Facebook was used to convey information about danger zones while the Virginia Tech shootings were occurring, and Twitter was widely praised for its ability to aid first responders after the 2010 Haiti earthquake. The Internet and mobile devices can also be used to promote primary prevention efforts so that people can increase their knowledge before a disaster occurs. Internet and mobile applications can be used to both screen and provide self-treatment when a large segment of the population is affected by a disaster.

Several investigators have evaluated the feasibility and efficacy of self-help interventions after disasters. One Internet-based intervention for adults exposed to the 9/11 attacks contained seven modules for a variety of conditions, including PTSD, depression, and drug and alcohol use (Ruggiero et al., 2006); results suggested that this type of intervention was workable and potentially useful in population-based settings. Internet-based interventions after Hurricane Ike also indicated promising results (Price et al., 2012). Although technological advances offer accessible, portable, easily transferable methods to reach those affected by disasters,

more rigorous research in postdisaster settings is needed for conclusive recommendations (Westmaas, Gil-Rivas, & Silver, 2011).

## EVIDENCE BASE FOR SUCCESS

Over the past four decades, numerous studies of various types of disasters have been conducted. Historically, the majority have used small samples and cross-sectional designs, but more stringent methods (e.g., longitudinal, prospective) with larger samples are becoming increasingly common, bolstering the extant knowledge base. In the sections that follow, we consider this evidence base for success.

### Natural Disasters

The 1972 Buffalo Creek flooding, which killed 125 people, precipitated the first formal empirical study of natural disasters (Lifton & Olson, 1976). After this event, survivors of the 1983 Ash Wednesday Australian Bushfires were studied longitudinally for more than 2 decades; psychosocial problems were evident in the short-term and, to a lesser degree, over the course of the life span (McFarlane & Van Hooff, 2009). In the 3 decades since Buffalo Creek, psycho-social outcomes have been studied in response to a variety of natural disasters, such as hurricanes, volcanoes, earthquakes, floods, wildfires, and tornadoes. Several review articles have concluded that although natural disasters have been studied widely, comparing across studies can be challenging because of variability in disaster severity, sampling designs, populations assessed, measurement instruments used, and temporal spacing of assessments (Bonanno et al., 2010; Neria, Nandi, & Galea, 2008; Norris, 2006). Nonetheless, despite the multiple moderators, the longitudinal evidence has indicated that recovery is normative for most disaster survivors (Bonanno et al., 2010). Yet for a minority, adverse effects are persistent (McFarlane & Van Hooff, 2009).

### Human-Perpetrated Events

Terrorism in Northern Ireland was the first to be extensively studied in the disaster literature. Although methodologically limited designs precluded strong inferences, this initial research

identified considerable psychological resilience among the populace, despite ongoing civil disorder (Curran, 1988). Since this early work, a large number of studies have examined psychological responses to terrorism among representative samples of the affected population. The majority of this work has focused on Israel (e.g., Gelkopf et al., 2012; Hobfoll, Canetti-Nisim, & Johnson, 2006), the Oklahoma City bombing (e.g., North et al., 1999), and, most prolifically, the 9/11 attacks (see Neria, DiGrande, & Adams, 2011; Silver, 2011). The epidemiological evidence has continued to demonstrate substantial resilience among the general population, although a substantial minority of individuals exhibit both acute- and long-term psychological effects, often exacerbated by preexisting risk factors, exposure to loss, and ongoing life stressors.

### Technological Disasters

The incident at Three Mile Island was one of the first technological disasters to be extensively studied in the disaster literature, with data suggesting that chronic stress levels associated with the event were linked with symptoms of PTS (Davidson & Baum, 1986). A number of studies after the Chernobyl disaster examined the long-term effects on those exposed, finding that even those evacuated as infants exhibited mild increases in mental health problems (Bromet et al., 2011). More recently, a study conducted after the 2010 Deepwater Horizon oil spill in the Gulf of Mexico found that exposure to spill-related stressors (e.g., parent's job loss, getting sick, concern over the environment) among children and adolescents was positively correlated with PTSD symptoms (Osofsky et al., 2016). Responses to this event were also associated with previous exposure to Hurricane Katrina, bolstering theories regarding cumulative effects of multiple types of disaster exposure (Garfin et al., 2015).

