60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981–2001

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Results for 160 samples of disaster victims were coded as to sample type, disaster type, disaster location, outcomes and risk factors observed, and overall severity of impairment. In order of frequency, outcomes included specific psychological problems, nonspecific distress, health problems, chronic problems in living, resource loss, and problems specific to youth. Regression analyses showed that samples were more likely to be impaired if they were composed of youth rather than adults, were from developing rather than developed countries, or experienced mass violence (e.g., terrorism, shooting sprees) rather than natural or technological disasters. Most samples of rescue and recovery workers showed remarkable resilience. Within adult samples, more severe exposure, female gender, middle age, ethnic minority status, secondary stressors, prior psychiatric problems, and weak or deteriorating psychosocial resources most consistently increased the likelihood of adverse outcomes. Among youth, family factors were primary. Implications of the research for clinical practice and community intervention are discussed in a companion article (Norris, Friedman, and Watson, this volume).

On average, a disaster occurs somewhere in the world each day. It may be a flood, hurricane, or earthquake, a nuclear, industrial, or transportation accident, a shooting spree, or peacetime terrorist attack. What these various events share in common is their potential to affect many persons simultaneously and to engender an array of stressors, including threat to one's own life and physical integrity, exposure to the dead and dying, bereavement, profound loss, social and community disruption, and ongoing hardship. As a result of both the high prevalence and high stressfulness of disasters, the question of whether they impact mental health has been of interest for decades, and a substantial literature has developed that identifies and explains these effects.

Although there are exceptions (e.g., Briere and Elliott 2000), most disaster studies examine the effects of a particular event that

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occurred at a particular time to a particular population in a particular place. Thus the literature might be described best as a series of cases studies. Our ability to generalize from any one case is limited and, for this reason, review articles (e.g., Green and Solomon 1995) and meta-analyses (Rubonis and Bickman 1991) have played an especially important role in this field. Notwithstanding the value of previous reviews, we believed, for several reasons, that it was important to attempt a new synthesis of the research. Many studies have been conducted in recent years and, more so than in the past, investigators have attended to the effects of disasters globally, to children as a high-risk population, and to mass violence as a third disaster category that is distinct from both natural and technological disaster. Technological disasters and mass violence are both human-caused, but the latter has the additional element of intention. Many recent studies also have shed new light on risk and protective factors, mechanisms, and processes that influence survivors' mental health.

To update understanding of this evolving research base, we conducted an empirical review of the empirical research that has been published over the past two decades. Our purpose was to determine what is known about (1) the potential range, magnitude, and duration of a disaster's effects on the mental health of the stricken community and (2) the experiential, demographic, and psychosocial factors that influence who within that community is most likely to be adversely affected. Approximately 250 articles, chapters, and books that addressed one or both of these topics are summarized here. The overarching goal of this review was to draw conclusions from the research base that have implications for practice in disaster mental health; these conclusions and implications are described in our companion article (Norris, Friedman, and Watson, this volume).

METHOD: CRITERIA FOR INCLUSION AND EXCLUSION

The articles, chapters, and books that were included within this review were all published between 1981 and 2001, or were in press by that time, thus covering roughly 20 years of research on the psychosocial consequences of disasters. The included works mostly are those that were identified by the authors as relevant by their use of the word, *disaster(s)*, in their titles, abstracts, or key words. However, not all of the included studies were found directly from searching databases, such as PILOTS, MED-LINE, and PsycLIT, as we also included studies that we previously had in our files or became aware of by reading other articles that emerged in the search. It is likely that there are studies that we did not find by either means, and thus the elements of our research are viewed more appropriately as a sample than as a population.

Because the amount of published, quantitative research was substantial, we also established a number of criteria for exclusion from this review. Qualitative studies, nonempirical works, conference papers, unpublished manuscripts and dissertations, previous reviews, older papers, and works published in languages other than English were not included. Our topic was disaster, not trauma per se. Although usually self-evident, what exactly constitutes a disaster is not always clear at the boundaries. We focused on acute, collectively experienced events with sudden onset, thereby excluding research on chronic hazards (e.g., living near a toxic waste site) and dislocation and terrorism that occurs within the context of ongoing political conflicts or war. In addition, the sample had to include at least some primary victims. We excluded research that relied solely on archival or "social indicator" data or that focused solely on distant or anticipated experiences. Finally, there had to be enough research to justify an empirical approach. For example, at present, there were few quantitative studies of bioterrorism that met our other criteria. As the threat of bioterrorism grows, scientific interest in its consequences is likely to grow as well (Ursano, Fullerton, and Norwood in press). Undoubtedly, future reviews will need to grapple with the complexities of defining individual and collective exposure to invisible biological or chemical agents.

