

Weighing the Costs of Disaster: Consequences, Risks, and Resilience in Individuals, Families, and Communities

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Summary

Disasters typically strike quickly and cause great harm. Unfortunately, because of the spontaneous and chaotic nature of disasters, the psychological consequences have proved exceedingly difficult to assess. Published reports have often overestimated a disaster's psychological cost to survivors, suggesting, for example, that many if not most survivors will develop posttraumatic stress disorder (PTSD); at the same time, these reports have underestimated the scope of the disaster's broader impact in other domains. We argue that such ambiguities can be attributed to methodological limitations. When we focus on only the most scientifically sound research—studies that use prospective designs or include multivariate analyses of predictor and outcome measures—relatively clear conclusions about the psychological parameters of disasters emerge. We summarize the major aspects of these conclusions in five key points and close with a brief review of possible implications these points suggest for disaster intervention.

1. Disasters cause serious psychological harm in a minority of exposed individuals. People exposed to disaster show myriad psychological problems, including PTSD, grief, depression, anxiety, stress-related health costs, substance abuse, and suicidal ideation. However, severe levels of these problems are typically observed only in a relatively small minority of exposed individuals. In adults, the proportion rarely exceeds 30% of most samples, and in the vast majority of methodologically sound studies, the level is usually considerably lower. Among youth, elevated symptoms are common in the first few months following a high-impact disaster, but again, chronic symptom elevations rarely exceed 30% of the youth sampled.

2. Disasters produce multiple patterns of outcome, including psychological resilience. In addition to chronic dysfunction, other patterns of disaster outcome are typically observed. Some survivors recover their psychological equilibrium within a period ranging from several months to 1 or 2 years. A sizeable proportion, often more than half of those exposed, experience

only transient distress and maintain a stable trajectory of healthy functioning or resilience. Resilient outcomes have been evidenced across different methodologies, including recent studies that identified patterns of outcome using relatively sophisticated data analytic approaches, such as latent growth mixture modeling.

3. Disaster outcome depends on a combination of risk and resilience factors. As is true for most highly aversive events, individual differences in disaster outcomes are informed by a number of unique risk and resilience factors, including variables related to the context in which the disaster occurs, variables related to proximal exposure during the disaster, and variables related to distal exposure in the disaster's aftermath. Multivariate studies indicate that there is no one single dominant predictor of disaster outcomes. Rather, as with traumatic life events more generally, most predictor variables exert small to moderate effects, and it is the combination or additive total of risk and resilience factors that informs disaster outcomes.

4. Disasters put families, neighborhoods, and communities at risk. Although methodologically complex research on this facet of disasters' impact is limited, the available literature suggests that disasters meaningfully influence relationships within and across broad social units. Survivors often receive immediate support from their families, relatives, and friends, and for this reason many survivors subsequently claim that the experience brought them closer together. On the whole, however, the empirical evidence suggests a mixed pattern of findings. There is evidence that social relationships can improve after disasters, especially within the immediate family. However, the bulk of evidence indicates that the stress of

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disasters can erode both interpersonal relationships and sense of community. Regardless of how they are affected, postdisaster social relations are important predictors of coping success and resilience.

5. The remote effects of a disaster in unexposed populations are generally limited and transient. *Increased incidence of extreme distress and pathology are often reported in remote regions hundreds if not thousands of miles from a disaster's geographic locale. Careful review of these studies indicates, however, that people in regions remote to a disaster may experience transient distress, but increased incidence of psychopathology is likely only among populations with preexisting vulnerabilities (e.g., prior trauma or psychiatric illness) or actual remote exposure (e.g., loss of a loved one in the disaster).*

Finally, we review the implications for intervention. There is considerable interest in prophylactic psychological interventions, such as critical incident stress debriefing (CISD), that can be applied globally to all exposed survivors in the immediate aftermath of disaster. Multiple studies have shown, however, that CISD is not only ineffective but in some cases can actually be psychologically harmful. Other less invasive and more practical forms of immediate intervention have been developed for use with both children and adults. Although promising, controlled evaluations of these less invasive interventions are not yet available. The available research suggests that psychological interventions are more likely to be effective during the short- and long-term recovery periods (1 month to several years postdisaster), especially when used in combination with some form of screening for at-risk individuals. Such interventions should also target the maintenance and enhancement of tangible, informational, and social-emotional support resources throughout the affected community.

Introduction

During the course of a normal lifespan, most people are confronted with any number of aversive events. Accidents happen, loved ones die, health gives out, money disappears, or property is damaged. These events can be distressing and, for some, debilitating. Fortunately, most people are usually able to survive isolated aversive events with no lasting psychological damage (Bonanno, 2004). But then, sometimes there are disasters. Disasters are bad events writ large. Although definitions vary (Quarantelli, 1998), disasters are most commonly conceptualized as natural or human-made events that cause sweeping damage, hardship, or loss of life across one or more strata of society. Disasters typically strike swiftly, but it can take years to recover from them.

The far-reaching impact of disasters can engender a range of psychological consequences (Raphael & Maguire, 2009). The big questions, though, are how bad can these consequences be, and for whom. Is it possible for people to survive a disaster without suffering lasting psychological damage, and if so, how many people are likely to be able to do so?

Answering these questions has proved surprisingly difficult. Studies of disasters encounter a number of formidable methodological obstacles, and as a result, the literature on disaster has struggled to present an accurate picture of their consequences. Indeed, somewhat ironically, the disaster literature has tended to minimize disasters' social-psychological scope while overestimating their psychological impact. It is not uncommon, for example, to read reports suggesting that many if not most people exposed to a disaster will develop posttraumatic stress disorder (PTSD). However, disaster studies often fail to consider other potentially more sweeping aspects of disasters' impact.

The minimization of the scope of a disaster occurs when the focus of inquiry is too narrow, emphasizing only specific aspects of mental or physical health outcomes. Despite the undeniably multifaceted nature of disaster, surprisingly little research has addressed its broader consequences. The vast majority of published studies on disaster have focused primarily on individuals and their reactions. Moreover, most of these studies have restricted their assessments almost exclusively to trauma reactions and most typically to PTSD (McFarlane, van Hooff, & Goodhew, 2009).

A historical perspective shows, however, that this limited focus was not always the case. As Raphael and Maguire (2009) noted, prior to the formal introduction of the PTSD diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders—third edition (DSM-III; American Psychiatric Association, 1980)*, previous research had “distilled the multiple and diverse stressors that may arise with disasters—life threat, loss and bereavement, dislocation, loss of resources” (p. 9). With the advent of the PTSD diagnosis, however, “the field . . . became almost overwhelmed by the evolving concepts of psychological trauma and traumatic stress as the principal paradigm” (Raphael & Maguire, 2009, p. 9). As a result, until relatively recently, the focus on PTSD has nearly engulfed all other considerations about the consequences and implications of disaster, including investigation of other patterns of outcome, such as a more gradual recovery trajectory and a pattern of stable healthy adjustment or resilience (Bonanno, 2004; Bonanno & Mancini, 2008).

Clearly, however, there is more to disaster than PTSD. Disasters can be shockingly lethal, often claiming the lives of hundreds if not thousands of people and spreading a wide web of loss and grief over a vast geographical range. Disasters often cause other types of losses beyond the death of loved ones, thus leading to more generalized states of dysphoria and depression. Disasters create long-term stressors that can instigate acute distress and anxiety and extract a general toll on the quality of everyday health and well-being, the insidious nature of which can produce or exacerbate health problems.

In addition, not everyone reacts to disasters the same way. The focus on dysfunction and psychopathology in the aftermath of potentially traumatic life events was largely fueled by the desire to understand disasters' psychological impact and to identify those who may be most vulnerable to developing adverse reactions so that intervention efforts could be targeted to those most in need. Although laudable, this research emphasis has tended to obscure the fact that most people exposed to

such events do not suffer enduring psychological dysfunction. Rather, many and often most people show clear evidence of resilience in the face of potential trauma (Bonanno, 2004). Although the stakes are often higher with disasters, the same basic patterns of distribution of dysfunction and resilience have been observed. In short, although many people are psychologically harmed by disasters, a great many people also manage to endure their consequences with minimal psychological cost.

Telescoping out further, disasters often impact broader domains that go well beyond the individual. Disasters affect the nature and structure of families. They impact the communities in which they take place, taxing their institutions and sometimes challenging their survival. The impact of a disaster can also ripple through larger segments of a society and sometimes alter the lives of people in remote regions far removed from the geographic loci of the event.

The opposite problem, the overestimation of a disaster's impact, occurs when researchers fail to apply adequate methodological constraints on their data. Disasters may impact many different aspects of life, and not surprisingly their study tends to cut across multiple investigative disciplines, including clinical, social, and developmental psychology; psychiatry; epidemiology; and sociology. As a result, the methodological character of disaster research has tended to vary greatly, and in some instances the quality of the empirical evidence has suffered.

A major limitation in many disaster studies is the reliance on convenience samples. Convenience samples generally do not adequately represent the exposed population but rather only those individuals willing or interested in participating in the research. In some cases, convenience samples have been found to estimate greater pathology than is found in community or population-based samples (e.g., Amato & Keith, 1991; Neria et al., 2007). In addition, convenience samples may have a restricted range and underestimate variability in postdisaster functioning.

Another instance of this problem occurs when researchers report wildly disparate conclusions about the prevalence of psychological dysfunction based on arbitrary cutoff points for disorders. For example, in one study researchers assessing adolescents 6 months after exposure to a Category 5 hurricane (Hurricane Mitch) developed their own "empirically derived" cutoff scores for PTSD and depression (Goenjian et al., 2001). On the basis of these cutoffs, the authors concluded that in the most devastated areas 90% of their subjects had met criteria for PTSD and that 81% met criteria for major depressive disorder. If these proportions were taken at face value, we would have to conclude that the vast majority of adolescents with severe levels of exposure to a hurricane suffer extreme mental duress. Such a dire situation appears highly unlikely, however, when we consider other research that has documented markedly reduced levels of disorder. Another study of children exposed to a Category 5 storm (Hurricane Andrew) used an alternative marker of PTSD based on the prevalence of symptom clusters and reported rates similar to other trauma research: 39% of the children

residing in the areas directly affected by the storm met probable PTSD criterion within the first 3 months of the disaster, whereas 18% met PTSD within 10 months of the disaster (La Greca, Silverman, Vernberg, & Prinstein, 1996). However, other studies have reported exceptionally low levels of PTSD. Another study of children in the aftermath of a Category 4 storm (Hurricane Hugo) estimated the prevalence of PTSD in the sample at only 5% (Shannon, Lonigan, Finch, & Taylor, 1994). Of course, the level of disaster exposure and other related factors account for some of the differences in the prevalence of psychopathology across studies (Hoven, Duarte, & Mandell, 2003; La Greca & Prinstein, 2002; Norris & Elrod, 2006; Norris, Friedman, Watson, Byrne, & Kaniasty, 2002). However, even with these factors taken into consideration, such far-ranging discrepancies speak loudly about the methodological limitations of the literature.

In our review, we have attempted to summarize the broad and sweeping costs and consequences of disasters while honoring the potential methodological challenges and limits of the evidence. We begin by reviewing the psychological consequences for individuals. Then, in sequence, we consider the psychological consequences for families, communities, and people in areas geographically remote from the disaster. We also devote considerable space in this review to risk and resilience factors. Throughout our review, we emphasize the quality of the research evidence when formulating our conclusions. We have attempted as much as possible to consider all available research evidence. However, given the voluminous literature on disaster, we found it necessary to selectively weight evidence from those studies that we deemed to be most methodologically sound. Specifically, we allotted the greatest conceptual weight to research that used either multivariate analyses of predictor and outcome measures or prospective designs that accounted for predisaster and postdisaster functioning. On the basis of our review of these studies, we propose five key points, each summarized in a separate section. We conclude with a brief set of implications for psychological intervention in disasters' aftermath.

Disasters Cause Serious Psychological Harm in a Minority of Exposed Survivors

Because the literature on individual reactions has dominated disaster research, this section is the largest in our review. To address the narrow scope of most previous reviews (for a noteworthy exception, see Norris & Elrod, 2006; Norris, Friedman, Watson, et al., 2002), we considered a wide range of individual responses, including PTSD, grief, depression and anxiety, suicide and suicidal ideation, substance abuse, and stress-related health problems. Disasters consistently produced elevations across each of these indices. Importantly, however, serious psychological and physical impairment was almost always observed in only a minority of the exposed population—rarely more than 30% of the sample and typically at lower percentages.

PTSD

Observations about the traumatic nature of disasters and other highly distressing life events are peppered throughout written history (Shay, 1991). In his 17th century diary account of the Great Fire of London, for example, famed memoirist Samuel Pepys described moments of acute fear, distress, and horror; anxieties about his and his family's safety; and as late as 6 months after the disaster, enduring trouble sleeping because of "great terrors of fire" (Daly, 1983, p. 66). For the most part, however, historical descriptions of highly aversive events focused primarily on the physical or medical aspects of trauma (Lerner & Micale, 2001). It was not until the late 19th century that formal theories first began to appear explicitly linking violent or life-threatening events with psychological dysfunction (Ellenberger, 1970; Lamprecht & Sack, 2002). Theoretical progress was slow, however, as controversy lingered about the nature and causes of trauma-related symptoms. Early observers of trauma were uncertain whether psychological symptoms were best explained as a response to the threatening nature of the event or as a by-product of physical injury, as for example in Erichsen's (1867) concept of "railway spine." The rise of the insurance industry, in the late 19th century, led to suspicions that trauma symptoms were due to secondary economic gain or malingering (Lamprecht & Sack, 2002; Lerner & Micale, 2001). Concerns about malingering were especially prominent in the context of war, as were associations between trauma and personal weakness (Kardiner, 1941; Shepard, 2001). When viewed through the lens of the psychoanalytic framework, which dominated psychological theorizing in the early 20th century, trauma-related dysfunction was explained as a form of personal "neurosis" (Adler, 1945; Kardiner, 1941) rooted in conflict or excessive dependency in the survivors' upbringing (Fairbairn, 1943; Lidz, 1946), repressed aggressive impulses (Rickman, 1941; Stengel, 1944), an unconscious death instinct (W.W. Roberts, 1943), and even latent homosexuality (Kris, 1944).

Midway into the 20th century, the convergence of evidence gradually led to consensus that extremely aversive events by themselves could be a primary source of psychological trauma. Medical evidence began to accumulate illustrating the corrosive impact that extreme stress can exert on normal human functioning (Selye, 1956). In addition, the century's two great global wars brought increasing awareness of the difficulties of the soldier's experience of combat (Keegan, 1976). These developments culminated in 1980 with the publication of the *DSM-III* and the formalization of PTSD as a legitimate diagnostic category (American Psychiatric Association, 1980) that captured extreme and debilitating trauma reactions.

The advent of the PTSD diagnosis promoted a surge of new research on traumatic stress (McNally, 2003) and led to marked advances in understanding of the etiology, neurobiology, and treatment of extreme trauma reactions (Brewin, Andrews, & Valentine, 2000; Dalgleish, 2004; Foa & Rothbaum, 1998; Ozer, Best, Lipsey, & Weiss, 2003). Although much of the initial PTSD research pertained to combat stress, the diagnosis

also greatly influenced research with civilian populations and, as we noted earlier, quickly superseded all other approaches to the study of disaster (Raphael & Maguire, 2009).

Several decades of PTSD research has led to a number of important conclusions about the nature of potentially traumatic life events. Most notably, although the majority of people experience at least one and often several potentially traumatic events during the course of their lives and most exposed people experience transient symptoms of traumatic stress, only a relatively small subset, usually around 5% to 10%, typically develop PTSD (Breslau, Davis, Peterson, & Schultz, 2000; Copeland, Keeler, Angold, & Costello, 2007; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Norris, 1992). Of course, the proportion of PTSD in any sample will vary depending on the type and degree of trauma exposure and a range of other risk and protective factors. When trauma risk is high, the prevalence of PTSD also tends to be higher. However, as we illustrate later, even at the highest levels of immediate trauma exposure, the proportion of any sample to develop PTSD rarely surpasses a ceiling of approximately 30% (Bonanno, 2005). Occasionally, trauma researchers report exceptionally high levels of PTSD, exceeding 50% of the sample and sometimes even greater. However, in almost all instances, these studies have serious methodological limitations, such as small samples, lenient cutoff points for pathology, or biased sampling procedures. Although the methods and measures used to assess PTSD in disaster research vary greatly, for the most part the literature indicates that the prevalence of PTSD conforms to a similar distribution as other types of potential trauma and rarely exceeds the 30% ceiling (Neria, Nandi, & Galea, 2008).

Children appear to be more vulnerable than adults to developing PTSD following disasters (Norris, Friedman, Watson, et al., 2002), but note that less research has been conducted on disaster-related PTSD among children (La Greca, Silverman, Vernberg, & Roberts, 2002) and the available research evidences even greater methodological variability than the adult literature. Not surprisingly, the prevalence rate for PTSD in children has varied considerably (Hoven et al., 2003). Consequently, it is difficult to estimate the rates of PTSD given widespread differences across studies in the assessment measures, ages of the youth assessed, timing of the postdisaster assessment, type and severity of the disaster, and sample selection procedures, among other issues (Silverman & La Greca, 2002).

In a rare epidemiological study, Copeland and colleagues (2007) assessed posttraumatic stress symptoms and exposure to potentially traumatic life events annually for up to 8 years among a large, representative sample of children in western North Carolina. Although rates of exposure to potential traumas, including natural disasters (11%) and fires (6%), were not uncommon in this sample, the prevalence of PTSD was surprisingly low and considerably lower than typically reported in disaster studies with children and adults (La Greca et al., 2002; Norris, Friedman, Watson, et al., 2002). It is not known, however, to what extent the youth were directly exposed to

disasters or whether the disasters were of high or low impact. One might argue that it is less meaningful to estimate the prevalence of PTSD in a general population than in a cohort of youth more directly exposed to traumatic events (J.A. Cohen & the Work Group on Quality Issues, 1998).

The results of cohort studies have also varied. For example, a survey conducted among French school children 9 months after exposure to a large-scale industrial disaster indicated exceptionally high proportions of PTSD, ranging as high as 44.6% in older children (Godeau et al., 2005). Closer inspection of the methods used in this study indicated too liberal a cutoff point for PTSD. The design of the study included a large comparison group of older children from a different geographic area assessed using the same instrument and cutoff point for PTSD. Although these children had no direct exposure to the disaster, their PTSD prevalence was also exceptionally high at 22.1%. When the prevalence rates in the exposed groups are adjusted for this baseline, they drop to levels similar to those observed among other high-exposure disaster samples.

In general, across a wide range of disasters, community studies indicate that elevated symptoms of PTSD are common among youth during the first few months following a high-impact disaster and that symptoms decline over the first year or more postdisaster (Chen & Wu, 2006; La Greca et al., 1996). Among studies with a longer postdisaster time frame (12 months or more), it is rare to see significantly elevated PTSD symptom severity or probable diagnoses of PTSD that exceed 30% of the youth sampled.

Depression and anxiety

Disasters cause harm, destroy property, and disrupt survivors' lives in myriad ways. The sweeping devastation can produce in survivors many of the symptoms typically associated with mood disorders: sense of loss, helplessness, fatigue, and withdrawal. Not surprisingly, disasters have been consistently linked to elevated depression in both children and adults (Bolton, O'Ryan, Udwin, Boyle, & Yule, 2000; Goenjian et al., 1995, 2001; Hoven et al., 2003; Kar & Bastia, 2006; North et al., 1999; Rehner, Kolbo, Trump, Smith, & Reid, 2000; Roussos et al., 2005; Shore, Tatum, & Vollmer, 1986; Staab, Grieger, Fullerton, & Ursano, 1996), especially in the aftermath of disasters that involved significant loss of life. Stressors caused by disasters have also been consistently associated with increased anxiety-related pathology across age groups (Kar & Bastia, 2006; La Greca, Silverman, & Wasserstein, 1998; Lonigan et al., 1991; McFarlane, van Hooff, & Goodhew, 2009; Shore et al., 1986; Udwin, Boyle, Yule, Bolton, & O'Ryan, 2000; Weems et al., 2007).

Given the traumatic nature of disaster, we might question whether these are truly depressive and anxiety reactions. Mood and anxiety disorders often occur together. In the context of disaster, depression and anxiety are often comorbid with PTSD. Perhaps depression and anxiety symptoms are simply the by-product of a more general trauma reaction. Common sense suggests this is not likely to be the case; even without the

experience of trauma, there is plenty about which to be depressed or anxious. Indeed, the empirical evidence appears to support the independent nature of depression and anxiety reactions to disaster.

Consider, for example, the 1989 Exxon Valdez oil spill disaster off the coast of Alaska (Palinkas, Petterson, Russell, & Downs, 1993). We usually think of oil spills as ecological disasters, rather than traumas, because, typically, oil spills do not meet the usual criterion for a potentially traumatic event (American Psychiatric Association, 2000). This fact was true of the Exxon Valdez spill as well. The disaster did not place survivors in immediately serious physical danger, and most survivors in the area did not believe that the spill created immediate risks to their personal safety.

Nonetheless, the Exxon Valdez spill dramatically and adversely impacted the surrounding community. The spill took place near a relatively rural coastal community of native and nonnative Alaskans. The local fishing industry, a primary source of livelihood in the area, was threatened. The influx of cleanup crews, news media, and other outsiders increased the population, introduced new stressors and conflicts, and taxed community resources and services. Visits to community health clinics also increased dramatically in the disaster's aftermath, perhaps in part as a result of concerns about possible toxic aftereffects.