### Postdisaster Research Methodology

Conducting research on disasters entails a unique set of challenges. To obtain the most valid information, it is important to design longitudinal studies that include acute, short-term, and long-term assessments using standardized measures administered systematically to large and representative segments

of the population. However, many inquiries are hindered by logistical difficulties such as obtaining rapid ethics board approval, garnering sufficient funding in a truncated time period, making contacts in the field, accessing distressed or demolished communities, and recruiting participants who are engaged in managing the personal repercussions of the disaster or have relocated because of damaged or destroyed homes (Silver, 2004). Access to pre-disaster data facilitates the ability to detect change likely influenced by the disaster, yet such designs are rare (for exceptions, see Asarnow et al., 1999; Silver et al., 2002) and are often the result of researchers accessing a population enrolled in a study before the occurrence of the disaster. An additional challenge in the disaster literature is that those most at risk for problems (e.g., children, minorities, residents of poor communities) are often more difficult to access, enroll, and evaluate (Norris, 2006). For example, assessing individuals in developing countries is difficult because of the lack of cross-validation of psychiatric measurements, as well as the inherent challenges of accessing rural or displaced populations (Widyatmoko et al., 2011).

Longitudinal studies of probability-based samples are essential for making population-based estimates of postdisaster responses (Norris, 2006). Population-based sampling types that allow for strong inferences include census sampling (used more often in developed nations), in which an entire community is sampled, or purposive sampling (used in developing nations), which uses a quasi-random sampling technique that tends to yield samples with demographic characteristics closely matching those of the true population. Although the vast majority of assessments are still cross-sectional (Norris, 2006), and only a few studies have followed people for a decade or longer after the initial event (Green et al., 1994; Lazaratou et al., 2008), longitudinal research is increasing (e.g., van Griensven et al., 2006; Wang et al., 2000).

### FUTURE DIRECTIONS

Although the 9/11 terrorist attacks ushered in a great deal of research that has guided evidence-based interventions to minimize postdisaster

maladjustment (Watson et al., 2011), methodological limitations have precluded researchers' ability to endorse definitive recommendations for targeting specific populations most at-risk (Bonanno et al., 2010). In the future, postdisaster interventions will be tailored in recognition that many individuals experience distress in the immediate aftermath that will resolve naturally without formal psychological assistance (Norris, Tracy, & Galea, 2009). Psychologists and community members will acknowledge the enormous variability that occurs in response to disasters and will avoid pathologizing normal responses to these events.

Given the robust findings linking disasters to psychosocial problems that may persist long after the structural debris has been cleared, evidence-based policies will appropriately meet the short- and long-term needs of a distressed population. So as to maximize limited postdisaster relief funds, future research will identify populations most in need for services and identify the appropriate timing of service delivery. Public service announcements and social media campaigns will be designed to inform people about services, communicate that feelings of distress are normative, and encourage people to seek professional assistance if symptoms persist. Such efforts can then be parlayed into screen-and-treat approaches that will provide further aid to those at-risk for longer-term difficulties. In addition, because of an increasing body of research indicating that media-based exposure to a disaster can trigger a psychological response similar to that of direct exposure (Holman et al., 2014; Silver et al., 2013), interventions will target populations broadly and not be limited only to those areas geographically proximal to the disaster. Finally, those exposed to disaster cascades are additional at-risk populations who will be targeted with increased postdisaster outreach.

In the future, practice and research with disadvantaged populations, particularly in developing nations, will inform international humanitarian relief efforts, especially because disasters in developing countries tend to result in greater death, destruction, and economic hardship. Standardizing state-of-the-art instruments for use in the field and validating measures for use in international settings

are also on the horizon. More longitudinal studies will evaluate the potential for delayed-onset symptomatology and will examine the possible interaction between exposure to disaster and subsequent life stressors on psychological and physical health. Randomized controlled trials of community-based approaches to postdisaster mental health interventions will evaluate these emerging techniques. Future rigorous research will foster stronger evidence-based recommendations for community members, clinicians, and policy makers seeking to ameliorate the deleterious psychological consequences of exposure to disasters.

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