RANGE, MAGNITUDE, AND DURATION OF EFFECTS

In this section, we focus on the range, magnitude, and duration of disaster effects. First, we provide a general description of the pertinent research database, both with regard to its breadth of coverage and with regard to its methodological rigor. Second, we describe the variety of psychosocial outcomes that have been observed across all the studies in this database. Third, on the basis of an empirical analysis of the articles reviewed, we describe the distribution of the overall magnitude of these events and draw conclusions regarding the relative impact of different types of disasters. Finally, we draw conclusions regarding the typical course of postdisaster reactions by describing changes that have been observed over time in longitudinal studies. The important thing to note about this section is that we pay minimal attention to individual differences in outcomes within events so as to describe potential and typical results and to identify event- and sample-level predictors of outcomes.

SURVIVORS REPRESENTED IN THE DATABASE

The primary database that was used to address the issues outlined was not only substantial but also quite diverse. The included works provided sample-level results pertaining to mental health outcomes for 160 distinct samples of disaster victims. (Ten entries only identified individual differences in outcomes within samples and were included only in the evaluation of risk/protective factors.) Table 1 provides a breakdown of the samples by disaster type, sample type, and location. Of the 160 samples, 88 (55%) experienced natural disasters (29 from earthquakes; 25 from hurricanes, typhoons, and cyclones; 15 from floods; 7 from wildfires; 5 from volcanoes; 4 from tornadoes; and 2 from an avalanche); 54 (34%) experienced technological disasters (12 from airplane crashes; 10 from ground transportation accidents; 8 from industrial accidents; 7 from ship, ferry, or boat wrecks; 7 from nuclear accidents; 5 from building fires or collapses; 3 from oil or chemical spills; and 2 from dam collapses); and 18 (11%) experienced mass violence (7 from shooting sprees or sniper attacks; 6 from bombings; 2 from other terrorist attacks; 2 from mass suicides; and 1 from a civil disturbance).

The database incorporated research conducted in 29 separate countries or territories, including Armenia, Australia, Belgium, Chile, China, Colombia, Denmark, Ecuador, Finland, France, Guam, India, Ireland, Israel, Italy, Japan, Malaysia, Mexico, the Netherlands, Nicaragua, Norway, New Zealand, the Philippines, Poland, Puerto Rico, Sweden, Turkey, the United Kingdom, the Ukraine, and the United States. We grouped the samples into three sets composed of the United States and territories, including Puerto Rico and Guam (91, 57%); other developed countries, composed primarily of samples from the United Kingdom, Australia, western Europe, and Japan (46, 29%); and developing countries, composed of samples from eastern Europe, Asia other than Japan, and the Americas, other than the United States (23, 14%). (There were no studies from Canada.)

A complication in the research is that adults and youth are almost always studied separately. Both adult survivors (109 samples, 68%) and school-aged youth (27 samples, 17%) were represented well in the database. Of the 27 youth samples, 9 were composed predominantly of adolescents and 18 predominantly of children ages 6–12. Four samples of preschool children or infants were omitted from the primary database because there were just too few studies available to draw meaningful conclusions about very young children. Twenty-four additional adult samples (15%) were composed of rescue or recovery workers, such as firefighters, body handlers, and family assistance counselors.

METHODOLOGIES REPRESENTED IN THE DATABASE

There is also considerable methodological diversity in the database. Two-thirds of the samples ($n = 109$, 68%) were drawn for studies that had a single postdisaster assessment. Of these, seven had true premeasures (Asarnow et al. 1999; Bravo, Rubio-Stipec,

TABLE 1
Samples in the Database by Disaster Type, Sample Type, and Disaster Location

	United States			Other developed country			Developing country		
	Youth survivor	Adult survivor	Recovery worker	Youth survivor	Adult survivor	Recovery worker	Youth survivor	Adult survivor	Recovery worker
Natural	11	42	2	3	9	2	3	16	0
Technological	3	13	7	3	16	9	0	2	1
Mass violence	4	6	3	0	4	0	0	1	0
All disasters	18	61	12	6	29	11	3	19	1