When people living in the geographic area that was exposed to the Exxon Valdez spill were compared with a group of nonexposed Alaskans from a nearby geographic region, an interesting pattern emerged (Palinkas, Petterson, et al., 1993). Levels of depression and anxiety mapped neatly onto level of disaster exposure. The relationship was linear: the more exposure, the more depression and anxiety. PTSD was also elevated in the sample. However, PTSD criterion symptom levels were only evident in the most severely exposed groups, suggesting a more skewed relationship to exposure. People with the greatest degree of exposure (property damage, participation in cleanup, direct contact with the oil spill, etc.) were almost four times as likely to have generalized anxiety disorder, nearly three times as likely to have PTSD, and almost twice as likely to be depressed compared with the nonexposed people. For the moderately exposed people, however, depression and anxiety were still high, but like nonexposed individuals, the moderately exposed group had almost no threshold-level PTSD.

Perhaps some of the exposed people were suffering from depression or anxiety before the oil spill? This question is difficult and reveals a recurrent problem that runs across virtually all investigations of disaster: how to tease apart reactions to an event from preexisting levels of adjustment. We can almost always count on the fact that at least some of the people who struggle with distress and depression after a disaster were struggling with distress and depression before the disaster. So how then do we distinguish preexisting conditions from reactions specific to the disaster? One solution would be to simply ask people how they were doing prior to the disaster. Unfortunately, recall of past psychological states is often plagued by inaccuracies. It is well-established that people's memories for

past emotional states, including psychological symptoms, depend in part on how they are functioning at the time of recall (Levine & Safer, 2002; Levine, Whalen, Henker, & Jamner, 2005). People who are suffering from dysphoric states at the time of recall are more likely to overremember past dysphoric states (Safer, Bonanno, & Field, 2001). The same has been found to be true of anxiety-related states (Safer, Levine, & Drapalski, 2002).

Fortunately, solid evidence for the increase in depression and anxiety after exposure to disaster has been generated in prospective research that accounted for preexisting levels of pathology. For example, Ginexi, Weihs, Simmens, and Hoyt (2000) examined predisaster and postdisaster interview data from a state-wide sample of Iowa residents following the 1993 Midwestern floods. Prospective group analyses indicated that the degree of exposure to the flood produced small but significant increases in postdisaster depressive symptoms and depression diagnoses.

Prospective evidence for the link between disaster exposure and increases in anxiety-related pathology has also been found. Dirkzwager, Kerssens, and Yzermans (2006) examined psychological problems reported to family practitioners before and after a Dutch fireworks disaster. Exposed children had significantly greater increases in reported psychological problems over time compared with nonexposed children. The increases were most prominently related to sleep problems among younger children but tended to focus on anxiety-related problems among adolescent survivors. Two additional studies of children that used predisaster and postdisaster prospective designs also found increases in youths' generalized anxiety levels in early months following exposure to severe hurricanes (La Greca et al., 1998; Weems et al., 2007). The degree of hurricane exposure in these studies was related to children's postdisaster anxiety levels, even when predisaster anxiety was controlled.

Prolonged and traumatic grief

An unfortunately common consequence of disaster is the large-scale loss of life (Norris & Wind, 2009). Under normal circumstances, the death of a close friend or relation results in intense sadness, dysphoria, and intrusive preoccupation with the lost loved one as well as transient cognitive disorganization, health problems, and impaired role functioning (Bonanno & Kaltman, 1999, 2001). Most bereaved people experience these reactions to only a mild or moderate degree and remain or return to preloss levels of functioning relatively soon after a loss (e.g., Bonanno, Moskowitz, Papa, & Folkman, 2005; Bonanno, Wortman, et al., 2002). A subset of bereaved individuals, usually between 10% and 15%, will suffer more enduring grief reactions (Bonanno & Kaltman, 2001; Lichtenthal, Cruess, & Prigerson, 2004), alternatively referred to as *traumatic* (Boelen, van den Bout, & de Keijser, 2003) or *complicated grief* (CG; Lichtenthal et al., 2004). Although available findings on youths are sparse, recent studies that followed offspring of parents who died suddenly by suicide, accident, or

natural causes over a 2-year period suggest a similar bereavement pattern (Brent, Melhem, Donohoe, & Walker, 2009; Melhem, Walker, Moritz, & Brent, 2008).

Only a small number of disaster studies have examined loss-related psychopathology, but the available data support an association between violent loss and both depression and PTSD (Fullerton, Ursano, Kao, & Bharitya, 1999; Goenjian et al., 2005; Wickrama & Kaspar, 2007). Survey data from a probability sample of the New York metropolitan area conducted 5 to 8 weeks after the September 11th, 2001, terrorist attack showed that among New Yorkers who lost loved ones in the attack, 17.8% met criteria for major depression and 11.3% also met criteria for PTSD (Galea et al., 2002). A later study showed, however, that among New Yorkers who lost a loved one and also witnessed the attack in person, thus exposing them firsthand to the violent nature of their loss, the proportion with PTSD rose to 31.3%, the highest for any type of exposure recorded in the study (Bonanno et al., 2006).

Recent studies have also reported an elevated prevalence of CG among people who have lost loved ones in disasters. In a study that involved survivors of loved ones lost in the September 11th attack, for example, approximately half of the bereaved participants who met criteria for CG did not meet criteria for any other category of psychopathology (Bonanno, Neria, et al., 2007). A recent study of Norwegians who lost first-degree family relations to the 2004 tsunami in Southeast Asia also confirmed the independence of CG reactions (Kristensen, Weisaeth, & Heir, 2009). Among those who lost family in the tsunami but were not directly exposed to the disaster (i.e., not in Asia at the time of the disaster), a small proportion (14.3%) developed CG. In another smaller sample of Norwegians who lost family and were themselves directly exposed to the dangerous waves of the tsunami, CG was almost twice as prevalent in the loss-exposed group (23.3%). Similar to the findings of Bonanno, Neria, et al. (2007), approximately half of the bereaved with CG did not meet criteria for other kinds of psychopathology.

Secondary grief reactions

By virtue of their capacity for large-scale destruction, disasters can potentially send ripples of grief through the exposed community. In many cases, disaster survivors may react strongly to the sheer magnitude of death and destruction and the seemingly ubiquitous grief of other survivors. We refer to this phenomenon as *secondary grief reactions* (Baker, 1997).

A likely marker of secondary grief reactions is the overall death toll of the disaster. However, disaster death tolls vary greatly depending on a mix of factors, such as population density, type of physical structures involved, and type of disaster. Earthquakes, which have consistently been among the deadliest of natural disasters, illustrate this variability. For example, the 1994 Northridge earthquake in California, one of the costliest earthquakes in modern history in terms of economic damage, resulted in a relatively circumscribed loss of life (Tierney, 1997). The famous San Francisco earthquake of 1906

physically destroyed a significant proportion of the city's buildings and claimed an estimated 2,000 to 3,000 lives (U.S. Geological Survey, 2009). By contrast, in 2005 an earthquake in a relatively sparsely populated mountain region in the Kashmir district of Pakistan claimed an estimated 80,000 lives, and the 2008 Wenchuan earthquake in Sichuan Province, China, is estimated to have exceeded this total. Probably the deadliest earthquake of the 20th century occurred in 1976 in the area of Tangshan, Hebei Province, China, and killed a staggering quarter of a million people.

The deadly impact of massive flooding shows a similar variability. Possibly the worst flooding disaster in recent history occurred in 1931 when the Huaihe and Yangtze River basins in China were jointly overwhelmed and combined to claim nearly 400,000 lives (Zhang & Liu, 2006). Owing to its unique geography, the Yangtze floods with some regularity. In 1954 another disastrous flood killed 37,000 people. Since that time, various control and flood management efforts have dramatically reduced the death toll. However, despite the management efforts, floods along the Yangtze have become even more frequent (Yin & Li, 2001) and continue to claim between 1,000 and 7,000 lives annually (Zhang & Liu, 2006). Flooding that resulted from the 2004 tsunami in Southeast Asia killed an estimated 225,000 to 275,000 people throughout the region.

An important question across these events is how the total loss of life in a disaster might affect individual survivors. The available data clearly suggest a direct relationship between overall death toll and individual-level psychopathology. In the study of survivors of the 2004 tsunami, mentioned earlier, the total number of deaths of family members, close relatives, and neighbors reported by mothers was significantly correlated with both depression and PTSD symptoms in children (Wickrama & Kaspar, 2007). In a meta-analysis of 18 disaster studies, Rubonis and Bickman (1991) showed that after controlling for methodological factors (e.g., measurement type, sampling strategy) and disaster characteristics (e.g., natural versus human cause), the number of deaths associated with disasters explained a striking 20% of the variance in a composite measure of disaster-related psychopathology.

Suicide and suicidal ideation

The hopelessness, despair, and grief that often result from disasters sometimes lead survivors to suicide. Not surprisingly, a number of disaster studies have reported what appear to be elevated rates of both suicide and suicidal ideation (Mortensen, Wilson, & Ho, 2009; Vehid, Alyanak, & Eksi, 2006). However, in the absence of baseline data, it is difficult if not impossible to gauge these effects or to tease them apart from preexisting conditions and vulnerabilities. Fortunately, several large-scale prospective disaster studies included measures of suicidality.

Somewhat surprisingly, these studies indicate no overall increase in suicide following either natural or human-induced disasters. In a comprehensive study of change in suicide rates, Krug and colleagues (1998, 1999) examined suicide prevalence before and after all natural disasters declared as federal

disasters in the United States over a 4-year period. Their analysis included data from almost 20 million people and indicated no significant disaster-related increases in suicide. Comparable findings were also reported in a population-based study of suicide in Los Angeles County during the 3 years prior to and 3 years following the Northridge earthquake (Shoaf, Sauter, Bourque, Giangreco, & Weiss, 2006). Again the disaster did not result in an increase in suicides in the geographically exposed population. Similarly, no increase in suicide was detected after the September 11th terrorist attack in New York City (Mezuk et al., 2009).

Although disasters do not reliably increase suicide levels in the exposed population, it is important to acknowledge that survivors do sometimes contemplate suicide after disasters. Among adolescent survivors from schools damaged in the 1999 Marmara earthquake in Turkey, 16.7% reported suicidal ideation (Vehid et al., 2006). Predictably, thoughts of suicide were significantly greater among students who suffered greater earthquake exposure or loss.

Prospective research has also shown that preexisting depression or suicidal ideation places people at risk for increased suicidal ideation after disaster. In a prospective population-based study of suicidal ideation among adolescents following Hurricane Andrew, analyses controlling for demographic variables and hurricane stress indicated that suicidal ideation prior to the hurricane was directly predictive of posthurricane suicidal ideation (Warheit, Zimmerman, Khoury, Vega, & Gill, 1996). Prehurricane suicidal ideation also mediated the links between prehurricane depression and posthurricane suicidal ideation. These findings strongly suggest that people already struggling with depression and suicidal thoughts prior to a disaster are at risk for greater suicidal tendencies after the disaster.

Substance abuse

Traumatic life events in general have been associated with increased substance use; however, these effects are typically more pronounced among those who develop PTSD compared with exposed individuals who do not develop PTSD (e.g., Breslau, Davis, & Schulz, 2003; Feldner, Babson, & Zvolensky, 2007). A similar but more complex pattern appears to characterize the findings on substance use or abuse and disaster. Disasters tend to increase the use of substances, such as alcohol, tobacco, and drugs, but typically only for people who were already users prior to the disaster (Nandi, Galea, Ahern, & Vlahov, 2005; van der Velden & Kleber, 2009).

Scant research on substance use among youth affected by disasters or terrorism exists, even though adolescence is the key developmental period for the initiation of substance use. Available evidence tentatively suggests that disasters may lead to increased substance use among adolescents. In a large-scale survey of New York City school children 6 months after the World Trade Center attacks of September 11th (Hoven et al., 2005; Wu et al., 2006), elevated rates of alcohol abuse and dependence were observed among youth who were most

directly exposed to the disaster. At 18 months after the attacks, a survey of adolescents attending schools nearest the World Trade Center suggested a strong relationship between disaster exposure and substance use (Chemtob, Nomura, Josephson, Adams, & Sederer, 2009). Controlling for demographics and symptoms of depression and PTSD, adolescents with one exposure risk factor reported a 5-fold increase in substance use, and those with three or more exposure risk factors reported a 19-fold increase in substance use. Although provocative, these findings are based on adolescents' retrospective recall of substance use and require further investigation using prospective research designs.

Injury-related health problems

Disasters can lead to serious physical health costs. However, the relationship between physical health and disaster is far from simple. Like trauma more generally, disaster can impact health in at least two distinct ways. The first source of impact is through direct physical insult and injury. Among the most hazardous natural disasters are earthquakes and weather-related phenomena. Literally hundreds of thousands of earthquakes take place each year. Most are small or occur in remote areas and have little direct impact on humans. However, approximately 3,000 earthquakes happen each year in populated areas, and on average, 21 produce disaster-level consequences, including death and traumatic injury (Ramirez & Peek-Asa, 2005). Hurricanes, tornados, and other weather-related disasters can be equally dangerous, often resulting in traumatic injuries as well as frequent minor injuries, with the most common being lacerations, blunt trauma, and puncture wounds (Shultz, Russell, & Espinel, 2005). Terrorist bombings may cause distinctive patterns of injury such as eardrum perforation (Pahor, 1981; Turegano-Fuentes et al., 2008).

A common health hazard of human-made disasters is the release of disease agents or noxious substances, which is often the case in large-scale terrorist attacks, as was poignantly illustrated in the 1995 sarin gas attack on the Tokyo subway system. Tokyo is a densely populated city with an extremely active system of commuter subway lines. In 1995, a religiously motivated cult, Aum Shinrikyo, released sarin gas into five subway cars on three different subway lines in an act of domestic terrorism. Sarin is an organophosphate similar to the chemical agents used in biological warfare. It is commonly referred to as a *nerve gas* because it blocks the normal suppression of the neurotransmitter acetylcholine and can produce convulsions, weakness, respiratory difficulties, and decreased consciousness in exposed individuals. In some cases, exposure to sarin can be lethal.

The 1995 sarin disaster in Tokyo claimed the lives of 11 people, but more than 5,000 people sought emergency medical evaluations. One Tokyo hospital received 640 victims of the sarin attack to its emergency medical department (Okumura et al., 1996). Most patients (82.5%) experienced mild to moderate symptoms related to visual difficulties (e.g., eye pain, decreased visual acuity) or respiratory problems

(e.g., difficulty breathing) and were released within 12 hours of arrival. The remaining 17.5% experienced more severe symptoms and required hospitalization. Symptoms included acute visual difficulties, gastrointestinal problems, headaches, weakness, and convulsions. Several victims required emergency respiratory support and two patients died.

The physical health consequences of toxic exposure can also manifest in a predictably delayed manner, as is often the case following larger scale chemical or nuclear accidents. Analysis of the long-term impact of the 1996 Chernobyl nuclear power plant disaster in the Ukraine, for example, confirmed the anticipated short- and long-term health consequences (Hatch, Ron, Bouville, Zablotska, & Howe, 2005). The short-term health effects of the disaster were manifest in symptoms of radiation sickness among emergency workers responsible for cleanup and decontamination. Although many of those receiving immediate treatment survived, subsequent mortality rates among cleanup workers were nonetheless high. Compared with the general population, Chernobyl cleanup workers evidenced a clear risk for leukemia and to a lesser extent thyroid cancer. Children in the exposed population were assumed to be especially at risk because of the small size of their thyroid, which renders them especially radiosensitive, and the increased likelihood of their consumption of contaminated milk. Commensurate with the assumed risk, numerous studies using different methods and controls have consistently observed a dose-response effect linking early age exposure after the disaster with elevated development of thyroid cancer (Hatch et al., 2005).

Stress-related (secondary) health problems

The second path by which disasters might impact health is more complex and more elusive. The sarin gas exposure and the Chernobyl nuclear disaster described earlier each produced expectable short- and long-term health consequences. In each case, the causal agent was known and there was little ambiguity about the anticipated physical costs of exposure. In the case of other types of disaster, however, attributions about the cause of observed physical symptoms are often more difficult to adduce. The reason is because disasters, like most other potentially traumatic events, can produce chronically stressful conditions that indirectly lead to physical health costs.

Stress in and of itself is not maladaptive. Acute stress reactions reflect an inherited and protective response to demanding environmental circumstances. For example, acute stress promotes immune functioning and both psychological and behavioral coping responses that aid in resisting potentially threatening events (McEwan, 1998, 2004). However, there is a physical cost to the stress response, and when stress becomes chronic, it results in wear and tear to bodily systems, or allostatic load (McEwan, 1998). When allostatic load is high, the short-term adaptive value of stress gives way to long-term physical costs. For example, high allostatic load has been linked to impaired immunity, atherosclerosis, obesity, bone decay, and atrophy of brain cells (Kiecolt-Glaser, Glaser,

Gravenstein, Malarkey, & Sheridan, 1996; Magariños, Verdugo, & McEwan, 1997; McEwen, 2004).

Unfortunately, accurate assessment of the secondary health costs associated with allostatic load is more complex than is the case for direct physical injury. One reason is that the global nature of disaster-related physical breakdown is difficult to untangle from preexisting health problems. The ideal approach thus requires a prospective design that controls for baseline health status. Abundant prospective evidence has demonstrated the general consequences of stress in nondisaster contexts. For example, prospective behavioral research has consistently documented that life stress can damage future physical well-being, more than prior health conditions (Lin & Ensel, 1989). Daily diary studies have also readily demonstrated associations between daily stress and both current and subsequent health problems (e.g., DeLongis, Folkman, & Lazarus, 1988).

Several prospective disasters studies have provided evidence for secondary health costs. An exemplary study pertained to the health impact of a large-scale explosion in a Dutch fireworks depot. Dirkzwager and colleagues (2006) obtained predisaster medical records of exposed children and adolescents and of comparable nonexposed groups from the same age range. Significant differences in postdisaster health emerged between the exposed and control groups. Most prominently, compared with the nonexposed controls, both the younger and older child survivors had significantly greater postdisaster increases in musculoskeletal problems. The younger exposed children also had greater increases in gastrointestinal and sleep problems.

In addition to the complexities of untangling disaster-related health complaints from preexisting health problems, a related assessment issue is that stress-related health costs (e.g., headaches, nausea, swelling, back pain, or respiratory problems) are ambiguous; in other words, there is no obvious medical explanation or direct physical relationship to the disaster. Such problems have been described as psychosomatic symptoms, functional disorders, or most recently as medically unexplained symptoms (van den Berg, Grievink, Yzermans, & Lebet, 2005). However, medically unexplained symptoms have proven “notoriously difficult to treat” primarily because patients and physicians often disagree about the nature of their cause (Jones, 2006, p. 533).

In the aftermath of disasters, this same tension around causal justification for medically unexplained symptoms creates an adversarial social context of “contested causation” (Engel, Adkins, & Cowan, 2002). The chaos that often ensues in the aftermath of disaster can, for example, foster suspicions about possible toxic exposure or deliberate government cover-up (Boin, van Duin, & Heyse, 2001; van den Berg et al., 2005). A telling example is provided by the 1992 crash of an El Al 747-F cargo jet. The plane crashed in an Amsterdam suburb with a large and relatively poor immigrant population, killing 44 people and destroying over 250 homes. A host of troubling ambiguities followed: The black box flight recorder detailing events on board the plane was never found, and authorities subsequently revealed that the plane had been carrying stores of depleted uranium. Moreover, neither the Dutch nor the Israeli

authorities could provide documentation of all the cargo on the plane. Suspicions about possible contamination from the disaster lead to “toxic fear” among citizens in the area (Boin et al., 2001). Many survivors reported health complaints, such as fatigue, skin problems, and backache, which they believed were linked to the disaster (Yzermans & Gersons, 2002). Physical-symptom reporting was especially high during a period of high media attention (Donker, Yzermans, Spreeuwenberg, & van der Zee, 2002). However, general practitioners who treated the survivors diagnosed only a very small percentage (6%) of the reported symptoms as disaster related (Donker et al., 2002). Instead, most of the health diagnoses assigned by general practitioners were attributed to “psychosocial causes” (46%), an “existing somatic disease” (13%), “no clear cause” (30%), or in some cases the survivor’s “personality” (8%). We return to this issue later in the article when we discuss the broader societal impact of disaster.

Summary

- People exposed to disaster may evidence PTSD, grief, depression, anxiety, stress-related health problems, increased substance abuse, and suicidal ideation.
- In adults, severe levels of these problems rarely occur in more than 30% of the samples; in the vast majority of methodologically sound studies, the level is usually considerably lower.
- Among youth, elevated symptoms are common in the first few months following a high-impact disaster but chronic symptom elevations rarely exceed 30%.

Disasters Produce Multiple Patterns of Outcome, Including Psychological Resilience *Limits of diagnoses and the problem of averages*

The vast majority of the literature on the psychological costs of disaster and other potentially traumatic events relies on two fundamental methods of assessment (Bonanno & Mancini, in press; Bonanno, Westphal, & Mancini, in press). The first and most common method is to measure disaster outcomes solely in terms of extreme or dysfunctional reactions. Often, such data are presented in relatively simplistic binary or categorical terms of pathology versus the absence of pathology. From a public health perspective, the reasoning behind this approach is obvious. The focus on psychopathology is the most straightforward and expedient way to identify and potentially treat psychologically harmed individuals. The focus on pathology also helps to quantify the more corrosive impact of disasters and facilitates planning and recovery efforts.