Canino, Woodbury, and Ribera 1990; Knight, Gatz, Heller, and Bengtson 2000; Lutgendorf et al. 1995; Robins et al. 1986; Ullman and Newcomb 1999; Warheit, Zimmerman, Khoury, Vega, and Gil 1996). The remaining samples ($n = 51$, 32%) were drawn for studies that had two or more postdisaster assessments. Of these, two used a successive cohort design (Dohrenwend 1983; Krause 1987), in which successive random subsamples were surveyed at various postdisaster intervals, and three were panel studies that had true predisaster measures (Alexander 1993; Alexander and Wells 1991; Nolen-Hoeksema and Morrow 1991; Norris, Phifer, and Kaniasty 1994). Although samples were first assessed after the disaster at any time from immediately to 7 years postdisaster, 60% were assessed within 6 months. Samples participating in longitudinal studies were interviewed as late as 17 years postdisaster (Green et al. 1994) but half (48% of the longitudinal samples) gave their last interview within 1 year postevent. The size of these samples varied from very small (13) to very large (5,687). The median size was 149. A striking statistic is that these 160 samples sum to 61,396 individuals.

Although sampling methods that preclude precise generalization to affected populations predominated, many samples were drawn with the use of probability sampling methods. These included in-home surveys (Bravo et al. 1990; Catapano et al. 2001; Norris et al. 1994; Robins et al. 1986), telephone surveys (Freedy, Saladin, Kilpatrick, Resnick, and Saunders 1994; Garrison et al. 1995; Hanson, Kilpatrick, Freedy, and Saunders 1995; Krause 1987; Smith, Christiansen, Vincent, and Hann 1999), and mail surveys (Carr, Lewin, Webster, Hazell, Kenardy, and Carter 1995; Logue, Hansen, and Struening 1981; Selley, King, Peveler, Osola, Martin, and Thompson 1997). Some other samples were drawn by using purposive sampling techniques and were generally, if not precisely, representative of the population of interest (Norris, Perilla, Ibañez, and Murphy 2001; Thompson, Norris, and Hanacek 1993). Occasionally, generally after human-caused disasters, the size of the affected population was small enough to make sampling unnecessary; that is, in these cases, the investigators attempted to include all persons who experienced the event (e.g., Gregg et al. 1995; Johnsen, Eid, Lovstad, and Michelsen 1997; Lindeman, Saari, Verkasalo, and Prytz 1996; Weisaeth 1989b). Least representative were samples composed primarily of litigants referred for clinical evaluation (Brooks and McKinlay 1992; Dooley and Gunn 1995; Gleser, Green, and Winget 1981; Livingston, Livingston, and Fell 1994). Data showing that litigants do not differ from nonlitigants in these communities are helpful in establishing that the validity of the data are not compromised by the primary sample's desire for compensation (Green, Grace et al. 1990).

RANGE OF OUTCOMES

Specific Psychological Problems

The various outcomes that were described across the articles reviewed were grouped into six sets. Illustrative studies are referenced in Table 2. Outcomes in the first set, *specific psychological problems*, were identified in 121 (77%) of the samples. This set includes continua of symptoms of posttraumatic stress, depression, and anxiety, and other psychiatric problems, as well as criterion-based conditions of posttraumatic stress disorder (PTSD), major depression disorder (MDD), generalized anxiety disorder (GAD), and panic disorder (PD). Undoubtedly, the condition most often assessed and observed in these samples was PTSD (109 samples, 68%). Investigators using continuous measures of PTSD (see Table 2) typically compared their sample's scores to those of a control group or published norms and cutpoints or examined how highly they correlated with severity of exposure. Investigators who used structured diagnostic measures documented widely varying rates of PTSD. The cutpoint strategy was especially common in studies of youth because nearly all of these studies used the Children's PTSD–Reaction Index (CPTSD-RI). Among those studies that examined the separate criteria for PTSD, a common finding was for intrusion