Although the diagnostic approach and in particular the emphasis on PTSD have advanced understanding of trauma and disaster, it has become increasingly clear that a broader perspective is needed (Bonanno, Westphal, & Mancini, in press). One of the most salient limitations of focusing on the binary presence-absence of psychopathology is that it restricts

data gathering and tends to obfuscate more normative aspects of trauma reactions and resilience (Bonanno, 2004). Another limitation is that diagnostic markers are conceptual constructs whose prevalence can be influenced by social and cultural factors (Horwitz & Wakefield, 2007; McNally, 2003). Detailed analyses of the latent structure of PTSD have consistently indicated a dimensional rather than a categorical structure (Broman-Fulks et al., 2006; Ruscio, Ruscio, & Keane, 2002) and suggest that the diagnostic cutoff points for PTSD are to some extent arbitrary (Davis, 1999; Robins, 1990). Finally, there is little understanding of the relations among categorical forms of psychopathology. For example, PTSD is typically comorbid with depression. Depression may come about subsequent to PTSD, as a dysphoric reaction to the failure or inability to recover from the initial trauma (Gilboa-Schechtman & Foa, 2001). It is also plausible that PTSD and depression co-occur as common responses to extreme adversity (Breslau et al., 2000) or in some cases that depression precedes or even plays a causal role in the development of PTSD (Bryant & Guthrie, 2007).

A second common method to assess individual responses to disaster, also evident in some of the literature reviewed, is to map average differences between exposed and nonexposed groups over time. Continuous measurement of symptoms and adjustment levels are often deemed less important than data on pathology, and even when such measures are obtained, they are frequently converted to binary categorical data or examined exclusively in terms of sample means. However, the use of continuous measures has practical applications; most notably, it allows for comparative analyses across conditions and types of disaster and provides a handy estimation of the duration of postdisaster impact. For example, it is well-established that the prevalence of survivors meeting criteria for PTSD will fall precipitously in the first months after the target event and then gradually taper to a small but persistent minority of individuals with chronically elevated PTSD (Breslau, 2001). We see this same pattern in continuous measures of PTSD symptoms. However, because continuous measures produce greater variability, they allow for more precise analyses of change over time. The variability of continuous measures also allows for sophisticated analyses of risk and resilience factors, as discussed later, and has proved especially useful in meta-analyses that summarize data across multiple studies (e.g., Norris, Friedman, Watson, et al., 2002).

Although both approaches—the emphasis on extremes and on average levels of dysfunction—have greatly advanced our understanding of the psychological costs of disaster, they present a limited and potentially misleading portrait of the full range of individual responses to disaster. Most notably, both approaches obscure individual differences in disaster response. As a result, until recently, relatively little was known about the characteristics of the distribution of adjustment across time or whether the relative absence of psychopathology and dysfunction was best understood as an aberration or as a form of superordinate health (Bonanno, 2004).

Consider, for example, a longitudinal study of Italian earthquake survivors. Bland and colleagues (2005) observed

that 10 years after the disaster, 30% of the most highly exposed survivors “still reported symptoms” of PTSD (p. 420). However, what information does the reporting of symptoms actually convey? In the absence of normative data on the distribution of PTSD symptoms in this population, the psychological meaning of having symptoms is unclear. Several symptoms included in the PTSD diagnosis are nonspecific with reference to the target event (e.g., difficulty sleeping). Structured clinical interviews on nonexposed populations have shown that even in the absence of a recent potentially traumatic event, many people will report one or two PTSD symptoms (Bonanno et al., 2006). In this context, the finding that one group has symptoms of PTSD carries little clinically meaningful information.

To cite a different kind of example, in the prospective study of the Dutch fireworks disaster, discussed earlier, exposed children evidenced significant increases in reported health problems in the first year after the disaster compared with nonexposed children (Dirkzwager et al., 2006). Although this finding is compelling, the differences in the actual proportion of increase were quite small. For example, in the year prior to the disaster 7.1% of the exposed young children and 9.2% of the nonexposed young children reported musculoskeletal problems. In the year after the disaster, only 1.5% of the exposed group reported more problems. The group difference was larger 1 to 2 years postdisaster, but again the magnitude of the difference was relatively small at only 4.2%.

Toward an individual-differences approach

In 1951, James Stewart Tyhurst published a seminal but now more or less forgotten article on individual differences in response to disaster. Tyhurst was part of a “mobile team of psychiatrists and sociologists” who made “on-the-spot observations” and conducted psychiatric interviews with survivors immediately following community disasters (p. 765). In the 1951 paper, Tyhurst reported the results of early interviews from survivors of four disasters: two large fires, a fire on a Marine vessel, and a flash flood. Although he provided little methodological detail, Tyhurst’s (1951) descriptions of the “natural history” of the initial response sequence following disaster were remarkably astute. He concluded that most survivors experience acute stress reactions usually lasting anywhere from a few minutes to an hour. The initial acute stress, he observed, is usually followed by a “period of recoil” in which most of the initial distress gives way to “a gradual return of self-consciousness and awareness of the immediate past.” It is at this point that survivors first begin to take stock of what they had just been through and the emotions they may have felt. Next comes the posttraumatic period in which survivors begin to deal with the disaster’s aftermath, the losses and disruptions they will have to contend with. The posttraumatic period, Tyhurst noted, is when “those phenomenon with which psychiatrists are familiar and which are described in the literature as posttraumatic reactions” first might emerge. These include intense anxiety and what later came to be known as PTSD.

As prescient as these observations were, Tyhurst's (1951) most significant contribution was the observation that not all survivors experience disasters in the same way. A sizeable minority of about 12% to 25%, Tyhurst observed, were "cool and collected" even in the initial stress phase. Although the majority of survivors were "stunned and bewildered" during the acute phase, most were nonetheless able to overcome their initial reactions and regain a sense of normalcy during the recoil phase. Finally, Tyhurst observed, another small group making up about 10% to 25% of survivors evidenced intensely acute stress reactions that often led to enduring emotional difficulties. Although Tyhurst did not forge a clear link between early reactions and longer-term responses to disaster, his observations opened a door to the study of individual variability.

Despite Tyhurst's (1951) seminal insight, however, the broader examination of individual differences in disaster outcome has gained currency only recently. The obvious reason for the delay, as we have argued, has been the dominance of the PTSD diagnosis. However, even when the investigative lens is narrowed only to pathology, individual differences might nonetheless still be evident. For example, McFarlane and colleagues (2009) observed that there are at least three possible pathways that lead to the development of psychopathological states, such as PTSD: One pattern, similar to the intensely acute reactions described by Tyhurst, occurs when survivors become extremely disorganized immediately following traumatic exposure; another is characterized by initially moderate symptom levels that are exacerbated through learning and contact with reminders; and finally a third pathway describes the emergence of elevated symptoms sometime within the first month after the trigger event. It would be extremely difficult to adjudicate among these pathways in the context of disaster because there is a paucity of systematic evidence on early reactions. Most of the literature that describes early disaster reactions is based on retrospective accounts gathered long after the initial exposure period (e.g., L. Morgan, Scourfield, Williams, Jasper, & Lewis, 2003; North et al., 1999) and thus unaccountably subject to reconstructive memory biases. More recently, however, a growing body of general trauma data has accrued that clearly supports the first pathway. Intensely acute physiological stress reactions (e.g., elevated heart rate and respiration rate) measured during and immediately after a potential trauma have consistently been found to predict the later development of PTSD (Bryant, Creamer, O'Donnell, Silove, & McFarlane, 2008).

What about other patterns beyond those leading to chronic dysfunction? Until recently there was little progress in this area, in part because the study of disaster, like most life-events research, has been hampered by enduring misconceptions about the nature of the variability in change across time. It is widely assumed that responses to major life events produce a single *homogeneous* distribution of change (Duncan, Duncan, & Strycker, 2006; Muthen, 2004). However, both conceptual (Bonanno, 2004, 2005; Bonanno & Mancini, 2008, in press) and statistical (Curran & Hussong, 2003; Jung & Wickrama, 2008; Muthen, 2004) perspectives on reactivity to life stress suggest a

dramatically different picture—one that emphasizes the natural *heterogeneity* of responding across time.

As interest slowly spread beyond PTSD and as more sophisticated field research methods developed, a broader appreciation of the full range of reactions to trauma and disaster began to take hold (Bonanno, 2004, 2005; Bonanno & Mancini, 2008; Norris, 1992). As a result of these trends, it became increasingly apparent that although a subset of disaster survivors will unavoidably suffer lasting emotional difficulties, the majority of people exposed to the event will evidence little or no disruption in normal functioning. For instance, in 1985 when tropical storm Isabel caused catastrophic flooding and mud slides on the island of Puerto Rico, nearly 180 people died, more than 4,000 were dislocated, and close to 20,000 suffered extensive material losses. Because an island-wide mental-health survey had only recently been completed, it was possible to assess the storm's psychological impact prospectively by comparing predisaster and postdisaster adjustment. In summarizing the results of such an analysis, Bravo, Rubio-Stipec, Canio, Woodbury, and Ribera (1990) concluded that although the storm did result in increased depression, somatic complaints, and PTSD symptoms, "all the effects, however, were relatively small, suggesting that most disaster victims were rather resilient to the development of new psychological symptoms" (p. 662).

Recovery and resilience

In recent years researchers have begun to map individual differences in outcome following aversive or stressful life events in terms of a discrete set of latent trajectories. Although the methodological approach and type of data used in these studies have varied, the same basic set of trajectories have been identified across markedly distinct types of stressor events, including the death of a loved one (Bonanno, Keltner, Holen, & Horowitz, 1995; Bonanno, Moskowitz, et al., 2005; Bonanno, Wortman et al., 2002;), divorce (Mancini, Bonanno, & Clark, 2010), life-threatening medical procedures (Deshields, Tibbs, Fan, & Taylor, 2006; Lam et al., 2010), and traumatic injury (deRoos-Cassini, Mancini, Rusch, & Bonanno, 2010). Importantly, as elaborated later, these same trajectories also characterize patterns of outcome following disasters (Bonanno, Ho et al., 2008; Bonanno, Rennie, & Dekel, 2005; Norris, Tracy, & Galea, 2009).

We depict the most common or prototypical trajectories in Figure 1. As could be expected from the robust literature on psychopathology, a small but consistent subset of the exposed population tends to exhibit a trajectory of chronic dysfunction. However, the more striking finding to emerge from the individual-differences approach is that the most common outcome across studies tends to be a relatively stable trajectory of healthy adjustment, or resilience (Bonanno, 2004). Less common is a pattern characterized as a classic recovery trajectory of initial elevations in symptoms and distress soon after the target event that only gradually decrease over the ensuing months. Finally, although its prevalence varies across

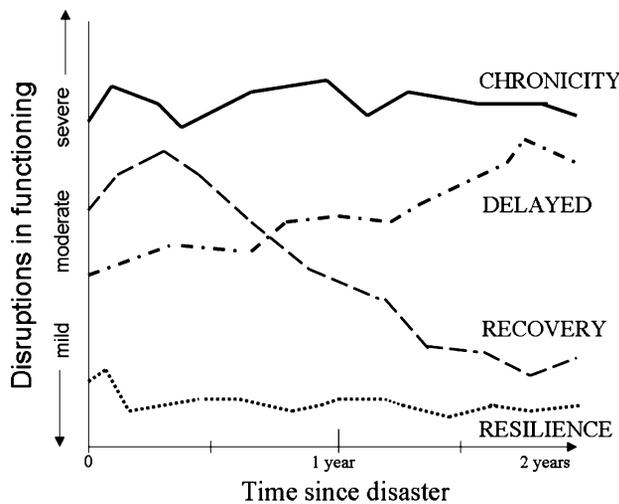


Fig. 1. Four prototypical trajectories of disaster outcome. Adapted from "Loss, Trauma, and Human Resilience: Have We Underestimated the Human Capacity to Thrive After Extremely Aversive Events?" by G.A. Bonanno, 2004, *American Psychologist*, 59, p. 21. Copyright 2004 by the American Psychological Association. Adapted with permission.

studies, a small subset of exposed individuals will sometimes exhibit moderate elevations in symptoms and distress that gradually worsen over time, suggesting a delayed pattern (Andrews, Brewin, Philpott, & Stewart, 2008; Bonanno, Rennie, & Dekel, 2005; Buckley, Blanchard, & Hickling, 1996).

Because the trajectory approach is nascent, its application to disaster is relatively new. One of the initial studies to use the approach mapped longitudinal patterns of outcome among high-exposure survivors of the September 11th attack in New York City (Bonanno, Rennie, & Dekel, 2005). The trajectories were created using a combination of continuous measurements of depression and PTSD symptoms. Not surprisingly, given the intensity of the exposure, 29% of the sample showed a pattern of chronically elevated symptoms. However, despite the near-ceiling level of pathology, the resilience trajectory was still observed in 35% of the sample. This proportion was somewhat lower than is usually observed in studies of potentially traumatic events and most likely due to the high level of exposure in this particular sample. Two other trajectories were also evidenced. A recovery trajectory (23%) was assigned to survivors who had elevated depression or posttraumatic stress early on but low levels of both types of symptoms by 18 months. Delayed reactions (13%) were assigned to participants who had low levels of both symptoms early on but elevated levels of either depression or posttraumatic stress at 18 months.

To further validate the trajectories, and in particular the prevalence of resilience in such a high-exposure sample, Bonanno, Rennie, and Dekel (2005) compared the symptom data with ratings of different aspects of positive adjustment (overall mental health, physical health, social adjustment, achievement, and coping efficacy) obtained anonymously from

participants' close friends and relatives. The friend and relative informants had known the participants they evaluated an average of 15 years and thus were able to rate participants' adjustment before and after 9/11. The friend and relative informants' ratings of changes in the participants' adjustment from pre-9/11 to post-9/11 were moderately to highly correlated with the participants' own symptom reports. The friend and relative informants also independently assigned participants' to outcome trajectories on the basis of their observations of the participant's adjustment over time. Friends' and relatives' trajectory assignments were highly concordant with the symptom trajectories and provided further validation for the resilience trajectory of stable positive adjustment.

Resilience was also found to be abundant in another post-9/11 study of New Yorkers using a larger ($N = 2,752$) population-based sample (Bonanno et al., 2006). In this study, people were considered resilient if they had no more than one symptom of PTSD at any point during the first 6 months after the attack. Resilient people, defined this way, also had almost no depression and reported significantly less substance use than other participants (Bonanno, Galea, Bucchiarelli, & Vlahov, 2007). Overall, 65% of the sample met criteria for resilience. More important, resilience was commonly in evidence in at least half the sample and never fell below one third of the sample regardless of level of exposure. There was generally an inverse relationship between the proportion of the sample that evidenced PTSD and the proportion that was resilient, but it was far from a perfect inverse relationship. For example, the PTSD prevalence in the New York metropolitan area during the first 6 months after the attack was about 6%. Among people who witnessed the attack in person, the PTSD prevalence doubled, to a little over 12%. Nonetheless, the proportion in this group that was resilient declined only slightly and remained well over 50%. Among people with the highest levels of direct exposure, for example, those who were in the World Trade Center at the time the planes struck, PTSD rose to about 25% of the sample. However, the proportion of resilience in this category remained essentially unchanged and continued to exceed 50% (Bonanno et al., 2006).

Latent growth mixture modeling

Although the trajectory approach described earlier addressed some of the limitations of traditional methods for assessing disaster outcome and provided a more elaborate portrait of individual variation in response to such events, the early research on trajectories did not address all the limitations of the traditional approach. Most notably, because cutoff points are to some extent arbitrary, any operational definition of an outcome trajectory necessarily requires an a priori conceptual model of resilience, recovery, and pathology. The use of cutoff points is especially problematic for designations of resilience, recovery, and delayed reactions because the theoretical underpinnings of these patterns are not well-established (Bonanno, 2004, 2005; Bonanno, Westphal, & Mancini, in press). Moreover,

theoretically defined trajectories necessarily exclude the detection of latent trajectories that had not previously been conceptualized.

Recently, disaster researchers have begun to surmount these problems by identifying outcome trajectories using relatively more sophisticated growth modeling techniques, such as latent growth mixture modeling (LGMM; Muthen, 2004), that determine trajectory membership on a primarily empirical basis. LGMM explicitly assumes heterogeneity in longitudinal data and extends conventional latent trajectory approaches (Curran & Hussong, 2003) by estimating growth parameters within groups or classes of individuals that represent distinct multivariate normal distributions. This approach is particularly well suited for disaster field studies, because it uses a robust maximum-likelihood estimation procedure that can accommodate missing data and allows parameters to vary as random effects across classes. Additionally, covariates that might influence the shape of the outcome patterns can be included in the modeling procedures, thus providing truer representations of actual variation in adjustment than simple (unadjusted) outcome scores.

In recent years, LGMM has been successfully used to identify longitudinal patterns of adjustment in relation to a wide variety of life events and circumstances, including drinking among college students (Greenbaum, Del Boca, Darkes, Wang, & Goldman, 2005), childhood aggression (Schaeffer et al., 2006; Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003), retirement in late life (Pinquart & Schindler, 2007), life-threatening medical procedures (Deshields et al., 2006; Lam et al., 2010), and traumatic injury (deRoon-Cassini et al., 2010).

One of the first disaster studies to use the LGMM approach identified trajectories of mental health in a relatively large sample of hospitalized survivors of the 2003 bioepidemic of severe acute respiratory syndrome (SARS) in Hong Kong (Bonanno et al., 2008). The best-fitting model was a four-class solution that included covariates representing physical health at 6 months posthospitalization, age, gender, social network size, social support, and SARS-related worry. It is important to note that the four-class solution yielded the same four prototypical trajectories observed in other studies: chronic dysfunction, recovery, delayed reactions, and resilience.

An unusually large proportion of the sample (42%) fit the chronic-dysfunction trajectory (Bonanno et al., 2008). Average mental-health levels for this group were more than two standard deviations below the Hong Kong normative mean at each assessment point. The most likely explanation for the high prevalence of chronic dysfunction was the mysterious and enduring nature of the syndrome. SARS is a highly contagious and potentially lethal illness that was virtually unknown prior to its first appearance in Guangdong Province, China, in 2002. SARS spread rapidly, however, and by the spring of 2003 it had infected over 8,000 people, in over 30 different countries.

In China, the epidemic was associated with high levels of fear and distress (Huang, Dang, & Liu, 2003; Qian, Ye, &

Dong, 2003; Shi et al., 2003). Prospective studies that compared psychological adjustment before and during the outbreak associated SARS with increased depression and emotional distress in the general population (Yu, Ho, So, & Lo, 2005). Other studies suggested that the psychological impact of the SARS epidemic was especially severe for people who had been infected and hospitalized for the syndrome. In Hong Kong, hospitalized survivors of SARS were more distressed on average than a matched group of healthy controls from the same geographic area (Chua et al., 2004). Categorical analyses indicated that 35% of the hospitalized SARS survivors in Hong Kong experienced moderate to severe levels of anxiety and depression (Cheng, Wong, Tsang, & Wong, 2004) and that 16% met criteria for depression and 10% for PTSD (Yan, Dun, & Li, 2004). Remarkably, almost as many survivors, 35% of the sample, evidenced a resilient trajectory of stable high mental health. The resilient group had levels of mental health that were well above the normative mean for Hong Kong. In other words, despite having been hospitalized in the middle of an epidemic for a mysterious illness with no apparent cure, their mental health was at least as good as what would be expected in the absence of a major stressor.

In another recent latent growth analysis, Norris and colleagues (2009) identified trajectories of PTSD symptoms in two large, representative disaster samples: survivors of a flood in Mexico and a city-wide sample of New Yorkers following the September 11th attacks. Their analyses identified similar class solutions as previous studies, but they observed a greater number of classes. The difference may have been due to Norris et al.'s use of a simpler modeling approach that, in contrast to LGMM, could not accommodate missing data, allow for parameter variance to differ (random effects) across classes, or include covariates in the fit estimation.

The damage from the flooding in Mexico was extensive. Most survivors needed to be relocated; more than one survivor in four lost loved ones in the flooding, almost half suffered property damage, and a majority (70%) experienced life-threatening danger. Using four waves of data on PTSD symptoms, Norris and colleagues (2009) identified five distinct outcome trajectories. The most common pattern (35%) again was a stable trajectory of mild or absent PTSD symptoms, suggestive of resilience. There were also two separate trajectories suggestive of recovery over time and two trajectories suggestive of chronically elevated PTSD. The difference between similar pairs of trajectories was a matter of symptom severity.

Norris and colleagues' (2009) 9/11 analyses yielded a more complex pattern, including seven unique trajectories, again with two separate patterns suggestive of recovery, two patterns suggestive of resilience, a delayed pattern, and a stable, chronic elevation pattern. Similar to Bonanno, Rennicke, and Dekel's (2005) study of high-exposure 9/11 survivors, the most common outcome was a stable trajectory of healthy adjustment or resilience, exhibited by 40% of the sample. Norris et al. (2009) also identified a second, less prevalent resilience-like pattern of consistently minimal PTSD symptoms. This group, which evidenced a slight decrease in symptoms from the first to the

second assessment, nonetheless never reported more than two PTSD symptoms at any point in the study. Together, the two low-symptom or resilient classes accounted for 54% of the sample.

Summary

- Multiple patterns of disaster outcome across time have been observed.
- Some survivors recover their psychological equilibrium within a period ranging from several months to 1 or 2 years.
- Many, often more than half, of those exposed experience only transient distress and maintain a stable trajectory of healthy functioning or resilience.
- Resilient outcomes have been evidenced across different methodologies, including studies that used sophisticated data-analytic approaches, such as LGMM.