TABLE 2
Outcomes Observed in Disaster-Stricken Samples

Outcome	Illustrative studies by assessment strategy
Specific psychological problems	*Continuous measures of posttraumatic stress symptoms* Asarnow et al. 1999; Bowler, Mergler, Huel, and Cone 1994; Brooks and McKinlay 1992; Carr, Lewin, Webster, et al. 1997; Chung and Werrett et al. 2000; Dalgleish, Joseph, Thrasher, Tranah, and Yule 1996; Davidson and Baum 1986; Davidson, Fleming, and Baum 1985; Durham, McCammon, and Allison 1986; Epstein, Fullerton, and Ursano 1998; Ersland, Weisaeth, and Sund 1989; Eustace, MacDonald, and Long 1999; Freed, Bowler, and Fleming 1998; Goenjian, et al. 1995, 2000, 2001; Green et al. 1994; Ironson et al. 1997; Johnsen, Eid, Lovstad, and Michelsen 1997; Jones and Ribbe 1991; Jones, Ribbe, and Cunningham 1994; Jones, Frary, Cunningham, Weddle, and Kaiser 2001; La Greca, Silverman, Vernberg, and Prinstein 1996; Lonigan, Shannon, Taylor, Finch, and Sallee 1994; March, Amaya-Jackson, Terry, and Costanzo 1997; Nader, Pynoos, Fairbanks, and Frederick 1990; Norris, Perilla, Ibanez, and Murphy 2001; Norris, Perilla, Riad, Kaniasty, and Lavizzo 1999; Pynoos et al., 1987, 1993; Schwarz and Kowalski 1991; Selley et al. 1997; Shaw et al. 1995; Sloan et al. 1994; Steinglass and Gerrity 1990; Thompson, Chung, and Rosser 1995; Turner, Thompson, and Rosser 1995; Ursano, Fullerton, Kao, and Bhartiya 1995; Vila, Witkowski, Tondini, Perez-Diaz, Mouren-Simeoni, and Jouvent 2001. *Structured diagnostic measures of PTSD* Bravo, Rubio-Stipec, Canino, Woodbury, and Ribera 1990; Catapano et al. 2001; David, et al. 1996; Durkin 1993; Howard, et al. 1999; Lima, Pai, Santacruz, and Lozano 1991; Madakasira and O'Brien 1987; Mellman, David, Kulick-Bell, Hebding, and Nolan 1995; North, Smith, and Spitznagel 1994; Shore, Tatum, and Vollmer 1986; Smith, Robins, Przyeck, Goldring, and Solomon 1986; Smith, North, and Spitznagel 1993; Staab, Grieger, Fullerton, and Ursano 1996; Trappler and Friedman 1996; Wang, et al. 2000; Yule, Bolton, Udwin, O'Ryan, and Nurrish 2000. *Continuous measures of depressive symptoms* Arata, Picou, Johnson, and McNally 2000; Baum, Gatchel, and Schaeffer 1983; Bland, O'Leary, Farinaro, Jossa, and Tervisan 1996; Fullerton, Ursano, Tzu-Cheng, and Bharitya 1999; Ginexi, Weihs, Simmens, and Hoyt 2000; Goenjian et al. 1995, 2001; Krause 1987; Logue, Hansen, and Struening 1981; Morgan, Matthews, and Winton 1995; Murphy 1984; Norris, Perilla, Riad, Kaniasty and LaVizzo 1999; Palinkas, Russell, Downs, and Petterson 1992; Pickens, Field, Prodromidis, Pelaez-Nogueras, and Hossain 1995; Staab, Grieger, Fullerton, and Ursano 1996; Tobin and Ollenburger 1996; Trappler and Friedman 1996; Ursano, Fullerton, Kao, and Bhartiya 1995; Warheit, Zimmerman, Khoury, Vega, and Gil 1996.