Disaster Outcome Depends on a Combination of Risk and Resilience Factors

What explains the wide-ranging variability in response to disasters? The obvious answer is that some factors or conditions will make it harder to adjust, thus placing people at risk, whereas others will foster adaptation, thereby rendering people more resilient. Numerous risk and resilience variables have been investigated. Unfortunately, the research has often suffered from a number of serious limitations. A primary limitation is that many of the studies are cross-sectional or based on retrospective assessments garnered from survivors well after the disaster had taken place. In the context of the highly distressing nature of disasters, this sort of evidence is problematic because it confounds predictors with outcomes. As discussed previously, memory for prior distressing circumstances is biased by current levels of distress. Thus, people who develop extreme reactions to disaster events will be more likely to remember highly emotional aspects of both the predisaster context and the actual disaster itself (Levine et al, 2005).

Another serious limitation is that in the vast majority of disaster studies, risk and resilience factors are considered in isolation. Typically, a single factor, for example, job loss, is examined in relation to a relevant outcome marker, say PTSD symptoms. Even in cases in which researchers examined multiple predictor variables, it has nonetheless been common to evaluate the impact of these variables independently, in univariate analyses. This practice is especially problematic in disaster research because many of the factors likely to influence disaster outcome are interrelated or confounded. For example, job loss is usually associated with income change and both income change and job loss tend to be confounded with disaster exposure.

Next, we catalogue what we believe to be the most consistent and methodologically sound findings concerning mitigating and aggravating factors in disaster outcome. We consider three broad categories of factors: contextual variables that describe dimensions of risk and resilience that existed prior to the disaster's onset, event factors that characterize variability in proximal exposure to the disaster itself, and postevent factors

that characterize more distal consequences of the disaster. Whenever possible, we emphasize evidence from studies that used prospective designs, studies that isolated the unique effects of specific factors, and studies that explored how different factors might be influenced by or interact with other factors.

Perhaps the key lesson that has emerged from multivariate studies is that there is no one single dominant predictor of disaster outcome. Rather, as with traumatic life events more generally, the various risk and resilience factors that inform disaster outcome appear to coalesce in a cumulative or additive manner (Bonanno, Galea, et al., 2007). Most predictor variables exert small to moderate effect sizes. Ultimately, how these effects impact disaster outcome and determine whether a disaster survivor is resilient, struggles with a more gradual recovery, or develops enduring psychopathology depends on the totality of these factors. This same point has long been in evidence in both the developmental literature on children coping with adversity (e.g., Luthar, Doernberger, & Zigler, 1993; Rutter, 1979) and the adult literature on traumatic life events (Bonanno, 2004, 2005; Bonanno, Westphal, & Mancini, in press).

It is also imperative to keep in mind that many of the predictors of disaster outcome are likely to fluctuate over time with changes in the availability of resources or life circumstances (Hobfoll, 1989, 2002). Thus, a person may be more or less resilient or more or less prone to severe reactions at different points in the life cycle or when disasters occur in different situations. For example, as discussed later, social support is consistently found to be a predictor of favorable disaster outcome. However, social support may vary when a person's life circumstances change (e.g., if the person moves to a new location) or may be altered by the disaster itself (Kaniasty, Norris, & Murrell, 1990). Together, these considerations suggest that how a person reacts psychologically to the imposition of disaster will depend on a cumulative summary of evolving risk and resilience factors. We revisit this point in our concluding section.

The predisaster context

Disasters are not the same for everyone, and one way that disasters differ across individuals has to do with the context in which they occur. Contextual factors inform how a person anticipates, interacts with, and eventually copes in the aftermath of a disaster. Some contextual factors, such as the season in which a disaster occurs, are more or less the same for all exposed individuals, whereas others vary greatly across individuals. Some contextual factors remain relatively stable, and others may change dramatically as a result of the disaster. Indeed, it is the capacity of disasters to almost completely alter the context of a person's life that sets them apart from most other forms of potential trauma. Together, contextual factors provide the backdrop against which disasters occur.

Age, gender, and race-ethnicity. A number of demographic variables have been found to inform the outcome of disaster. We consider what are arguably the three most obvious and

well-researched factors: age, gender, and race–ethnicity. Regarding age, it is often assumed that both older adults and young children are at greatest risk for serious psychological and health problems in the aftermath of disaster. Summarizing the disaster literature from 1981 to 2000, Norris and colleagues (Norris, Friedman, Watson, et al., 2002) observed that children consistently exhibited more extreme psychological impairment and less frequently had minimal psychological impairment compared with adult disaster survivors. Although very young children, because of their early stage of cognitive development, tend not to encode or recall important aspects of disaster events relative to older children (Bahrick, Parker, Fivush, & Levitt, 1998), there is some evidence to indicate that younger children are more fully impacted and less likely to show a rapid recovery from disaster-related PTSD than are older children (Schwarzwald, Weisenberg, Solomon, & Waysman, 1994). Within child disaster samples that span the school years, younger age has been associated with higher levels of PTSD (e.g., McDermott, Lee, Judd, & Gibbon, 2005; Weems et al., 2010; Yelland et al., 2010). By the same token, however, older children may be more prone to disaster-related depressive reactions (Thienkrua et al., 2006).

Children may also respond to disaster-related distress in ways that are unique to their specific age group. For example, young children have been observed to respond to disasters with temper tantrums, refusing to sleep alone, and incontinence, whereas adolescents have evidenced disaster-related elevations in minor deviance and delinquency. In some instances children may also be at greater risk for disaster-related health problems. For example, as discussed earlier, following the Chernobyl nuclear accident, younger children were more likely to develop thyroid cancer (Hatch et al., 2005). There are of course a number of factors that might moderate the impact of disaster on children. We discuss these factors when relevant later in our review.

It is also important not to lose sight of the fact that despite their vulnerability, children typically exhibit a natural resilience in the aftermath of extreme adversity (Masten, 2001). The research on children and disaster is methodologically heterogeneous and has frequently produced contradictory findings (Hoven, Duarte, Turner, & Mandell, 2009). Although no studies have explicitly examined resilient trajectories in children after disaster, there is no reason to doubt that this evidence would emerge. Moreover, longitudinal studies have generally indicated that even among children who experience acute disaster-related distress, many recover within the first year after the event (La Greca et al., 1996; Schwarzwald et al., 1994), after which rates of recovery appear to taper off more gradually (La Greca, Silverman, Lai, & Jaccard, in press; Weems et al., 2010). Over very long periods of time, almost all exposed children will likely return to baseline levels of adjustment (Green et al., 1994). By the same token, we nonetheless hasten to add that disaster-related distress and life disruption of even a year or less may adversely impact children's functioning, at least in the short term and possibly in the long term, through missed school, reduced academic functioning, interrupted social opportunities, and increased exposure to major life stressors (Silverman & La Greca, 2002).

There may also be domains in which disaster positively impacts children. For example, preliminary research indicates that children may potentially learn from or experience personal growth after disaster (Cryder, Kilmer, Tedeschi, & Calhoun, 2006). At a broader level, disruptive behaviors in school-age children have been observed to temporarily decline after disaster. Following Hurricane Andrew, researchers aggregated 21 measures of disruptive behavior obtained from school records, including defiance of school authority, damaging school property, rude and discourteous behavior, excessive tardiness, and trespassing (Shaw et al., 1995). Children in the schools most heavily impacted by the hurricane had markedly decreased frequencies of disruptive behavior for the first two of four grading periods following the hurricane.

At the opposite end of the age spectrum, older adults have been assumed to be at risk during and after disasters because of their relative lack of mobility, dependence on others, and potential for deprivation and physical injury. The age-specific needs and vulnerabilities of older adults are indeed worthy of serious consideration in disaster policy (Cook & Elmore, 2009). However, although older adults as a group do experience distress during disasters, typically they weather disasters with fewer psychological costs than do younger adults (Huerta & Horton, 1978; Kato, Asuki, Miyake, Minakawa, & Nishiyama, 1996; Knight, Gatz, Heller, & Bengston, 2000) and evidence a greater likelihood of stable health or resilience than do younger adults (Bonanno, Galea, et al., 2007). This reverse age effect can be attributed at least in part to older adults' greater life experiences and, as we discuss later, inoculation effects related to previous experiences with disaster (Knight et al., 2000).

Gender is another demographic marker of considerable relevance for disaster. As is true for trauma more generally (Brewin et al., 2000), both women and girls consistently have higher levels of distress and psychopathology in the aftermath of disasters than do men and boys (Norris, Friedman, Watson, et al., 2002). A number of possible reasons exist for this difference. For example, females may experience greater objective exposure, may have greater prior trauma, or may have a greater number of postdisaster stressors (Kimerling, Mack, & Alvarez, 2009). Note, however, in multivariate models that controlled for possible confounds of this nature, female gender was still found to predict both greater disaster-related psychopathology (Ahern, Galea, Fernandez, et al., 2004; Carr, Lewin, Kenardy, et al., 1997; Carr, Lewin, Webster, et al., 1997; Hoven et al., 2005; Galea, Tracy, Norris, & Coffey, 2008; Vernberg, La Greca, Silverman, & Prinstein, 1996; Weems et al., 2010) and reduced resilience (Bonanno et al., 2008; Bonanno, Galea, et al., 2007).

A mechanistic explanation for the gender effect that holds some currency in multivariate analysis is that women and girls tend to subjectively experience greater initial disaster threat (Garrison, Weinrich, Hardin, Weinrich, & Wang, 1993; Norris, Friedman, Watson, et al., 2002). A compelling example of gender differences in subjective disaster experience was provided by a study of college students assessed within 24 hours of the Loma Prieta earthquake (Anderson & Manuel, 2004). Women

in this sample estimated that the earthquake had lasted for a longer duration (78 seconds) than did men (46 seconds). Women's duration estimates were also less accurate than were men's when compared with the actual duration of the earthquake. In a study of Nicaraguan adolescents exposed to Hurricane Mitch, girls and boys reported the same level of objective exposure (e.g., serious injury; home severely damaged or destroyed), but girls reported significantly greater subjective exposure (e.g., "scared you would die"; "scared you would be hurt badly"; Goenjian et al., 2001). Hierarchical multivariate modeling of these data showed that gender was significantly associated with posttraumatic stress when objective exposure was controlled but was no longer significant when subjective exposure was included. Thus, the gender difference in the experience of subjective threat appeared to fully explain the gender difference in posttraumatic stress.

Racial-ethnic differences suggest another potentially important moderator of disaster outcome. Determining the precise nature of this influence, however, has proven elusive for several reasons. For one, there is only limited empirical data on race-ethnicity within disaster samples (Norris, Friedman, Watson, et al., 2002). In some cases, the lack of data is due simply to the fact that communities most severely impacted by disasters are often homogeneous along racial-ethnic lines. For example, the vast majority of evacuees from Hurricane Katrina (94%) reported their race as Black (Mortensen et al., 2009), whereas the vast majority of survivors of the 1993 Midwestern flood disaster (93%) were White (Ginexi et al., 2000). In some cases, the population under study is so homogeneous that race-ethnicity is not even assessed. This was the case, for example, in studies of the Mount St. Helens volcanic eruption in the rural northwestern United States (Shore et al., 1986), flood survivors in southeastern Kentucky (Phifer, 1990), earthquake survivors in rural China (Wang et al., 2000), and Nicaraguan adolescents following Hurricane Mitch (Goenjian et al., 2001).

In more heterogeneous samples, the impact of race-ethnicity is complicated by its confounding overlap with socioeconomic status and other risk and resilience factors. For example, racial-ethnic groups who are culturally in the minority and of lower socioeconomic status typically have poor disaster outcome (Norris, Friedman, Watson, et al., 2002). Disaster studies that fail to control for such confounding factors generally report significant racial-ethnic effects. Simple logistic analyses of race-ethnicity following the September 11th attack in New York, for example, showed that African Americans and Latinos (e.g., Dominicans, Puerto Ricans) had poorer physical and mental health (Adams & Boscarino, 2005) and were less likely to evidence resilient outcomes (Bonanno et al., 2006) compared with Whites. However, in multivariate analyses that controlled for socioeconomic differences, African Americans and Latinos were no longer different than Whites (Bonanno, Galea, et al., 2007). Null effects for race-ethnicity on disaster outcome were also reported in studies using multivariate modeling to control for socioeconomic indicators, for example, among public school children following 9/11 (Hoven et al., 2005) and among adult

survivors of major hurricanes in Florida (Ruggiero et al., 2009). It is important to note, however, that unique racial-ethnic differences in disaster-related distress among children have sometimes emerged a number of months after a disaster (La Greca et al., 1996, 1998; Vernberg et al., 1996).

Preparation and prior exposure. In some geographic locations, disasters occur with predictable frequency, for example, in flood-prone or hurricane-prone regions. The fact that people continue to live in these regions suggests the intriguing possibility that prior experiences with disaster might inoculate people against possible psychological harm in subsequent disasters. If this were the case, we might also consider whether it is possible to train people about what they might expect in a disaster, thereby improving their chances for a resilient outcome.

The idea of stress inoculation is not new (Eysenck, 1983). Ironically, however, much of the available literature on psychological trauma seems to point to the opposite pathway (Breslau, Chilcoat, Kessler, & Davis, 1999; Kessler et al., 1995; King, King, Foy, & Gudanowski, 1996)—that prior exposure to traumatic life events sensitizes a person to be more rather than less reactive to subsequent trauma (Post & Weiss, 1998; van der Kolk & Greenberg, 1987). A closer inspection of the evidence reveals however that the trauma-sensitization idea is problematic. Almost all of the evidence in support of sensitization is based on retrospective accounts of past events. As noted earlier, these studies failed to separate the occurrence of a potentially traumatic event from the outcome of the event. Moreover, in one recent study that used prospective data gathered over a 10-year period, no relationship was found between the occurrence of potentially traumatic life events and the later development of PTSD (Breslau, Peterson, & Schultz, 2008).

By contrast, a number of disaster studies have produced data in support of the inoculation hypothesis. These studies uniformly suggest that stressor exposure helps buffer against subsequent disasters but only when the experiences are of a similar nature. For example, surviving an assault is not necessarily going to help a person cope with a flood, because the two experiences are so completely different. However, prior experience with disastrous floods would likely teach people about the nature, timing, and aftermath of severe flooding and therefore help them psychologically prepare for or cope with subsequent flood disasters. This outcome was in fact observed in a study of older adult survivors of a major flood (Norris & Murrell, 1988). The extent that survivors endured personal loss or damage in the flood was associated with increased anxiety and with increased weather-related distress 6 weeks after the flood, but only for those survivors who had not previously experienced a flood. For the survivors who had previously experienced a flood, level of personal loss in the most recent flood did not meaningfully impact their psychological outcomes.

This same pattern of similar-event inoculation has also been evidenced for other types of disasters. Following a disastrous airplane crash, for example, rescue workers with past exposure

to potentially traumatic experiences but not specific experience with a plane crash had greater distress and greater crash-related intrusive cognitions (Dougall, Heberman, Delahanty, Inslight, & Baum, 2000). By contrast, rescue workers with prior exposure to a similar airplane disaster did not evidence these reactions. Similarly, in a study of earthquake survivors in Southern Italy, those who had not previously suffered earthquake damage were more distressed 3 years later when renewed seismic activity resulted in a forced evacuation (Bland, O'Leary, Farinero, Josa, & Trevisan, 1996). However, those who had previously experienced earthquake damage were not adversely affected by the evacuation.

Disaster inoculation has also been observed in a prospective study that involved multiple waves of data (Knight et al., 2000). The study revolved around the 1994 Northridge earthquake which took place in an earthquake-prone region of southern California. Because the vast majority of participants in the study had at least one previous firsthand earthquake experience, it was possible to explore a dose-response inoculation effect. The number of prior earthquake experiences was inversely related to changes in depression from preearthquake to postearthquake. Thus, the more previous earthquake experiences a person had endured, the less likely they were to have extreme psychological reactions to a recent earthquake.

Social support. A well-studied contextual factor in disaster research pertains to the support survivors perceive and receive from others. A great deal has been written about the important role social support plays in adaptation, both to aversive life events (Brewin et al., 2000) and everyday strains and stressors (e.g., S. Cohen & Wills, 1985). Researchers have identified a number of forms or types of support. Support may come in the form of emotional reassurance, instrumental help with the immediate tasks of daily living, or the provision of information about how to do something or what the best course of action might be (Kaniasty & Norris, 2009). Support can also be positive, as when one feels confident that help will be forthcoming, or negative, as when generally supportive others are perceived as unwilling or unable to listen to one's deepest personal worries and concerns (Lepore, Silver, Wortman, & Wayment, 1996). There are also important variations in sources of support (e.g., kin, nonkin, coworkers, community) and the ways support manifests across broader networks, as captured by constructs like social embeddedness (Kaniasty et al., 1990) and social network size (S. Cohen, Gottlieb, & Underwood, 2000).

The most crucial distinction to emerge in research on the role of social support in the aftermath of disaster has been that of actual support provided, or *received support*, versus the subjective experience of being supported, or *perceived support* (Barrera, 1986). Interestingly, although conceptually similar, received and perceived support tend to be only moderately correlated (Norris & Kaniasty, 1996). Received and perceived support also differ in prevalence and in their relationship to adjustment. For instance, the amount of actual support a disaster survivor might receive (received support) tends to follow what Kaniasty and Norris (1995) called "the rule of relative

needs." In other words, a large part of received social support is mobilized by actual disaster-related losses. By contrast, postdisaster perceptions of support availability (perceived support) tend to deteriorate in a disaster's aftermath (Kaniasty & Norris, 1993; Kaniasty et al., 1990), mainly because collective emergencies can dramatically impact interpersonal social dynamics and availability of community resources.

Perceived and received support also evidence different patterns of association with postdisaster adjustment. Received support shows a mixed pattern of results. In several studies, received support has been shown to be beneficially related to adjustment (e.g., Bolin, 1982; Drabek & Key, 1984; Joseph, Andrews, Williams, & Yule, 1992), whereas in other studies it has been found to be unrelated to adjustment (e.g., I. Morgan, Matthews, & Winton, 1995; Murphy, 1988). By contrast, perceived support has been consistently positively associated with better postdisaster adjustment among adults and children (Bonanno, Rennicke, & Dekel, 2005; Kaniasty & Norris, 1993; La Greca et al., 1996; Norris & Kaniasty, 1996; Ruggiero et al., 2009). Importantly, several recent multivariate studies have specifically linked perceived social support with a resilient outcome after disaster, while controlling for potentially confounding demographic and predictor variables (Bonanno, Galea, et al., 2007; Bonanno et al., 2008).

Earlier we had considered the fact that disasters often impact and change the context of a person's life, which, indeed, appears to be the case for social support. For example, perceived support is especially important for helping children and adolescents manage the distress associated with disasters (e.g., Bokszczanin, 2008; La Greca et al., 1996; Lee, Ha, Kim, & Kwon, 2004; Prinstein, La Greca, Vernberg, & Silverman, 1996). However, children's support systems are complex and dynamic and potentially disrupted by disasters, given that parents, teachers, friends, and other support providers in children's lives may also be adversely affected by the disaster (e.g., Galea et al., 2008). For example, longitudinal data following Hurricane Charley showed that children's social support levels were negatively impacted by disaster-related stressors as well as subsequent life stressors (e.g., a family member's illness, parental divorce or separation; La Greca et al., in press).

Longitudinal studies of support and adjustment have revealed a dynamic interplay between received and perceived support over time. Specifically, these studies suggest that received support influences adjustment indirectly through perceived support. In an illustrative study, Norris and Kaniasty (1996) examined changes in the association of support and adjustment using independent samples of survivors from two different hurricanes. They found a greater degree of disaster exposure predicted a greater amount of actual support received but also a reduction over time in the overall perception of available support. The amount of actual support received was unrelated to distress. However, actual support evidenced a significant indirect path to reduced distress that led through perceived support. Greater received support predicted greater perceived support over time, and greater perceived support in turn predicted greater reductions in distress over time.

Economic resources. Another contextual factor that informs but can also be impacted by disaster is economic resources. In studies of traumatic life events, low socioeconomic status is consistently identified as a predictor of PTSD (Brewin et al., 2000). Disasters sometimes strike in regions of relatively homogeneous socioeconomic status, thus reducing the relevance of economic indicators. However, when there is variability, which is most often the case, economic resources clearly make a difference. In their review of the disaster literature, Norris, Friedman, Watson, et al. (2002) examined 14 studies that measured socioeconomic status and concluded that “lower [socioeconomic status] was consistently associated with greater post-disaster distress” (p. 236).

Although the link is consistent, the ways that economic resources might place people at risk can be as varied as are disasters themselves. In the most basic sense, a lack of economic resources makes it more difficult to withstand the short- and long-term demands imposed by disasters. For example, interviews with survivors of Hurricane Andrew revealed that although people in low-income areas were aware of the emergency storm warnings, they lacked the resources to purchase storm-buffering supplies or to evacuate the area (Morrow & Enarson, 1996). More broadly, the general lack of infrastructure in economically underdeveloped areas tends to impede the spread of information in advance of and during a disaster as well as the ability of emergency response teams to provide aid (Chandrasekhar & Ghosh, 2001). Not surprisingly, given these impediments, although poorer nations experience natural disasters at about the same frequency as wealthy nations, the death toll from natural disaster is greater in poorer nations compared with the death toll in wealthy nations (Kahn, 2005). Furthermore, as detailed analyses of the economic impact of the 1995 Kobe earthquake in Japan have shown, because poorer households have fewer collateralizable resources, when disaster strikes they are less able to borrow as a means of withstanding its economic impact or of rebuilding for the future (Sawada & Shimizutani, 2008).

Personality. In addition to the situational factors that establish the context of a disaster, each person brings something of themselves to the mix in the form of their personality. A great deal of attention has been devoted to personality in the psychological literature, most certainly because of its salience. In contrast to most other psychological constructs, we can see personality. We notice differences in people and we continually make inferences about their personality as a way of accounting for those differences (Ross, 1977). Not surprisingly, there has been a great deal of speculation about the types of personality traits that might inform resilience to disaster and trauma as well as considerable interest in developing methods to engender these traits in the broader population (e.g., Bell, 2001; Maddi, 2005; Paton, Smith, & Violanti, 2000).

We caution, however, that although personality factors may appear to be salient, their explanatory power is easily overestimated. As Mischel (1969) famously observed, personality rarely explains more than 10% of the actual variance in

people’s behavior across situations. We suggest, therefore, that although personality is a compelling feature of human behavior, it is most appropriately viewed as one of many risk and resilience factors that might contribute to the course and ultimately the outcome of a person’s reaction to disaster (Bonanno & Mancini, 2008).

A crucial methodological consideration is that in the vast majority of disaster studies that have examined personality variables, these variables are almost always assessed after the disaster occurred, which is problematic because although personality is assumed to be stable, most personality measures evidence at least some variability over time. It is entirely plausible therefore that the relationship between personality and disaster may be bidirectional. In other words, personality may influence how people react to disasters but the experience of disaster may also influence how people describe themselves on personality inventories. Within the context of this limitation, then, the most compelling evidence necessarily comes from multivariate studies that statistically control for exposure and other potentially confounding factors or from prospective studies that measure personality prior to the disaster’s advent.

Several disaster studies using multivariate analyses have demonstrated straightforward effects for the personality dimension of neuroticism (emotional instability). Neuroticism is associated with a general disposition toward negative affectivity and dissatisfaction (Costa & McCrae, 1980). Not surprisingly, neuroticism has been associated with negative disaster adaptation (Carr, Lewin, Kenardy, et al., 1997; McFarlane, 1989). In a study that included both multivariate analyses and a prospective design, Weems and colleagues (2007) examined negative affectivity, a trait dimension similar to neuroticism, in a small sample of adolescents before and after Hurricane Katrina. Controlling for predisaster mental health, gender, and number of hurricane-related stressors, they found that predisaster negative affectivity predicted greater postdisaster symptoms of PTSD, anxiety, and depression.

Several studies documented that various manifestations of psychological sense of control are important positive predictors of recovery following disastrous events. These effects emerged in both cross-sectional and prospective analyses that accounted for a number of control variables (e.g., socioeconomic variables, level of exposure, psychological resources). In a prospective study, Ullman and Newcomb (1999) showed that earthquake victims who had higher levels of perceived control before the disaster experienced lower intensity of intrusive symptoms after the event. Perceptions of control and sense of mastery assessed after disasters were also associated with better mental-health outcomes (e.g., Karanci, Alkan, Aksit, Sucuoglu, & Balta, 1999; Norris, Perrila, Riad, Kaniasty, & Lavizzo, 1999; Sumer, Karanci, Berument, & Gunes, 2005). In addition to direct effects, after a flood in Poland, sense of mastery buffered the impact of threat to life and injury on symptoms of posttraumatic stress and depression (Kaniasty, 2006). A general sense of self-efficacy was also related to lower distress among bereaved adults 1 and 3 years after the Mount St. Helens volcano eruption (Murphy, 1988) and a year

after Hurricane Hugo among high school students (Hardin, Weinrich, Wienrich, Hardin, & Garrison, 1994). A number of disaster studies have also assessed disaster-specific coping self-efficacy: that is, the belief that one can exercise control over the challenges of recovering from disaster. Disaster-specific coping self-efficacy has been associated with better psychological adjustment, both immediately and in the months after both natural disasters (e.g., Benight & Harper, 2002; Benight et al., 1999; Kessler, Galea, Jones, & Parker, 2006; Sumer et al., 2005) and terrorist attack (Benight et al., 2000).

Another personality dimension of relevance to disaster is the tendency to ruminate. Rumination is the act of “repetitively and passively focusing on symptoms of distress and the possible causes and consequences of these symptoms” (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008, p. 400). The tendency to engage in rumination appears to be a relatively stable response style and has been associated with increased vulnerability to distress and depression, decreased problem-solving abilities, disruption in the execution of instrumental behaviors, and the dissolution of social relationships (see Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008). Because disasters tend to evoke high levels of disruption and distress, survivors prone to ruminate would presumably be at considerable risk for negative outcomes. A prospective multivariate study by Nolen-Hoeksema and Morrow (1991) supports this supposition. These investigators measured the ruminative response style in a group of college students just 2 weeks prior to the Loma Prieta earthquake in California. Controlling for preearthquake functioning and stress caused by the earthquake, preearthquake ruminative tendencies predicted PTSD symptoms 10 days after the earthquake and greater depressive symptoms 10 days and 7 weeks after the earthquake.

In addition to these straightforward effects, the intense and demanding circumstances that surround disasters also suggest possible counterintuitive associations with personality. Bonanno and colleagues (Bonanno, 2004, 2005; Bonanno & Mancini, 2008; Westphal, Bonanno, & Bartone, 2008) have argued that effective coping with extremely aversive situations often demands immediate, goal-directed behaviors that under normal circumstances might be ineffective or even maladaptive. They have referred to this phenomenon as pragmatic, a “whatever it takes” approach, and “coping ugly” (Bonanno, 2004, 2005, 2009).

One trait that fits the whatever-it-takes pattern is self-enhancement. In the most general terms, self-enhancement refers to the use of overly positive or unrealistic and self-serving biases (e.g., Taylor & Brown, 1988, 1994). The trait dimension of self-enhancement simply describes people who tend to habitually engage in self-serving biases. As is true of pragmatic coping traits generally, in normal circumstances trait self-enhancement can be something of a mixed blessing (Paulhus, 1998). On the positive side, trait self-enhancers tend to have high levels of positive affect and self-esteem and to cope well with aversive circumstances (Bonanno, 2005). On the negative side, however, trait self-enhancers evidence narcissistic characteristics and tend to evoke

negative reactions in other people (John & Robins, 1994; Paulhus, 1998).

When the chips are down and self-enhancers are confronted with extreme or potentially traumatic life circumstances, however, they appear to adapt exceptionally well. The link between trait self-enhancement and positive adaptation to potential trauma is well established (Bonanno, Field, Kovacevic, & Kaltman, 2002; Bonanno, Rennie, & Dekel, 2005). In one study, trait self-enhancement was measured prospectively at the onset of a 4-year longitudinal study (Gupta & Bonanno, 2010). Multivariate analyses indicated that self-enhancement predicted better adjustment after subsequent exposure to potentially traumatic events, beyond its possible overlap with the personality dimensions of optimism and neuroticism.

Trait self-enhancement also appears to be particularly salubrious in the aftermath of disaster. Among high-exposure survivors of the September 11th terrorist attack in New York City, for example, trait self-enhancement was more frequent among those evidencing a resilient trajectory of low PTSD and depression symptoms (Bonanno, Rennie, & Dekel, 2005). Trait self-enhancement was also associated with reduced negative affect and greater positive affect in the months following the attack and in multivariate analyses with reduced symptoms net of trauma exposure. At the same time, however, the social cost of self-enhancement again emerged in the 9/11 data. Specifically, in anonymous ratings obtained from participants' close friends and relatives, trait self-enhancers were seen as having declining social relations over time and, at the greatest levels of exposure, as less honest. On the whole, however, trait self-enhancers appear to have fared quite well. Of the four other dimensions of positive adjustment assessed (mental health, physical health, goal accomplishment, and coping ability) trait self-enhancers were rated more favorably than other participants. In addition, trait self-enhancers reported broader social networks and their friends and relatives reported more frequent daily contact with them (Goorin & Bonanno, 2009). Finally, consistent with other data associating self-enhancement with leadership abilities (Sosik, 2005), trait self-enhancers were more likely to have organized and comforted others during the 9/11 attack (Goorin & Bonanno, 2009).

If a pragmatic whatever-it-takes approach is adaptive in the context of disaster, than it follows that optimal adjustment should be associated with the capacity to shape and modify one's behavior to meet the shifting challenges that arise in different situations. At the trait level, this capacity has been referred to variously as *ego resilience* (Block & Block, 2006), *hardiness* (Kobasa, 1979), and *adaptive flexibility* (Bonanno, 2005). Flexibility can be observed relatively early in development (Block & Block, 2006) and has been consistently associated with positive adjustment in the face of potential trauma (Bonanno, Pat-Horenczyk, & Noll, in press; Ong, Fuller-Rowell, & Bonanno, 2010).

The personality dimension of hardiness (Kobasa, 1979; Kobasa, Maddi, & Kahn, 1982) captures a form of cognitive flexibility. Hardy individuals tend to believe that they can control or influence the outcome of events and tend to reframe

or reconceptualize stressful life events as challenges rather than threats. One consequence of these tendencies, supported across a number of studies, is that hardy individuals appraise potentially stressful events as less threatening than do nonhardy individuals (Allred & Smith, 1989; Kobasa et al., 1982; Rhodewalt & Zone, 1989; Wiebe, 1991). Several studies have demonstrated a moderating effect of hardiness on disaster-related stress. However, most of this research is limited to cross-sectional observations. For example, hardiness was associated with enhanced psychological well-being, greater positive affect, and reduced negative affect and psychiatric symptoms following a military base disaster (Bartone, Ursano, Wright, & Ingraham, 1989). Another study showed that in the weeks following an acute industrial accident, hardy individuals were less distressed and retained higher organizational commitment and job satisfaction (Barling, Bluen, & Fain, 1987).

A different trait form of flexibility pertains to the ability to regulate the expression and suppression of emotion across different situational demands. This ability has been measured using an experimental laboratory task and has evidenced good test-retest reliability over a span of several years (Westphal, Seivert, & Bonanno, 2010), suggesting that it is in fact a trait dimension. In the specific context of disaster, New York City college students who evidenced expressive flexibility soon after the 9/11 terrorist attack were found to be less distressed 2 years after the attack relative to other less expressively flexible students (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004).

Most of the research on personality and disaster has been conducted with adults, with a few notable exceptions, such as the study by Weems and colleagues (2007) described earlier. Given the unexpected nature of disasters, few studies have examined the impact of children's predisaster psychological functioning, in large part because of difficulties obtaining accurate predisaster evaluations of such characteristics. Nevertheless, several prospective studies are available that implicate youths' preexisting anxiety levels as a specific area of vulnerability for postdisaster distress. For example, La Greca and colleagues (1998) obtained robust measures of anxiety and behavioral problems on a sample of 4th- through 6th-grade children, using self-reports, peer reports, and teacher reports, 15 months before the area was struck by Hurricane Andrew. Assessments 3 and 7 months after the hurricane showed that children's predisaster levels of general anxiety predicted postdisaster PTSD symptoms, controlling for disaster exposure and demographic variables. Children's predisaster levels of inattention and academic difficulties also predicted greater PTSD symptoms at 3 months but not at 7 months postdisaster. Also noteworthy, children with higher peer-rated anxiety before the hurricane were less likely to decline in PTSD symptoms (i.e., to recover) from 3 to 7 months postdisaster than those with low predisaster anxiety. These findings are compatible with those of Asarnow et al. (1999), who conducted phone interviews with children participating in a study of childhood-onset depression at the time of the Northridge earthquake. Interestingly, children with preearthquake anxiety disorders

(but not preearthquake depressive symptoms) reported more symptoms of PTSD 1 year after the earthquake.

Proximal exposure: The disaster event

Numerous researchers have attempted to document the multifaceted relationship between exposure to disaster and psychological adjustment. Overall, studies that have assessed exposure have consistently reported a dose-response effect, whereby greater exposure is generally associated with poorer psychological adjustment. As noted earlier, however, exposure is only one of many cumulative risk and resilience factors, and even at the highest levels of exposure psychological resilience is nonetheless evidenced in significant portions of the sample.

Invariably, the assessment and definition of exposure is complicated by the heterogeneous nature of disasters. Different types of disasters engender different types of risk. For example, in a terrorist attack the danger of immediate physical injury is acute but generally transient and limited to a relatively focused geographic location. By contrast, the danger period for a natural disaster such as an earthquake may encompass hours or even days, may spread over a broader geographic area, and may induce both short- and long-term health consequences. Of course, disasters are by definition chaotic and sweeping in their consequences and not likely to conform to preconceived notions of impact. In the most global terms, however, disasters involving mass violence generally result in more severe levels of psychological impairment than technological disasters, which in turn tend to produce more severe impairment than natural disasters (Norris, Friedman, Watson, et al., 2002).

Any number of disaster-induced experiences and consequences might be taken to constitute exposure, including, for example, threat to life, injury, shock and horror, loss of loved ones, property damage, change in finances, or impact on the broader community. Exposure can also be quantified along continuous dimensions such as geographic proximity to the disaster or number and intensity of disaster-related stressors or in terms of more abstract dimensions related to the survivors' subjective appraisals of short- and long-term risk (Marshall et al., 2007).

Given the complexities in the ways disasters unfold over time, we suggest that perhaps the most parsimonious conception would be one that distinguishes between proximal and distal aspects of exposure. *Proximal exposure* refers to events and consequences that occur during the approximate period of the disaster itself, and *distal exposure* refers to events and consequences that manifest most clearly in the disaster's aftermath. Proximal exposure to some extent overlaps with the concept of psychological trauma. Although there is more to proximal exposure than trauma reactions, the immediate impact of a disaster is nonetheless nicely captured by two event criteria specified as part of the PTSD diagnosis (American Psychiatric Association, 2000): immediate physical danger and/or witnessing death or serious injury to others.

Greater proximal exposure to disaster has been consistently linked to increased distress and psychopathology, even in

multivariate analyses that controlled for its overlap with other predictors and conditions (e.g., Bonanno et al., 2006; Bonanno, Rennike, & Dekel, 2005; Epstein, Fullerton, & Ursano, 1998; Nolen-Hoeksema & Morrow, 1991; Norris, Kaniasty, Conrad, Inman, & Murphy, 2002). However, high levels of proximal exposure have not precluded psychological resilience. As reviewed earlier, survey data obtained from New York City following the September 11th terrorist attack indicated that about half of the sample was resilient even at extreme levels of proximal exposure (e.g., being inside the World Trade Center when one of the planes struck) and that resilience never fell below one third of the sample for any category of exposure measured (Bonanno et al., 2006).

In terms of practical reality, it should be emphasized that the distinction between proximal and distal exposure is primarily heuristic. For example, losing one's home may occur during the disaster. However we consider home loss or displacement as a form of distal exposure because its full consequences are felt primarily in the weeks and months after the disaster. The parsing of these different aspects of exposure may also depend on the specific populations affected by the disaster. When children are involved, for example, the actual events of the disaster are rivaled and sometimes even eclipsed by the disaster's distal impact on the child's immediate caregivers or family (McFarlane, 1987b). In the aftermath of the Buffalo Creek Dam collapse, children's level of PTSD was predicted by life threat during the disaster but also independently by their mothers' level of psychopathology and by the quality of the postdisaster family atmosphere (Green et al., 1991). A population study of psychopathology among New York City public school children in the months following the September 11th attacks reported a clear dose relationship with both direct personal exposure and family exposure. However, family exposure evidenced an even stronger relationship to psychopathology than did personal exposure (Hoven et al., 2005).

One nuance in the data regarding proximity and individuals' disaster reactions has to do with the distinction between objective life threat (e.g., doors or windows breaking in the house during a hurricane or earthquake) and perceived life threat (e.g., thinking one might die during the disaster). Perceptions of life threat are thought to be critical to the emergence of PTSD symptoms (Green et al., 1991). Across a number of studies of children and adolescents, for example, the perceived-life-threat aspect of proximal exposure is often one of the strongest predictors of youths' postdisaster PTSD reactions (e.g., La Greca et al., 1996, 1998, in press; Lonigan et al., 1991; McDermott et al., 2005; Udwin et al., 2000; Yelland et al., 2010).

Geographic location is also an important component of proximal exposure. It is important to note, however, that location by itself can be misleading and is often confounded with other aspects of exposure. Geographic locations where terrorist attacks occur with regularity, for example, are also typically encumbered by other terrorist-related stressors, such as frequent reminders of the attack, likelihood of losing a loved one, personal injury, disruption in routine, and postdisaster

stress in the community (Shalev, Tuval, Frenkiel-Fishman, Hadar, & Eth, 2006). Indeed, although studies of the September 11th attacks in New York consistently reported a positive association between geographic proximity and psychological distress (e.g., Adams & Boscarino, 2006; Boscarino, Adams, & Figley, 2004; Galea et al., 2002, 2003; Schuster et al., 2001; Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002), population studies of terrorist attacks in Israel have often failed to reveal such associations (Bleich, Gelkopf, & Solomon, 2003; Bleich, Gelkopf, Melamed, & Solomon, 2006; Shalev et al., 2006; Somer, Ruvio, Sever, & Soref, 2007; Somer, Ruvio, Soref, & Sever, 2007).

Of interest, survey research on reactions to the recent Wenchuan earthquake in Sichuan China suggested a "psychological typhoon eye" effect (Li et al., 2009, 2010). Respondents in the areas most devastated by the earthquake actually reported less concern about personal safety and health, estimated that fewer relief workers would be needed, and predicted a lower probability of disease outbreak, compared with respondents from less devastated areas.

Similar findings, mentioned earlier, were reported in the 9/11 study of New York City public school children. Children in that study who attended schools nearest to Ground Zero did not have greater levels of psychopathology than other children, and in fact, children from these schools had significantly less psychopathology than children from schools more remote to Ground Zero (Hoven et al., 2005). Numerous factors might explain this somewhat surprising finding, including the moderating impact of distal exposure. The schools closest to Ground Zero experienced a considerable degree of international media prominence. The closest schools also received higher levels of support and assistance in the aftermath of the disaster. The moderating influence of the latter was poignantly illustrated in another earthquake study in Northern China (Wang et al., 2000). Random samples drawn from two villages were similar in all demographic categories and both villages were located well within the geographic area of the earthquake. However, one village was situated extremely close to the earthquake's epicenter (0.5 km) and suffered markedly greater physical damage during the quake than the other village which was located further (10 km) from the epicenter. Three months after the earthquake, however, the village closer to the epicenter had considerably fewer cases of PTSD than did the village that was further out from the epicenter. Because the closer village had been assessed by government relief authorities as having suffered greater damage, that village was allotted a considerably greater amount of both immediate disaster relief and subsequent reconstruction support. These resources in turn appeared to have helped buffer members of the village from developing chronic PTSD reactions (Wang et al., 2000).

Distal exposure: The disaster's aftermath

Economic resources loss. We noted earlier that a lack of economic resources makes it more difficult for people to withstand the impact of disaster. However, the *loss* of

economic resources as a result of disaster poses what is arguably an even more imposing risk factor (Hobfoll, 1989, 2002). An obvious manifestation of disaster-related economic loss comes in the form of material destruction. Damage to home or property has been positively associated with greater postdisaster distress and increased worry about the future (Elliot & Pais, 2006) and with elevated PTSD and mood disorders (Galea et al., 2007; La Greca et al., 1996; Yelland et al., 2010). In young children, disaster-related property loss has been found to predict a longer duration of postdisaster behavioral problems (Swenson et al., 1996).

Property loss from disaster is to some extent moderated by predisaster economic resources. More precisely, property loss tends to be regressive. Poorer households stand the most to lose in a disaster because a greater portion of their assets is usually tied up in tangible goods and property. When Hurricane Mitch struck Honduras in 1998, for instance, people in the lowest quintile of wealth lost over six times as much of their assets compared with those in the highest quintile of wealth (Morris, Niedecker-Gonzales, Carelto, Munguia, & Medina, 2002). In addition, as noted earlier, poorer households are less able to borrow money in a disaster's aftermath, which makes it more difficult for them to rebuild for the future (Sawada & Shimizutani, 2008).

Another way disasters impact survivors economically is through the loss of employment and income. When Hurricane Mitch hit Central America in 1998, it killed over 5,000 people and severely injured a staggering 1.2 million. However, the long-term economic impact of the disaster was felt primarily in the way it devastated food crops. Hurricane Mitch wiped out the region's primary protein and dietary energy sources, maize and beans, which are consumed by the poorest 25% of families. As a result, over one third of the survivors reported loss of income as a result of crop damage (Rogers, Swindal, & Ohri-Vachaspita, 1996). The reduction in income following disaster, in turn, is commonly associated with greater disaster-related psychopathology. Six years after the Exxon Valdez oil spill off the coast of Alaska, for example, income loss among commercial fisherman in the region was linked to elevated levels of anxiety, depression, and posttraumatic stress (Arata, Picou, Johnson, & McNally, 2000).

As pervasive as the negative impact of economic loss may appear to be, like many aspects of disaster, it is often confounded with other potentially corrosive exposure factors. Untangling these factors can be difficult. However, impressive multivariate and longitudinal data have consistently supported the independent impact of job loss on long-term mental health. Multivariate analyses of population survey data collected following Hurricane Katrina showed that the loss of financial resources uniquely predicted increased distress and worry, net of other demographic and predictor variables (Adeola, 2009). Another independent study of Hurricane Katrina, also using multivariate modeling, demonstrated a predictive association between financial loss and PTSD while controlling for other factors, including exposure to Katrina-related traumatic events and exposure to post-Katrina stressors (Galea et al., 2008). New

Yorkers who lost their jobs following the September 11th terrorist attack have also been found to have greater levels of trauma symptoms (DeLisi et al., 2003). However, of particular significance, multivariate modeling of longitudinal population data from the New York area indicated that job loss after 9/11 was a significant predictor of both immediate PTSD and the persistence of elevated PTSD symptoms over time (Nandi et al., 2005).