	Structured diagnostic measures of MDD Bolton, O'Ryan, Udwin, Boyle, and Yule 2000; Bravo, Rubio-Stipec, Canino, Woodbury, and Ribera 1990; Bromet, Parkinson, Schulberg, and Gondek 1982; David et al. 1996; de la Fuente 1990; Durkin 1993; Gleser, Green, and Winget 1981; Green, Grace, and Gleser 1985; Green et al. 1990; Howard et al. 1999; Maes, Mylle, Delmeire, and Altamura 2000; McFarlane and Papay 1992; North, Smith, and Spitznagel 1994; North et al. 1999; Smith, North, McCool, and Shea 1990.
	Continuous measures of anxiety symptoms Arata et al. 2000; Baum et al. 1983; Bland et al. 1996; Bowler et al. 1994; Cook and Bickman 1990; Creamer, Burgess, Buckingham, and Pattison 1993; Morgan et al. 1995; Norris and Murrell 1988; Thompson, Norris, and Hanacek 1993; Vila et al. 2001.
	Structured diagnostic measures of GAD Bromet et al. 1982; Brooks and McKinlay 1992; Canino, Bravo, Rubio-Stipec, and Woodbury 1990; Creamer et al. 1993; David et al. 1996; de la Fuente 1990; Gleser et al. 1981; McFarlane and Papay 1992; Palinkas, Downs, Petterson, and Russell 1993; Shore et al. 1986.
Nonspecific distress	*Global Severity Index of the SCL-90, HSCL, or BSI* Bromet et al. 1982; Brooks and McKinlay 1992; Canino, et al. 1990; Creamer et al. 1993; David et al. 1996; de la Fuente 1990; Gleser et al. 1981; McFarlane and Papay 1992; Palinkas, et al. 1993; Shore et al. 1986; Taylor and Frazier 1982.
	General Health Questionnaire Brooks and McKinlay 1992; Carr, Lewin, Webster, et al. 1997; Catapano et al. 2001; Chung and Werrett et al. 2000; Chung, Easthope, Chung, and Clark-Carter 2001; Clayer, Bookless-Pratz, and Harris 1985; Creamer et al. 1993; Dyregrov, Kristoffersen, and Gjestad 1996; McFarlane 1989, McFarlane and Hua 1993; Smith 1996; Thompson et al. 1995; Turner et al. 1995; Vila et al. 2001.
Health problems	*Self-reported somatic complaints* Baum et al. 1983; Bland et al. 1996; Bravo et al. 1990; Cheever and Hardin 1999; Clayer et al. 1985; Cleary and Houts 1984; Escobar, Canino, Rubio-Stipic, and Bravo 1992; Murphy 1984; Phifer, Kaniasty, and Norris 1988; Shariat, Mallonee, Kruger, Farmer, and North 1999; Smith and Freedy 2000.

(*continued*)

TABLE 2
(Continued)

Outcome	Illustrative studies by assessment strategy
	Verified morbidity Holen 1991; Palinkas et al. 1993.
	Physiological indicators of stress and immune functioning Baum et al. 1983; Ironson et al. 1997; Inoue-Sakurai, Maruyama, and Morimoto 2000.
	Laboratory assessments of sleep quality Mellman et al. 1995.
	Self-reported sleep disruption Bland et al. 1996; Bowler et al. 1994; Davidson, Fleming, and Baum 1987; Gleser et al. 1981; Hagstrom 1995; Raphael, Singh, Bradbury, and Lambert 1983–1984; Shariat et al. 1999; Smith et al. 1993; Weisaeth, 1989a.
	Increased use or abuse of substances Clayer et al. 1985; Dooley and Gunn 1995; Gregg et al. 1995; Kaiser et al. 1996; Sims and Sims 1998; Smith Christiansen, Vincent, and Hann 1999.
	Relapse and illness burden Lutgendorf et al. 1995.
Problems in living	*Life events* Creamer et al. 1993; Hutchins and Norris 1989; Koopman, Classen, and Spiegel 1997; Murphy 1984; Norris et al. 1999.
	Chronic stress and strain Bolin and Klenow 1982–1983; Dooley and Gunn 1995; Norris and Uhl 1993; Ollendick and Hoffman 1982; Palinkas et al. 1993; Sattler et al. 1995; Sims and Sims 1998; Solomon 2002.
	Ecological stress and disruption Bowler et al. 1994; Burnett et al. 1997; Riad and Norris 1996.