In addition to its links to enduring psychopathology, disaster-related economic loss also reduces the odds of a survivor experiencing a stable trajectory of health or resilience. A study of Taiwanese earthquake survivors reported that a majority (69%) were mentally and physically healthy. Nonetheless, survivors who suffered financial loss immediately after the earthquake had poorer overall mental health, reduced energy and vitality, poorer physical functioning, and greater physical pain (Chou et al., 2004). Analyses of population data following the 9/11 attacks indicated that 65% of the sample could be classified as resilient (Bonanno et al., 2006). However, subsequent multivariate analyses indicated New Yorkers who experienced significant income loss were less than half as likely to be resilient as other survivors (Bonanno, Galea, et al., 2007).

Displacement and relocation. Related to the loss of economic resources is the displacement and relocation of disaster survivors. As always, marked variation exists across disasters. Depending on the type of disaster, the number of people displaced from their homes can range from minimal to catastrophic. Terrorist-instigated disasters, for example, tend to strike public targets and typically do not lead to displacement. There are exceptions, of course, as in the case of the September 11th attack in New York City. The Amsterdam airplane crash, discussed earlier, physically impacted a relatively small area of the city, but the crash and the resulting fire ultimately destroyed 500 homes, damaged over 1,000, and dislocated over 1,200 people (Dirkzwager et al., 2006). Earthquakes often cause major damage to homes, but again there is variability. Following the 1989 Newcastle earthquake in Australia, over 800 people requested emergency accommodation (Carr, Lewin, Webster et al., 1997). The Loma Prieta earthquake that struck California that same year had considerably more impact, leaving an estimated 12,000 people homeless (Earthquake Engineering Research Institute, 1990). The displacement that resulted from the recent Wenchuan earthquake in Sichuan China was nearly incomprehensible. One estimate set the number of people left homeless by the earthquake at 21 million (Ciu et al., 2009). Weather-related disasters also tend to result in widespread displacement. Rampant flooding in the Midwestern United States in the early 1990s caused the evacuation of nearly 23,000 people (Ginexi et al., 2000). Hurricane Katrina wrought damage on an even larger scale, displacing an estimated 700,000 to 1.2 million people (Picou & Marshall, 2007).

A key question is whether displacement in and of itself has negative psychological consequences. In many disasters, the loss of a home occurs in a context of potentially traumatic

levels of exposure. Displacement is also often accompanied by other kinds of losses, such as the loss of possessions, job loss, income loss, and curtailed access to resources like health care (Mortensen et al., 2009). Whether these factors combine to elevate distress, depression, or PTSD or whether displacement by itself might have a corrosive effect has yet to be clarified.

Only a small number of studies have separated out the specific effects of displacement from more general disaster-related exposure. Surprisingly, these studies suggest that displacement in and of itself does not produce negative consequences. In one study, for example, older Taiwanese who had lost their home in a 1999 earthquake were found to have identical levels of depression symptoms as older exposed Taiwanese who had not lost their home (Watanabe, Okumura, Chiu, & Wakai, 2004). Similarly, a study of children affected by the 2004 tsunami in Southeast Asia found no difference in either PTSD or depression symptoms between children who were directly affected by the tsunami but not displaced and those who were both affected and displaced (Thienkrua et al., 2006).

A related issue is whether it is advantageous to relocate people who lose their homes to an area unaffected by the disaster. Theoretically, there are arguments both for and against relocation. On the one hand, moving to an unaffected location would be desirable because it provides safety and enhanced resources. On the other hand, relocation might potentially interfere with psychological adaptation by disrupting family cohesion and depriving people of preexisting support networks (Erikson, 1976; Galante & Foa, 1986).

The available evidence, like theory, seems to support both views. One study compared three groups of mothers: those who had lost their homes in the devastating 1988 Armenian earthquake but remained in the area, living in tents, trailers, or temporary shelters; those who lost their homes and immediately relocated to an unaffected Armenian city; and those who did not experience the earthquake (Najarian, Goenjian, Pelcovitz, Mandel, & Najarian, 2001). The results reveal a complex pattern of findings that did not show clear psychological benefits one way or the other. For example, the two groups who had lost homes did not differ in level of PTSD symptoms. However, the relocated mothers were more depressed than those who remained in the earthquake area, but those who remained had more variable mood during the course of the day and reported feeling worse in the mornings and late evenings compared with mothers who relocated. A similarly complex picture emerged after the Hurricane Katrina disaster. Many of the refugees from Katrina left behind poverty and poor living conditions in New Orleans and relocated to more prosperous areas. Of the Katrina refugees who moved to Houston, Texas, more than one third felt they had gained better housing and more than half felt they had moved to better schools. By the same token, however, a majority of the refugees also reported that they had smaller social networks and weaker relations with family after relocation (Wilson & Stein, 2006).

It is important to note, however, that when prolonged displacement involves large numbers of survivors, the possibility of

other untoward consequences is increased. For example, resettlement camps and other temporary housing arrangements designed for mass refugees can create elevated risk for reduced hygiene, exposure to communicable disease, insufficient or contaminated water, and malnutrition. These risks are especially pronounced in areas of rampant poverty or ongoing military conflict (Watson, Gayer, & Connolly, 2007). A meta-analysis of studies comparing refugees and internally displaced people with nondisplaced people reported a moderate-size overall effect linking refugee status with increased psychopathology (Porter & Haslam, 2005). Of significance, because a number of the studies in the meta-analyses had included data on exposure, it was possible to statistically separate the effects of exposure and refugee status. Generally, when exposure was similar in the displaced and nondisplaced groups, the negative effects of refugee status on mental health decreased but did not altogether disappear.

Media exposure. The marked technological advances in news and Internet media over the past half century have created an unprecedented potential for the rapid dissemination of disaster-related information. Televised media remains the most popular overall news source (Gallup, 2007, 2008; Pew Research Center for the People & the Press, 2008) and during disasters the majority of people in the exposed regions tend to turn to national news networks for information. This trend was particularly striking during the September 11th terrorist attack, in which 63% of Americans reported being “addicted” to news coverage of 9/11 as opposed to 50% after the 1991 Gulf War (Rainie, 2001). However, Internet news media sites also reported dramatic increases in visits after 9/11 (Glass, 2002).

For the most part, news from these sources is dominated by intensely graphic visual imagery. How such imagery might influence responses to disaster has received comparatively little attention, even though threatening and intrusive images are central to the concept of posttraumatic stress (e.g., Holmes, Creswell, & O’Connor, 2007). Most of the available research comes from studies of two high profile events: the 1995 bombing of a federal office building in Oklahoma City and the September 11th terrorist attack in New York City. There is good reason why these events in particular generated research on the role of media in disaster. The images they produced were both gripping and of great political and historical importance. The images were also aired repeatedly during the first days of the event.

Published research on the media impact after the Oklahoma City bombing focused exclusively on children. Across studies, middle school children (Grades 6–8) with greater media exposure to the bombing reported higher levels of PTSD symptoms (Pfefferbaum et al., 2001; Pfefferbaum et al., 2003). Media exposure was also associated with posttraumatic stress in middle school children living more than 100 miles from the site of the bombing (Pfefferbaum et al., 2003). Research on adults’ and children’s reactions to the September 11th attacks has also consistently demonstrated a positive association between media exposure and elevated

PTSD symptoms. This association was found in national samples as well as in more directly exposed samples from the New York Metropolitan area (Fairbrother, Stuber, Galea, Fleischman, & Pfefferbaum, 2003; Saylor, Cowart, Lipovsky, Jackson, & Finch, 2003; Schlenger et al., 2002; Schuster et al., 2001). Again, although these studies did not explicitly define a category of resilient individuals, minimal 9/11-related media exposure was consistently associated with the lowest levels of posttraumatic stress.

A study of a large, representative sample of New Yorkers revealed that the vast majority of New Yorkers saw televised images of the disaster more than daily during the first week after the attack (Ahern et al., 2002). Repeated television viewing of graphic 9/11 images among New Yorkers was generally associated with greater post-9/11 psychopathology, whereas minimal media exposure to 9/11 imagery was associated with the lowest levels of posttraumatic stress (Ahern, Galea, Resnick, & Vlahov, 2004). These associations held even after statistically controlling for exposure and a range of other possible explanatory variables, including variations in demographic characteristics, social support, and past stressors. Several images were particularly harmful. The most injurious images were those of people falling or jumping from the burning towers. People who viewed these images on television more than daily during the first week after the attack were more than three times as likely to have developed PTSD and also more than three times as likely to be depressed. Moreover, repeated viewing of these images was especially likely to result in PTSD among people who were directly most affected by the attack (e.g., witnessed the attack in person, lost a friend or relative, suffered lost or damaged possessions; Ahern, Galea, Resnick, & Vlahov, 2004).

A limitation of these and most studies of media exposure is that they used cross-sectional designs with retrospective assessment of media exposure. Although media viewing immediately after the disaster would have predated the onset of PTSD, reports of early television viewing were measured retrospectively and simultaneously with the first assessment of PTSD symptoms. Thus, it is not possible to untangle whether media exposure led to PTSD or whether people who developed PTSD sought out the images or had better memory of the images they had viewed.

Importantly, the link between media exposure and disaster-related distress has also been demonstrated in several longitudinal studies. One study measured changes in PTSD status over the first year after 9/11 in relation to media coverage of the first anniversary of the attack (Bernstein et al., 2007). Among a representative sample of New Yorkers, those who did not have PTSD at 6 months but watched 12 or more hours of anniversary news coverage were more than three times as likely to develop new-onset PTSD at 12 months. An important finding here is that the strongest relationship between anniversary media exposure and new-onset PTSD was observed among New Yorkers who had at least some prior symptoms of PTSD. New Yorkers with no previous PTSD symptoms (i.e., those who were resilient across the first 6 months) were only slightly

more likely to develop a new case of PTSD with added media exposure.

Another prospective study examined posttraumatic stress and media exposure to the anthrax bioterrorism attacks that followed soon after the September 11th attack (Dougall, Hayward, & Baum, 2005). One interesting finding from this study was that media exposure may be influenced by stable individual differences. People who watched the most news coverage following the 9/11 attack also tended to watch more news coverage of the anthrax attacks. More important, the amount of media coverage participants watched when they first learned of the anthrax attacks predicted anthrax-related posttraumatic stress at that time and also 6 months later. Finally, the relationship between initial media coverage and later posttraumatic stress was mediated by the extent that participants perceived themselves or their families to be at risk for anthrax exposure. In other words, media coverage of the anthrax attacks appeared to increase the perception of personal risk, which in turn led to increases in posttraumatic stress.

When considered together, these findings suggest that the media and perhaps also government information agencies might play a valuable role in helping to reduce fear and promote calm following a major disease outbreak (Menon & Goh, 2005; Wallis & Nerlich, 2005). In the context of SARS, for instance, an analysis of 17 cities in China suggested that providing the public with realistic information about risk and recovery helped assuage SARS-related worry (Shi et al., 2003). In Hong Kong, Ng et al. (2006) piloted a brief group intervention during the SARS epidemic with the aim of helping at-risk populations “cope with fear” (p. 56). Their preliminary findings suggest this approach may be efficacious.

Finally, it is important to note that children may be especially vulnerable to perceiving personal and societal threat via television viewing (Comer, Furr, Beidas, Babyar, & Kendall, 2008). In the absence of media controls, efforts to restrict children’s media viewing of disaster events (e.g., La Greca, Sevin, & Sevin, 2001, 2005) and/or to provide parents with strategies for addressing televised news with children (e.g., Coping and Media Literacy; Comer, Furr, Beidas, Weiner, & Kendall, 2008) may be useful after a disaster.

Summary

- Individual differences in disaster outcome are informed by a number of unique risk and resilience factors.
- These factors include variables related to the context in which the disaster occurs, to proximal exposure during the disaster, and to distal exposure in the disaster’s aftermath.
- Multivariate studies indicate that there is no one single dominant predictor of disaster outcome.
- Most predictor variables exert small to moderate effects, and it is the combination or additive total of risk and resilience factors that informs disaster outcomes.

Disasters Put Families, Neighborhoods, and Communities at Risk

Shifting layers of support

Reviews of literature on public responses to disasters offer insights into two very different, and at times conflicting, processes that routinely emerge in the aftermath of catastrophic events (e.g., Bourque, Siegel, Kano, & Wood, 2006; Kaniasty & Norris, 2004, 2009; Raphael & Wilson, 1993). All catastrophes and natural disasters in particular elicit an outpouring of immense mutual helping. Immediately after the impact, communities of victims, professional supporters, and empathetic witnesses rally to rescue, protect, and help each other. Unfortunately, however, this compassionate stage must inevitably cease. Tangible losses of natural and human-made environments are often accompanied by growing sense of loneliness, competition, and polarization within what used to be a united community in shared distress.

Numerous studies indicate that mutual helping is abundant in the immediate aftermath of natural disasters (e.g., Beggs, Haines, & Hurlbert, 1996; Bolin, 1982; Carr, Lewin, Carter, & Webster, 1992; Drabek & Key, 1984; Kaniasty & Norris, 1995, 2000; Tyler, 2006). Historically, this instant postdisaster mobilization of support has been referred to in the sociological disaster literature with an assortment of highly descriptive terms: *democracy of distress* (Kutak, 1938), *postdisaster utopia* (Wolfenstein, 1957), *stage of euphoria* (Wallace, 1957), *altruistic community* (Barton, 1969), or *heroic and honeymoon phases* (Frederick, 1980). The most distinguishing features of such collectives are a heightened internal solidarity, a sense of unity, a disappearance of community conflicts, a utopian mood, an overall sense of altruism, and heroic action. It has been assumed that the increased postcrisis benevolence and community cohesion carry with them *therapeutic features* that might result in an *amplified rebound*. In other words, these heightened communal sacrifices and concerns for each other may mitigate the adverse psychological consequences of disasters or even take the disaster-struck community “beyond its pre-existing levels of integration, productivity, and capacity for growth” (Fritz, 1961, p. 692; see also Quarantelli, 1985).

Although in many instances, especially in more affluent regions of the world, there is a great deal of formalized aid offered by governmental and relief agencies, disaster victims tend to rely primarily on their indigenous support networks (Barton, 1969). Notwithstanding some exceptions (see Kaniasty & Norris, 2009), it is well documented that disaster survivors chiefly depend on, and are taken care of by, their families, relatives, friends, and neighbors. However, a similarly authoritative statement concerning the impact of disasters on subsequent kin and nonkin relationships cannot be made because the empirical evidence is limited and equivocal.

One of the earliest major studies of postdisaster adaptation at the family level was an investigation of the 1966 Topeka (Kansas) tornado (Drabek & Key, 1984). The study’s complex methods included exposed and nonexposed families as well as predisaster (baseline) data and a prospective design, the first in

the history of disaster research. The primary questions of this investigation, derived from the *therapeutic-community* hypothesis, concerned the impact of the tornado on marriage, on interactions with immediate kin and relatives, and on social contacts with neighbors, friends, and others in the community. The results revealed a mixed pattern. For example, survivors were slightly less satisfied with their marriages but reported more frequent instances of husbands and wives going out together without their children. Likewise, affected families had stronger linkages to relatives and friends but their bonds with neighborhoods weakened. They interacted with fewer neighbors, held less favorable attitudes toward them, and engaged less frequently with them in helping exchanges. Exposed families also declined in their participation in a wide variety of social and civic groups ranging from fraternal organizations, or lodges, to hobby or political action groups. However, there was an increase in church attendance among survivors who reported religious affiliation.

Another influential study investigated family recovery from tornados that devastated two communities in Texas in 1979 (Bolin, 1982). Similarly to Drabek and Key’s (1984) findings, postdisaster interpersonal dynamics registered 12 and 18 months after the impact were again mixed. Socializing between victims and their primary groups increased between the interviews, but the same held for control respondents. Victims with greater disaster losses reported more frequent visits with kin, but their involvement with neighbors declined.

Studies that used a variety of postdisaster social-support instruments also speak to the quantity and quality of interpersonal relationships unfolding in the aftermath of disastrous events. One study investigated Mexican survivors of devastating floods and mudslides in different cities using measures of social support normed for the population (Norris, Baker, Murphy, & Kaniasty, 2005). At 6 months, survivors on average scored below the population mean on social embeddedness (i.e., number of connections) with family and friends. Survivors from the more devastated community also scored below the population norm on within-household embeddedness. Two years after the disasters, the social embeddedness means for the more exposed sample still remained significantly below population norms, whereas for the less exposed areas, only family embeddedness remained below normative levels. A study of flood survivors in Poland used multivariate analyses to control for potential confounding variables and found that both material disaster losses and the subjective experience of trauma were predictive of increased withdrawal from close interpersonal relationships (Kaniasty, in press).

Losses in communal activities and relations are not restricted to the experience of primary survivors (see Bolin, 1985), that is, disaster survivors with high levels of direct exposure. In a prospective study of flood survivors that controlled for preflood social support, global disaster exposure operationalized as *community destruction* had a generally detrimental impact on levels of socializing and closeness with kin and nonkin for all the residents living in the affected areas (Kaniasty et al., 1990). It is also important to reiterate that that

there is abundant evidence that disaster survivors tend to experience, at least temporarily, deterioration in their perceptions of social support from multiple sources (e.g., Kaniasty et al., 1990; Norris & Kaniasty, 1996; Tyler, 2006; Warheit et al., 1996). Although not necessarily in a uniform manner across all survivors or all sources of support, social-support appraisals generally tend to recover to baseline levels over time (Kaniasty et al., 1990; Norris et al., 2005).

A number of forces combine to produce social-support deterioration within survivors' immediate social networks and community (for comprehensive summaries, see Kaniasty & Norris, 1999, 2004, 2009). Disasters remove significant supporters from survivors' networks through death, injury, and relocation. Even if they return to rebuild, many survivors find that their neighbors and friends have moved away, thus permanently changing the structure of the community (Hutchins & Norris, 1989). Another factor is that the victims' expectations (usually inflated) for support may clash with postdisaster reality. The likelihood is high that potential support providers are victims themselves, and as a result, the need for support among all who are affected frequently surpasses its availability. Often, even a considerable influx of support from external sources is not enough to fulfill a community's support needs in the immediate disaster aftermath. Consequently, survivors may experience profound disappointment because external help from relatives and friends or other sources was not provided as readily as anticipated (Kaniasty et al., 1990; Kasapoğlu, Ecevit, & Ecevit, 2004).

Concerns about depleting resources, the resulting social climate of competition, lack of transparency, and inadequacies in allocation of aid may add to frustrations about the manner in which the postdisaster help was provided and received. Among flood survivors in Poland, for example, dissatisfaction with aid received, interpersonal and community animosities, and disagreements experienced within the first 12 months after the flood were predictive of lower perceived social support and community cohesion at 20 months postflood as well as of lower levels of beliefs in benevolence of people and in efficacy of mutual helping behavior (Kaniasty, in press).

Changes in the dynamics and structure of social relationships

Disasters can instigate dramatic and complex changes in interpersonal dynamics within families, especially families with children and adolescents. There is strong consensus that postdisaster family functioning is an important factor explaining variability in the psychological distress of their members. Across numerous studies using a variety of samples, measurement strategies, and methodologies, increased levels of postdisaster parental symptoms have been associated with higher levels of symptoms in children (e.g., Gil-Rivas, Kilmer, Hypes, & Roof, 2010; Green et al., 1991; Kiliç, Özgüven, & Sayil, 2003; McFarlane, 1987b; McLaughlin et al., 2009; Proctor et al., 2007; Scheeringa & Zeanah, 2008; Spell et al., 2008; Swenson et al., 1996). This association is not surprising, in that

parents are a primary source of social support for children and adolescents (Cauce, Reid, Landesman, & Gonzalez, 1990) and also the primary source of coping assistance for children in the aftermath of disasters (Prinstein et al., 1996).

The influence of parents' psychological reactions on children's psychological well-being is due at least in part to shared trauma exposure. However, whether directly mediated or moderated by reactions of others, when disasters impact entire families, coping becomes a fundamentally collective process. One aspect of family functioning that may interfere with adjustment is a reluctance to share feelings and reactions about the disaster. For example, parents and children may avoid talking about the experience for fear of upsetting each other. One year after Hurricane Katrina, children who perceived their caregivers as unwilling or as being too upset to talk reported higher levels of posttraumatic stress symptoms (Gil-Rivas et al., 2010). In a study of families indirectly exposed to the September 11th attacks (Gil-Rivas, Silver, Holman, McIntosh, & Poulin, 2007), higher posttraumatic stress symptoms were reported by adolescents who chose not to talk about the event because they did not want to upset their parents and/or doubted that talking would help. Higher distress levels also were observed for adolescents who claimed that their parents recommended planning as a coping approach (e.g., "think about what steps to take"). Such findings highlight the fact that parents are often unaware of the extent of their children's postdisaster reactions and may be at a loss for knowing how to help their children cope.

Disasters also may lead to changes within the family. Cohan and Cole (2002) prospectively examined changes in various social circumstances in the state of South Carolina during a period that encompassed Hurricane Hugo. Time-series analyses of these data indicated that the rates of marriages, births, and divorces all increased in the disaster-declared counties in the year following the hurricane, prompting Cohan and Cole (2002) to conclude that Hurricane Hugo simply pressed people to take actions that were most likely contemplated before this potentially life-altering event.

Although such major life events can be very positive, they may also contribute to increased stress levels within disaster-exposed families. Major life events occurring during the postdisaster recovery period, such as the birth of a new sibling or parental divorce, have been found to contribute to children's PTSD symptoms. Moreover, disaster-exposed children who reported such life events were less likely to recover during the first year postdisaster (La Greca et al., 1996).

Another source of family stress is conflict among family members. In analyses of older adult flood survivors that controlled for preflood resources, mental health, and socio-demographic characteristics, exposed survivors were more likely to report a new conflict with extended family than were nonexposed survivors (Hutchins & Norris, 1989). In a study of bushfires in Australia (McFarlane, 1987a), disaster-related property loss predicted levels of family irritability and distress. Interestingly, 26 months after a disaster, the best

predictor of family distress was the mother's symptoms (McFarlane, 1987a). Family conflicts and negative family atmosphere have been related to higher levels of distress in child and adolescent disaster survivors (Bokszczanin, 2008; Green et al., 1991; Roussos et al., 2005; Tuicomepee & Romano, 2008; Wasserstein & La Greca, 1998). Multivariate analyses of data on survivors of Hurricane Hugo indicated that various facets of disaster exposure (e.g., trauma, injury, property damage) were associated with higher levels of marital stress and filial (caring for older relatives) stress (Norris & Uhl, 1993). Familial stress was also found to mediate the impact of the hurricane on mental-health outcomes.

The family stress of disasters often manifests as increased parental burden. In a study of families exposed to flooding and potential toxic exposure as a result of dioxin contamination in St. Louis, the highest levels of psychological symptoms were observed among single parents, regardless of their exposure status, and among exposed married parents (Solomon, Bravo, Rubio-Stipec, & Canino, 1993). Solomon et al. (1993) surmised that single parents are chronically overburdened by parental responsibilities, whereas exposed married parents face new marital and parental challenges and burdens after disasters and therefore become as vulnerable as single parents on an everyday basis. This finding may be especially true for families headed by middle-aged parents because there is an influx of additional communal obligations and responsibilities (e.g., they may be "recruited" to provide more support to others; e.g., Kaniasty & Norris, 1995) that can disrupt their own coping efforts (e.g., Solomon, Smith, Robins, & Fischbach, 1987). Of relevance to this issue is a study of psychological functioning following Hurricane Hugo that observed a curvilinear relationship between age and psychological distress, with middle-aged adults exhibiting the highest levels of distress (Thomson, Norris, & Hanacek, 1993).

Despite these detrimental effects, disasters may have beneficial effects on interpersonal relationships, such as by increasing rates of marriage and births, as noted earlier. Myriad testimonials have been recorded in which people who faced disasters claim that these events brought them closer together with their families (e.g., Henry, Tolan, & Gorman-Smith, 2004; Kaniasty, 2003; Kessler et al., 2006). A number of studies have documented the salutary nature of such effects. Bolin (1982) and Bolin and Bolton (1986) observed that primary-group aid facilitated emotional recovery from disaster. Drabek and Key (1984) documented similar effects in their analysis of social functioning 3 years after the Topeka tornado. Controlling for the degree of damage, they found that tornado victims who received help from friends or relatives, compared with those who did not, reported being less alienated, healthier, happier in their marriages, and more involved in activities with friends, churches, or social organizations. Similarly, Hutchins and Norris (1989) reported that in the aftermath of flooding, elderly survivors had fewer children who chose to leave home during the recovery period than did comparably aged nonvictims.

The impact of technological disasters on community relations

The vast majority of studies reviewed in this section thus far pertained to natural disasters. Technological disasters can impart particularly dramatic consequences on community relations. Approximately 1 year after the 1989 Exxon Valdez oil spill, those living in the area who were most exposed to the spill (e.g., worked at the cleanup, incurred damages to their properties or their commercial fishing areas) experienced significantly greater declines in the quality and frequency of their interpersonal relationships, both within and outside their households (Palinkas, Downs, Petterson, & Russell, 1993; Russell, Downs, Petterson, & Palinkas, 1996). High-impact participants were more likely to report reduction in the frequency of socializing within families and among friends and neighbors. Conflicts among families, friends, neighbors, and coworkers were more prevalent among those in highly exposed communities. These individuals were also more likely to voice their concerns about an increase in domestic violence in their communities as well as among their families and friends. Moreover, multivariate analyses that controlled for potentially confounding factors indicated that postspill social disruptions predicted PTSD diagnosis (Palinkas, Petterson, Russell, & Downs, 2004).

Another research team documented similar social dynamics following the Exxon Valdez catastrophe (Picou, Gill, Dyer, & Curry, 1992). Compared with respondents from a control community, those living in one of the areas afflicted by the oil spill experienced significantly more issues within family and work settings and uniformly perceived their community as undergoing negative changes. Although these negative evaluations ameliorated over time, the data suggested an overall continuing pattern of community disruption in the affected group. Postdisaster deterioration in relationships with nonrelatives was associated with greater depression, anxiety, and posttraumatic stress (Arata et al., 2000).

More often than not, the postcrisis reality of individuals and communities affected by technological disasters is that of erosion of sense of community. Terms such as *toxic* or *corrosive* are frequently used to describe the interpersonal and communal dynamics of human-induced disasters (Cuthbertson & Nigg, 1987; Freudenburg, 1997). These events are characterized by ambiguity, uncertainty, absence of consensus, and the lack of a clearly identifiable low point ("the worst of the negative impact is over"). The residents of affected areas, local authorities, and those accountable for the hazard often bitterly debate the severity of the actual threat and the extent of harm done. Such polarization and antagonism was observed, for example, in a community contaminated by a railroad chemical spill of thousands of gallons of toxic substance (Bowler, Mergler, Huel, & Cone, 1994). The majority of respondents (69%) believed that the community was hurtfully divided between those who felt they suffered from the contamination and others who insisted that they did not experience any harmful consequences. Furthermore, many (36%) alleged that they

were personally hurt by some of their friends and neighbors who downgraded or dismissed their sense of victimization.

Not surprisingly, many human-caused disasters are routinely followed with lasting litigation, deliberating the allocation of fault for the calamity and restitution arrangements. On the one hand, legal actions and lawsuits may become vehicles for social cohesion and mutual support among those victims who share the common goal of seeking justice and compensation. On the other hand, litigation may delay communities from social and psychological recovery. Picou, Marshall, and Gill (2004) presented a case in point with a structural equation model of data collected in an Alaskan community, 3.5 years after the Exxon Valdez oil spill. Respondents' appraisals of lasting community damage were predicted by a measure of litigation stress and a measure of distrust of institutions and authorities responding to the spill. Litigation stress was also associated with intrusive symptoms similar to those seen in PTSD.

The impact of a technological disaster on a community appears to unfold at different periods after the initial impact, which is often the case, for example, when government response is deemed inadequate or suspect or when there are perceptions of neglect or a cover-up of the facts of the disaster. Although there has been little research on the longitudinal course of the community-level response, Yzermans and Gersons (2002) provide a compelling observational study of the course of community reactions to the 1998 Amsterdam airplane disaster, mentioned earlier. They identified two distinct periods of disaster reaction that were determined primarily by the types of question the disaster evoked in the surviving community. During the first period, which lasted about 2 years, survivors were occupied with pressing questions about the extent of the damage, the number of people killed, and importantly, what might have caused the disaster. These were not easy questions to answer, and as a result, rumors about the true impact of the disaster began to spread. During the initial weeks, for example, accurate information about the death toll was not available. The plane crash obliterated numerous buildings and produced a "towering sea of flames that arose from the tanks of the jumbo jet" (Yzermans & Gersons, 2002, p. 86). It was difficult to identify or even locate the bodies of victims. Initial estimates of the death toll ran as high as 1,500 victims. However, when the official toll was later set at 43 deaths, far fewer than many people felt possible, suspicions of a cover-up or of underreporting began to spread. Because the crash occurred in an immigrant neighborhood, for example, many believed that illegal aliens were not counted in the death toll.

As the community began to move back toward equilibrium, approximately 2 years after the crash, a new set of questions began to emerge that instigated a second period of disaster reaction. Troubling details came to light to suggest that the plane was secretly transporting toxic cargo that may have been harmful to the physical health of survivors. Millions viewed a parliamentary inquiry on Dutch television. A climax of sorts occurred when an air traffic controller testified that he had been

pressured after the crash not to disclose information about lethal substances that had in fact been aboard the plane. Rumors began to augment the facts of the case. One popular but unverified account held that within 30 min of the crash, government agents in white "space suits" appeared on the scene, removed several objects, and then promptly disappeared in helicopters. The ambiguity and fear that characterized this second period led, according to Yzermans and Gersons' (2002) observations, to a sense of "collective secondary victimization" that essentially became a "second disaster" (p. 96).

In contrast to these destructive forces, it has also been observed that disasters potentially enable a broad-based community partnership and collaboration that may instigate social and economic enhancements. Constructive community activism may reduce the disempowering impact of the present stressor, "domesticate it" for the future, or even prevent it from developing or happening again. The sociological literature provides examples of such processes, suggesting that disasters provide venues for reforming the stagnated (status quo) economical, political, and social arrangements (e.g., Aronoff & Gunter, 1992; Bolin & Stanford, 1990; Gunter, Aronoff, & Joel, 1999; Rich, Edelstein, Hallman, & Wandersman, 1995).

Summary

- Survivors often receive immediate support from their families, relatives, and friends, and many survivors subsequently claim that the experience brought them closer together.
- The empirical evidence suggests a mixed pattern of findings. Several studies documented that social relationships can improve after disasters, especially within the immediate family. However, the bulk of evidence indicates that the stress of disasters can erode both interpersonal relationships and sense of community.
- Regardless of how they are affected, postdisaster social relations are important predictors of coping success and resilience.

The Remote Effects of a Disaster in Unexposed Populations Are Generally Limited and Transient

Focusing further outward, we consider the ways disasters might influence populations geographically remote from the affected area. Available research on the remote consequences of disasters is mostly derived from recent studies of mental and physical health following the September 11th terrorist attacks. Although these attacks targeted the American cities of New York and Washington, D.C., their impact resonated throughout the United States, if not the entire globe. As a result, considerable debate ensued regarding the nature of reactions in remote populations.

The central issue in the debate pertained to whether it is possible to acquire PTSD in the absence of geographic proximity (Marshall, Amsel, & Suh, 2008; McNally & Breslau, 2008).

Given that terrorists seek to communicate threat to a wide audience, the distinct possibility is raised that even *secondhand exposure* to terrorism may have adverse psychological effects in our global, media-driven society (Comer & Kendall, 2007). Although the assessment of PTSD represents just one aspect of the broader population-based impact of disaster, this debate highlighted a number of key methodological concerns, most notably whether exposure in distant populations is qualitatively different (e.g., voluntary exposure by media consumption) or whether symptoms in remote areas have different meanings because they tend to occur without the functional impairment that normally accompanies psychopathology. Accordingly, in the absence of information about the impact of such events on individuals' day-to-day lives, increased symptoms in distant populations might be better characterized as normal distress and worry rather than psychopathology (La Greca, 2007; McNally & Breslau, 2008).

Given these concerns, we argue that a full understanding of the nature of remote impacts of disaster requires data on both predisaster and postdisaster functioning to establish whether the disaster led to a net change in a disorder, attitude, or behavior. Studies that do not include predisaster data are still potentially valuable in that they provide comparison with individuals more geographically proximal to the disaster and allow for assessment of changes in broader health and behavioral consequences over time. Accordingly, in our review, we have parsed the available studies into two categories: (a) those that assessed aspects of health, attitudes, and behavior after the disaster without reference to predisaster levels on the same variables in the same population and (b) those that included predisaster indices on the same variables in the same population.

Distress and pathology

The mental-health data obtained from remote areas following high-profile disasters, like the 9/11 attacks, reveal a striking discrepancy. As elaborated later, studies that initiated data collection in remote areas after the occurrence of a high-profile disaster consistently reported elevated symptoms of PTSD and emotional distress. However, when researchers were able to compare prospective data from before to after the disaster, the most common finding was that rates of mental disorder showed little or no change outside the immediately affected population. To more fully illuminate this intriguing discrepancy, we first review the data garnered using different methodological approaches and then consider possible explanations for their divergence.

Studies without predisaster data. Among studies that did not include predisaster comparison data are investigations of adults, children, and vulnerable populations, such as psychiatric patients. The common pattern across these studies is one of initially elevated distress or elevated psychopathology that decreased soon after the disaster. For example, a national survey conducted 3 to 5 days after 9/11 reported that 44% of adults had one or more substantial symptoms of distress related to these events (Schuster et al., 2001). Two months later, 16%

were found to have persistent distress. Unlike at the earlier time point, however, distance from the World Trade Center was no longer related to presence of symptoms (Stein et al., 2004). In a separate national Web-based survey conducted in October and November 2001, rates of 9/11-related PTSD in the rest of the United States (nonmetropolitan areas) were estimated at 4.0%, compared with 11.2% in New York City (Schlenger et al., 2002). Rates of general clinically significant distress in the rest of the United States were 11.1%, which was not different from usual population norms.

Another national Web-based survey conducted within the first month after 9/11 found that 8.9% of respondents reported acute stress symptoms related to these events, including impairment (Silver et al., 2002). High levels of acute stress were found in areas from between 25 and 100 to over 1,000 miles from the World Trade Center, with only respondents within 25 miles reporting substantially greater rates. At 12 months, high rates of 9/11-related PTSD remained only among the directly exposed, and in all others, rates were under 5% (Silver et al., 2005). In a largely female Hispanic sample from Miami studied several months after 9/11, 14% met criteria for PTSD related to the attacks, including the presence of at least moderate symptoms and impairment (Pantin, Schwartz, Prado, Feaster, & Szapocznik, 2003). Similarly, Neria and colleagues (2006) studied 9/11-related PTSD rates in a primary care sample in upper Manhattan between 7 and 16 months after the attacks, focusing on the interaction of vulnerability characteristics and exposure. Of crucial significance, however, among the participants who did not have direct exposure, a family psychiatric history, or traumatic experiences prior to 9/11, none reported probable PTSD symptoms related to the 9/11 attacks.

Numerous studies have investigated the remote effects of the September 11th attacks on psychiatric patients. Several weeks following 9/11, psychiatric outpatients living approximately 150 to 200 miles from the attack sites were significantly more likely than medical patients (33% to 13%) to report distressing symptoms meeting criteria for PTSD despite no differences in learning about the attacks or personal involvement with the victims (Franklin, Young, & Zimmerman, 2002). Approximately 1 year after 9/11 in Boston, a city almost 200 miles from New York, 20% of a sample of patients with bipolar disorder were diagnosed with new-onset PTSD related to the attacks (Pollack et al., 2006). In Oregon, a study of refugees with previous trauma exposure reported that many, and especially those already suffering from PTSD, experienced marked deterioration lasting several months after 9/11 (Kinzie, Boehnlein, Riley, & Sparr, 2002). Other studies have also affirmed that psychiatric patients are a vulnerable group, although there is little consensus on the severity or persistence of symptom exacerbation after 9/11 (Franz, Glass, Arnkoff, & Dutton, 2009).

Moving outside the United States, in London, England, a minority of 10- to 11-year-olds reported moderate to severe PTSD symptoms with functional impairment at 2 months (14.5%) and 6 months (9.2%) after viewing the September 11th events on television (Holmes et al., 2007). In one of the

few remote studies not focused on 9/11, Terr and colleagues (1999) examined the reactions of children in New Hampshire and California to the space shuttle *Challenger* explosion, which took place over the skies of the southeastern United States. *Challenger*-related fears were very common within 2 months after the disaster, and East Coast and younger children were significantly more symptomatic than West Coast and older children (adolescents). However, after 14 months symptoms had greatly reduced.

Studies with predisaster–postdisaster comparison data. In contrast to the evidence from postdisaster studies of symptom elevations in remote regions, prospective studies comparing data from predisaster to postdisaster suggest little or no health impact. In a nationally representative sample of full-time employed Americans, no overall change in depressive symptoms was found between pre-9/11 and post-9/11, although there was evidence for a temporary increase in depressive symptoms lasting 1 month (Knudsen, Roman, Johnson, & Ducharme, 2005). Another nationally representative survey (Holman et al., 2008) showed a significant increase in the proportion of physician-diagnosed cardiac ailments (heart problems, stroke, and hypertension) from 21.5% prior to 9/11 to 30.5% in the 3 years after 9/11. This increase was not predicted by amount of exposure or distance from New York City but by respondents' description of an acute stress reaction within 1 month of the attacks. The effects were worse in those with ongoing terrorism-related worries.

A prospective study of residents of Connecticut, a state contiguous with New York City, found that although psychological problems related to the terrorist incidents were reported by more than half of the respondents, measures of overall physical or mental health did not change in the 3 months after September 11th (Ford, Adams, & Dailey, 2007). Some evidence has shown, however, physical signs of stress in remote populations. A prospective review of patients undergoing routine heart monitoring in Connecticut demonstrated decreased parasympathetic tone, a sign of autonomic dysfunction, during the week of September 11th (Lampert, Baron, McPherson, & Lee, 2002). A prospective study of 9-year-old children living 300 miles from New York City examined cardiovascular responses to an acute stress task before and after 9/11 (Gump, Reihman, Stewart, Lonky, & Darvill, 2005). Compared with before the attack, children tested 2 months after 9/11 had a significantly greater cardiovascular response to the stress test, specifically greater stroke volume and cardiac output. These differences were no longer observed when children were tested 1 year after 9/11.

Data from a longitudinal study of children in Seattle, Washington, 2,400 miles from New York, showed that 1 month after 9/11 there were numerous reports of specific stress and PTSD symptoms (Lengua, Long, Smith, & Meltzoff, 2005). Approximately 8% met diagnostic criteria for PTSD including functional impairment. Compared with before 9/11, however, overall levels of psychopathology were significantly lower, although they had increased somewhat 5 months later. Similar

results were obtained in a longitudinal study that compared data on Chicago families collected 100 days before and after 9/11 (Henry et al., 2004). Although parental monitoring of children increased after 9/11, prospectively there were no differences in either anxiety or depression levels of either children or their parents. Among children in Boston who were at risk for anxiety disorders and participating in a longitudinal study, relatively low rates of symptomatic PTSD were reported in children (5.4%) and their mothers (1.2%) in the months after 9/11 (Otto et al., 2007). Interestingly, preattack child and parent diagnostic variables were not related to children's PTSD, although children with less behavioral inhibition and younger children (10 years or less) who watched more television on the day of the 9/11 attacks were more likely to have full or subclinical PTSD.

In a particularly informative study, Whalen, Henker, King, Jamner, and Levine (2004) examined reactions to 9/11 among adolescents living in California, almost 3,000 miles from the site of the attack, using an electronic diary methodology. They queried participants 25 to 30 times daily both before and after 9/11 about their moods, contexts, and activities and also included various post-9/11 questionnaire measures. When asked directly about the attacks 2 months after 9/11, on average the adolescents in the study rated 9/11 as having a moderately severe impact on their lives (mean score of 55.9 on a 100-point scale) and reported elevated levels of anger, anxiety, and sadness. Strikingly, however, participants' daily diary reports of anger, anxiety, and sadness were not significantly different from pre-9/11 to post-9/11.

In one of the few non-U.S. studies, Krastel and Margraf (2009) examined data from national surveys of Swiss residents conducted prior to and after September 11th. Two local disasters had also occurred in Switzerland within months of the September 11th attack, which Krastel and Margraf speculated had "aggravated the climate of uncertainty, uncontrollability, unpredictability, and general threat in Switzerland" (p. 222). Their results showed that anxiety symptoms did not change from pre-9/11 to post-9/11, but depressive symptoms increased post-9/11 and remained high for 2 years (Krastel & Margraf, 2009).

Four studies tested for effects of September 11th on the psychiatric treatment of remote populations. Druss and Marcus (2004) found that although in New York City there was an increase in the proportion of existing users with psychotropic dose increases in the weeks after the attacks, nationally and in Washington, D.C., there was no evidence of an increase in overall prescriptions, new prescriptions, or daily doses for psychotropic medications. There was no significant increase in the use of Veterans' Administration services for the treatment of PTSD or other mental disorders or in visits to psychiatric or nonpsychiatric clinics in New York City in the 6 months after September 11; there was also no significant increase in PTSD treatment for veterans in the greater New York area, Washington, D.C., or Oklahoma City (Rosenheck & Fontana, 2003). Although visits to emergency departments for behavioral and mental-health care rose in the 3 months after

the September 11th attacks within a 3-mile radius of the World Trade Center, elsewhere in New York City and New York State there were declines (DiMaggio, Galea, & Richardson, 2007). The only non-American 9/11 study on psychiatric populations examined inpatient admissions in the Canton of Zurich, Switzerland, in the month following 9/11 and reported no differences compared with pre-9/11 admissions (Haker, Lauber, Malti, & Rossler, 2004).

Attitudes and behavior

Studies without predisaster data. Results of various national opinion polls conducted immediately after the September 11th attacks indicated that a majority of Americans prayed for peace, displayed the flag, sang patriotic songs, and donated money or food to relief efforts (Bowman, 2008). Large numbers of Americans also reported that they made special efforts to keep in touch with family and friends and to tell them that they loved them. A Gallup poll revisited these issues in March and September 2002 and found that smaller numbers had flown the flag, prayed more than usual, or called loved ones in the previous 2 weeks than had done so immediately after 9/11. In September 2007, a Gallup-USA Today poll found that 50% of those surveyed thought that the 9/11 attacks had permanently changed the way Americans lived their lives. When asked about themselves, however, only 29% said it had changed the way they lived. A survey of the residents in states near New York City (New York, New Jersey, and Connecticut) in the months after 9/11 found that approximately 3% of alcohol drinkers reported increased alcohol consumption, 21% of smokers reported an increase in smoking, and 1% of nonsmokers reported that they started to smoke after the attacks (Centers for Disease Control, 2002). A national survey 3 years after 9/11 (Torabi & Seo, 2004) found that 24% of respondents reported turning more to prayer, religion, or spirituality; 25% reported limiting outside activities, and of these, 28% were still doing this 1 year after 9/11; and 23% changed mode of transportation, and of these, 32% continued to do so at 1 year.

Studies with predisaster–postdisaster comparison data. Schlenger (2005) examined data from the National Survey of Drug Use and Health and found no change in substance use or in substance-abuse treatment participation from pre-9/11 to 3 months following the attacks, either in New York or elsewhere in the United States. Similarly, in a representative sample of full-time employed Americans, there was no overall change in alcohol use (Knudsen et al., 2005). If anything, alcohol consumption appeared to have lessened. However, in the 3 months after 9/11, investigators found evidence for a regional increase in alcohol and drunk driving offences and traffic fatalities in New York State and in the northeastern United States more generally (Su, Tran, Wirtz, Langteau, & Rothman, 2009). This finding did not appear to be due to more miles being driven but rather to a greater incidence of impaired driving. National rates of volunteering for charitable activities increased significantly for 3 weeks following September 11th,

particularly for crisis-related organizations (Penner, Brannick, Webb, & Connell, 2005).

Teenagers living in California were asked 1 month after 9/11 to judge their risk of dying from unrelated causes (Halpern-Felsher & Millstein, 2002). Compared with those sampled before 9/11, they reported a greatly increased sense of risk, implying that the world had become a more dangerous place. In the 2 months after September 11, respondents answering an Internet survey endorsed a number of character strengths more strongly, including gratitude, hope, kindness, leadership, love, spirituality, and teamwork (Peterson & Seligman, 2003). Four days after the attacks, college students in Pennsylvania showed a temporary increase in identification with their country that was no longer present 18 months later (Moskalenko, McCauley, & Rozin, 2006). They also showed a temporary increased rating of the importance of their country and their university. Moving beyond the United States, 2 weeks after the 9/11 attacks, Hong Kong residents under 35 years of age showed greater preference for spending time with emotionally close social partners than with novel partners, relative to before 9/11. This temporary preference had returned to normal 4 months later (Fung & Carstensen, 2006).

Other studies with U.S. college students indicated that attitudes to war became more positive after September 11th, and although this effect diminished over time, positive attitudes toward war persisted more than a year later (Carnagey & Anderson, 2007). Trait aggression and anger were elevated 1 week after 9/11 but had fallen back again by November that year. In contrast, a large study of employee attitudes toward work failed to find any impact of the September 11th attacks, either in the United States or elsewhere (Ryan, West, & Carr, 2003).

Making sense of the discrepancies

The studies involving predisaster–postdisaster comparisons of the health of adult and youth samples as well as the treatment studies are remarkably consistent. Although symptoms related to the attacks were frequently reported, outside the immediately exposed populations there was no overall increase in rates of mental disorder after September 11th. There was some evidence for time-limited symptomatic responses including depression and an increased cardiovascular response to stress. These acute reactions may have been sufficient to produce, in vulnerable individuals, the increased cardiovascular ailments reported by Holman et al. (2008).

Postdisaster studies are equally consistent in showing that when asked about specific reactions related to September 11th, respondents in remote locations frequently endorsed symptoms of psychological trauma. One limitation in these studies is that they tended to rely on screening instruments derived from non-disaster-related situations. Unfortunately, this method can be problematic because the specificity (minimization of false positives) and sensitivity (minimization of false negatives) of these instruments has rarely been assessed in disaster situations. After the 2005 London bombings, for

example, the specificity of the screening instrument used to assess PTSD was dramatically lower than reported in the samples on which it had been developed, although it improved steadily over the following 2 years (Brewin, Fuchkan, Huntley, & Scragg, 2010). Because low specificity of screening instruments leads to an overestimation of the prevalence of a disorder, it is likely that many postdisaster studies have overestimated the prevalence of PTSD in the general population.

The generally rapid decline in disaster-related symptoms in remote populations suggests these symptoms usually reflect transient distress. In the minority of respondents who have persistent and significant levels of symptoms accompanied by impairment (Galea & Resnick, 2005; Pantin et al., 2003; Silver et al., 2005), there is often actual exposure, previous or concurrent trauma, or a previous or concurrent psychiatric history. Thus, when social bonds are taken into account, exposure levels may be high even in remote samples. In one study, about 7.5% of the sample outside of the New York City and District of Columbia metropolitan areas reported they had a family member, friend, or coworker killed or injured in the September 11th attacks (Schlenger et al., 2002). The results of U.S. national surveys also show that up to 50% of persons in the general population report at least one lifetime psychiatric disorder, and close to 30% report at least one 12-month disorder (Kessler et al., 1994). It has yet to be shown that remote disasters are able to produce full-blown PTSD in the absence of these elements (e.g., Neria et al., 2006).

What mechanisms may account for events causing communal bereavement (Knudsen et al., 2005) or widespread fears about personal safety (Marshall et al., 2007), resulting in prolonged and persistent disorder in vulnerable individuals? One likely factor is the acquisition of fear by observation. Observational fear learning is integral to contemporary models of anxiety disorders (Mineka & Zinbarg, 2006). Symptom development following observation of or other exposure to remote events has been explained in terms of a mediating process of relative risk appraisal that is influenced by factors such as personal standards for acceptable risk and prior experience with situations judged to be similar in risk (Marshall et al., 2007). According to Marshall et al. (2007), specific aspects of the 9/11 attacks, such as its scale, unpredictability, and implications for future safety, signaled that there was a significant ongoing threat of harm from additional attacks. As mentioned previously, media viewing may heighten perceptions of societal threat and personal vulnerability (Comer, Furr, Beidas, Babyar, & Kendall, 2008). Risk appraisal would tend to be additionally elevated by low tolerance for danger and by previous experience of trauma. Another possibility is that preexisting anxiety raises the probability of a panic reaction, which has been repeatedly shown to predict subsequent PTSD, including after September 11th (Ahern, Galea, Resnick, & Vlahov, 2004).

Thus, although the development of PTSD in remote populations appears to go against current conceptualizations of the disorder (Marshall et al., 2007; McNally & Breslau, 2008), it is not implausible in cases in which there is actual exposure (via the involvement of close family or friends) or preexisting vulnerability. Such constraints are consistent

with current diathesis-stress models of PTSD (Brewin, Lanius, Novac, Schnyder, & Galea, 2009) and help to account for the apparent discrepancy between increased reports of trauma symptoms in remote populations coupled with the lack of evidence for a net increase in persistent emotional disturbance or in treatment needs.

Summary

- Increased incidence of extreme distress and pathology are often reported in remote regions hundreds if not thousands of miles from a disaster's geographic locale.
- Careful review of these studies indicates that increased incidence of psychopathology is likely only among populations with preexisting vulnerabilities (e.g., prior trauma or psychiatric illness) or actual remote exposure (e.g., loss of a loved one in the disaster).

Implications for Intervention

In this final section, we consider the policy implications of our findings for psychological intervention after disaster. Specifically, we focus on the timing of interventions and the necessity of multidimensional assessment.

The limits of immediate psychological intervention

A useful heuristic for conceptualizing postdisaster interventions involves the distinction between interventions applied in the immediate aftermath of the disaster (e.g., within the first month after the disaster's onset) and those applied during the short- and long-term recovery period (e.g., 1 month to 1 year after the disaster's onset; La Greca & Silverman, 2009; Vernberg, 2002).

In the past decade, there has been a considerable increase in the use of prophylactic psychological interventions applied globally to all exposed survivors in the immediate aftermath of a disaster. However, when viewed from the vantage point of this article, such a practice seems highly problematic. The evidence we reviewed in our second point indicated, for example, that although almost all disaster survivors will experience some initial distress, most will cope effectively and many will be able to maintain a stable trajectory of good mental health or resilience. Ideally, global interventions would enhance the already existing strengths and resources of resilient individuals. However, if most people are likely to cope effectively on their own, global prophylactic interventions may be pointless or might even undermine people's natural coping abilities (Bonanno, Westphal, & Mancini, in press).

Currently, the most common form of immediate psychological intervention consists of a single session, described most commonly as *psychological debriefing* or *critical incident stress debriefing* (CISD). Advocates of CISD assume it to be a useful if not necessary generic remedy for entire populations of exposed disaster survivors. In stark contrast to this assumption, however,

the outcome data on CISD in the aftermath of disaster and of trauma more broadly defined have consistently failed to support its effectiveness. Indeed, multiple studies have shown that CISD is not only ineffective but, as suggested earlier, in some cases can actually be psychologically harmful (Litz, Gray, Bryant, & Adler, 2002; McNally, Bryant, & Ehlers, 2003; Rose, Bisson, & Wessely, 2003; Stallard et al., 2006). A striking lack of effectiveness has also been observed for immediate, multiple-session prophylactic interventions (N.P. Roberts, Kitchiner, Kenardy, & Bisson, 2009) and for prophylactic grief counseling interventions when applied indiscriminately to all bereaved survivors (Currier, Neimeyer, & Berman, 2008).

In response to sobering findings of this nature, in the aftermath of the 2004 tsunami that devastated much of Southeast Asia, the World Health Organization (2005) posted the following warning on its Web site: "Single-session Psychological Debriefing: Not recommended." The reason, the report concluded, was that psychological debriefing as an early one-size-fits-all intervention "is likely ineffective and some evidence suggests that some forms of debriefing may be counterproductive by slowing down natural recovery" (World Health Organization, 2005).

Perhaps CISD would be more effective if applied only to disaster survivors exhibiting elevated signs of distress? This assumption is problematic for several reasons (Gray, Maguen, & Litz, 2004). First, because most disaster survivors are likely to experience at least some transient distress, there will be relatively limited variability in early disaster-related reactions. In the context of this lack of variability, attempts at immediate psychological assessment will be uninformative if not misleading (Gray et al., 2004). The sole exception may be that some exposed individuals may evidence acute physiological stress reactions (e.g., elevated heart rate and respiration rate). As we noted earlier, acute physiological reactions measured during or immediately after a traumatic event have been shown to predict the later development of PTSD (Bryant et al., 2008). However, in the chaos of disaster, assessment of physiological responses would be extremely difficult if not impossible to obtain and thus would hold little if any practical utility.

Second, and more sobering, the available evidence indicates that highly distressed individuals are actually more likely to react unfavorably to early intervention than nondistressed individuals. In a study of hospitalized survivors of serious automobile accidents, for example, those randomly assigned to receive a single session of debriefing within 24 hours of hospitalization had greater levels of distress, more severe physical pain, more physical problems, more impaired functioning in their daily lives, greater financial problems, and even reported less enjoyment being an automobile passenger 3 years later compared with patients who did not receive the debriefing (Mayou, Ehlers, & Hobbs, 2000). More to the point, the most highly distressed patients reacted most negatively to the debriefing. Highly distressed patients who received the debriefing were almost as distressed 3 years after the accident as when they first arrived at the hospital. By contrast, patients who were initially distressed but did not receive an intervention had for

the most part recovered spontaneously within months of the accident.

Psychological first aid and other early disaster response programs

Although CISD seem unwarranted, other less intrusive forms of immediate disaster response may be useful. An alternative approach, psychological first aid (PFA), is an evidence-informed response program developed by disaster mental-health experts that is culturally sensitive, nonintrusive, and applicable across broad developmental levels (Gist & Devilly, 2010; Ruzek et al., 2007; Vernberg et al., 2008). PFA focuses on providing practical assistance and promoting a sense of safety, calming, connectedness, self-efficacy and community efficacy, and hope among disaster victims. PFA may also help identify individuals who at later points after the disaster may require more intensive assistance. Although promising, controlled evaluations of PFA's effectiveness are not yet available (Ruzek et al., 2007).

Psychoeducational materials and fact sheets, readily available via the Internet, also provide information regarding common disaster reactions and how to facilitate postdisaster coping. Such materials are distributed by relief organizations, such as the American Red Cross and the Federal Emergency Management Agency, and by mental-health organizations, including the American Psychological Association, the National Institute of Mental Health, and the National Child Traumatic Stress Network. Typically, these materials normalize postdisaster reactions, correct misinformation about disasters, address fears and security concerns, and encourage individuals to express their feelings but also to resume normal roles and routines (see La Greca & Silverman, 2009, in press).

Unfortunately, at present, no evidence has shown that any of the psychological interventions or psychoeducational materials developed for the immediate aftermath of disasters are effective for reducing individuals' short- or long-term distress (e.g., La Greca & Silverman, 2009). This critical gap in disaster research is largely due to the challenges of conducting controlled intervention research in the aftermath of disasters, including ethical concerns regarding withholding treatment and difficulties obtaining rapid institutional review board approval and external funding (see Fleischman, Collogan, & Tuma, 2006). Although PFA and well-designed psychoeducational materials might be potentially useful, controlled evaluations of these materials are essential to determine whether such interventions are in fact beneficial and, if so, for whom. Benefits might be indirect, for example, influencing community cohesion, optimism, or levels of appropriate help seeking but not necessarily impacting on distress. Further, whatever potential benefits such interventions might carry would need to be weighed against their potential pitfalls, such as the risk of retraumatizing vulnerable individuals or reducing future help-seeking in individuals who believe they have already received treatment.

Assessment and intervention in the short- and long-term recovery periods

We believe that psychological intervention is more likely to be effective during the short- and long-term recovery periods (1 month to several years postdisaster), especially when used in combination with some form of screening for at-risk individuals. Our endorsement of this approach follows from the first and third points of our review: Disasters can produce clear and serious psychological consequences in both children and adults and across a range of domains of functioning in a significant minority of the exposed population (typically 30% or much less); there are multiple predictors that inform these extreme reactions. Evidence has shown that structured psychological interventions, such as cognitive behavioral therapy, may be effective for those with severe trauma symptoms developing within 1 month of a major trauma (Bryant, Harvey, Dang, Sackville, & Basten, 1998; McNally, 2003). However, the competing demands of likely infrastructure damage coupled with the large scale of disasters mean that it will rarely be possible for mental-health services to respond within such a short time frame.

A useful and well-researched analogy to disaster intervention can be found in prophylactic interventions aimed at self-injurious behaviors, such as eating disorders and suicide (see Bonanno, Westphal, & Mancini, in press). Several large-scale education and curriculum-based programs have been designed to increase attention to suicide risk in both school and community settings. For the most part, these interventions have had no appreciable impact on the rates of suicide (Guo & Harstall, 2002; Mann et al., 2005), and in some cases they have had the unintended side effect of actually increasing suicidal ideation (Shaffer, Garland, Vieland, Underwood, & Busner, 1991). By contrast, suicide-prevention programs that included some form of screening to identify those at most risk have shown more promising results (Shaffer & Craft, 1999; Spirito & Esposito-Smythers, 2006). The same pattern of results has been observed for prevention programs for eating disorders (Pratt & Woolfenden, 2002; Stice & Shaw, 2004; Stice, Shaw, & Marti, 2007).

The key question then for disaster research pertains to the type of assessments that would be most informative. A limitation of most current forms of disaster assessment and intervention is that they focus predominantly on posttraumatic stress. However, as our review has shown, disasters can impact multiple domains of functioning. Less information is known about how to address some of these other disaster reactions (with or without concurrent PTSD). Our review also highlighted the broader range of risk and resilience factors that inform disaster outcome. Given this backdrop, we recommend that postdisaster screening efforts to identify high-risk individuals investigate whether there are benefits to be gained from broadening the scope of the variables that are assessed.

Children represent a vulnerable population postdisaster, as we have indicated, and their distress is often missed or overlooked by adults. Future efforts should be made to assess children directly and not only through parent or teacher report.

The intervention needs of children are also likely to differ markedly from those of adults. Although many children who are initially distressed recover over the first year, stress symptoms (e.g., difficulty concentrating, trouble sleeping) could seriously interfere with academic performance and school adjustment and thus may have lasting negative consequences. Children's main support systems (parents, teachers, friends) are also adversely affected by disasters. Continued efforts to evaluate strategies for supporting and/or intervening with youth postdisaster are important and desirable.

One approach to overcoming the documented undertreatment of disaster survivors with significant psychological problems (Pfefferbaum, North, Flynn, Norris, & DeMartino, 2002; World Trade Center Medical Working Group of New York City, 2008) involves mounting an outreach program accompanied by screening and assessment using validated instruments. Survivors screening positive can then be provided with effective, evidence-based treatment. A study conducted after the 2005 London bombings suggests this approach can successfully identify those with mental-health needs who would otherwise go untreated and can achieve good clinical outcomes (Brewin et al., 2008, in press). The approach has not been formally tested in a controlled trial, however, and ethical and political constraints on randomizing and withholding interventions from a subset of recent survivors create considerable barriers to the evaluation of postdisaster mental-health programs.

Similarly, with children, Chemtob, Nakashima, and Hamada (2002) conducted a large, systematic attempt to evaluate a combined school-based screening and psychosocial intervention to identify and treat children with persistent disaster-related trauma symptoms, 2 years after Hurricane Iniki. Children were randomly assigned to one of three consecutively treated cohorts, and treated children reported significant reductions in posttraumatic stress symptoms, which were maintained at 12-month follow-up. Other recent work with children suggests that screening followed by trauma-focused cognitive behavioral treatment may be useful for children experiencing severe and persistent postdisaster trauma symptoms (see La Greca & Silverman, in press).

Community interventions. As clearly established by this and other reviews (e.g., Kaniasty & Norris, 2004, 2009; Norris, Friedman, Watson, et al., 2002), the loss of important attachments is common following disasters, as is the deterioration of social and community resource at the time when survivors need them the most. By the same token, the individual and collective capacity to triumph over shared adversities is rooted in maintaining and augmenting perceptions of being supported, of social cohesion and cooperation, and of a sense of belonging to a valued social group and community. As we noted earlier, psychological adjustment in the aftermath of disasters depends not only on individual resources and losses but on the resources and losses of the community. Hence, sensitive, thoughtful, and timely community-wide interventions designed to mobilize, maintain, and improve community resources at all times after

disasters are essential (Hobfoll et al., 2007; Norris, Friedman, & Watson, 2002; Somasundaram, Norris, Asukai, & Murthy, 2003).

Tangible, informational, and emotional forms of social support are each likely to be salubrious to disaster survivors, regardless of the disaster's cause. Tangible support, such as shelter, food, and money, is perhaps the most straightforward. Both governmental and nongovernmental agencies are generally willing to provide tangible supports to hasten physical and fiscal recovery. The general public's empathy and solidarity further propels the emerging abundance of tangible support and aid. However, it is important to note that even when abundant, material resources may not necessarily achieve their targeted aims. The most generous aid can potentially undermine the struggling communities' cohesiveness and sense of collective efficacy (e.g., Kaniasty, in press). This result happens when postcrisis allocation is not transparent, not easily understood, and not perceived as fair or culturally sensitive. Distributing aid in concert with degree of disaster exposure (the rule of relative needs) makes sense. However, it is important to acknowledge cultural and historical mores about seeking help from others. We need to be aware that relative need is not the sole or even strongest predictor of who gets help when many people are simultaneously in crisis. In fact, profound need may even interfere with one's willingness or ability to seek replacement resources (e.g., Kaniasty & Norris, 2000).

Informational support can be as important as tangible support, especially after human-caused disasters that are typically characterized by collective confusion and uncertainty. However, communications endorsed by authorities and responsible media should be perceived as accurate and trustworthy. Otherwise, authorities and relevant channels of communication run the risk of exacerbating processes that contribute to support deterioration (e.g., lack of consensus in appraisals, mistrust, misinformation, group polarization, stress contagion; Kaniasty & Norris, 1999, 2004).

The greatest challenge is fostering naturally occurring social resources, which are vital for disaster stricken communities, particularly with regard to exchanges of emotional support. The studies catalogued in our review suggest several general recommendations. To slow down the cycle of losses in social resources, even when there is massive relocation, it is almost always advisable to keep people in their natural social groups (e.g., Najarian et al., 2001; Watson et al., 2007; Wilson & Stein, 2006). A swift return to routine activities (e.g., Prinstein et al., 1996) is also crucial for both children and adults because these activities provide a sense of security and normalcy, keep people informed about the relative needs of network members, and provide the best forums for sharing experiences and feelings. A shared understanding of loss and distress may be especially important in achieving coherence in collective coping efforts within families and neighborhoods (e.g., Beggs et al., 1996; Carr et al., 1992, 1995; Drabek & Key, 1984; Gil-Rivas et al., 2007). Naturally occurring social comparison and attribution mechanisms will help survivors recognize that some distress is a normal reaction to an abnormal event. Encouraging

and providing the means for restoration of social and interpersonal contacts promote self-efficacy and collective efficacy and help preserve a sense of continuity, connectedness, and quality of community life (e.g., Kaniasty, in press; Kaniasty & Norris, 1993; Norris et al., 2005). In this context, providing victimized communities with the resources they need to help one another should be the primary objective of postdisaster interventions. Indeed, in a community-centered intervention, the community itself plays an active role in shaping successful disaster readiness, recovery, and maintaining postcrisis resilience (see Society for Community Research and Action, 2010).

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