Resource loss	*Global indices* Arata et al. 2000; Freedy, Shaw, Jarrell, and Masters 1992; Freedy, Saladin, Kilpatrick, Resnick, and Saunders 1994; Smith and Freedy 2000.
	Loss of optimistic biases Burger and Palmer 1992; Dolinski, Gromski, and Zawisza 1987; Greening and Dollinger 1992; Helwig-Larsen 1999; Norris, Smith, and Kaniasty 1999; Weinstein, Lyon, Rothman, and Cuite 2000.
	Loss of psychological resources Benight, Swift, Sanger, Smith, and Zeppelin 1999; Burger, van Staden, and Nieuwoudt 1989; Ullman and Newcomb 1999
	Loss of social resources Arata et al. 2000; Bland et al. 1997; Bowler et al. 1994; Dooley and Gunn 1995; Kaniasty, Norris, and Murrell 1990; Kaniasty and Norris 1993; Norris and Kaniasty 1996; Norris et al. 1999; Palinkas et al. 1993; Solomon, Bravo, Rubio-Stipec, and Canino 1993; Wang et al. 2000.
Problems of youth	*Parent and teacher reports, children and adolescents* Durkin, Khan, Davidson, Zaman, and Stein 1993; Galante and Foa 1986; Goenjian et al. 1995; Kitayama et al. 2000; March et al. 1997; Saylor, Swensen, and Powell 1992; Vila et al. 2001.
	Self-reported delinquency, adolescents Khoury et al. 1997.

Note. PTSD, posttraumatic stress disorder; MDD, major depression disorder; GAD, generalized anxiety disorder; SCL-90, symptom checklist-90; HSCL, Hopkins Symptom Checklist; BSI, brief symptom inventory.

and arousal to be highly prevalent and avoidance less so, and thus the latter tended to drive the diagnosis of PTSD (Catapano et al. 2001; McMillen, North, and Smith 2000; Maes et al. 1998; Norris 1992; North et al. 1999). Nightmares have been studied in their own right, as well as because they are a symptom of PTSD (Wood, Bootzin, Rosenhan, Nolen-Hoeksema, and Jourden 1992). Dissociative responses (Koopman, Classen, and Spiegel 1996) and acute stress disorder (Grieger et al. 2000; Staab, Grieger, Fullerton, and Ursano 1996; Waelde, Koopman, Rierdan, and Spiegel 2001) also have been observed in the immediate aftermath of disasters.

Identified in 58 samples (36%), depression was the second most commonly observed psychiatric problem (see Table 2). Numerous studies have found elevations in depressive symptoms as measured by self-report scales, and studies that used structured diagnostic measures often found rates of MDD in disaster-stricken samples to exceed those in normative samples or control groups. Related symptoms, such as suicidality and remorse, also increase with severity of exposure (Norris et al. 2001; Warheit et al. 1996).

Anxiety was identified in 32 (20%) of the samples. Self-reported symptoms of anxiety after a disaster quite often are elevated over norms or those of controls. Although less prevalent than PTSD or MDD, GAD has been diagnosed at higher than normal levels in disaster-stricken samples when structured diagnostic measures were used. Death anxiety, phobias, and panic disorder have been assessed and observed only occasionally in samples of disaster victims (Armenian et al. 2000; Bolton, O'Ryan, Udwin, Boyle, and Yule 2000; Chung, Chung, and Easthope 2000; David et al. 1996; Maes, Mylle, Delmeire, and Altamura 2000).

Nonspecific Distress

The second set of outcomes, identified in 62 (39%) of the samples, is labeled *nonspecific distress* because it refers to the elevation of various stress-related psychological and psychosomatic symptoms rather than to a particular syndrome, such as anxiety or depression. Nonspecific distress has been measured most often by the Global Severity Index of the Symptom Checklist-90 or Brief Symptom Inventory (see Table 2). The General Health Questionnaire (e.g., McFarlane 1989; McFarlane and Hua 1993) and other instruments (Lima et al. 1990; Lima, Pai, Santacruz, and Lozano 1991) have been used to screen for psychiatric "caseness" without regard to a specific diagnosis. Demoralization (Dohrenwend 1983), perceived stress (Thompson et al. 1993), and negative affect (Phifer and Norris 1989; Smith 1996) refer to similar states of nonspecific distress. In one of the few studies to explore culturally specific syndromes after disasters, Guarnaccia, Canino, Rubio-Stipec, and Bravo (1993) documented a moderately high prevalence of *ataques de nervios* 2 years after a disaster in Puerto Rico.

Health Problems and Concerns

The third set of outcomes, *health problems and concerns*, was identified in 36 (23%) of the samples. Typically, disaster victims score higher than norms or controls (or occasionally their own predisaster measures) on self-reported somatic complaints or checklists of medical conditions (see Table 2). Disaster victims' physiological indicators of stress are often elevated and the quality of their sleep is poor compared to that of laboratory controls. A symptom of any number of physical and mental illnesses, self-reported sleep disruption is extremely common. Less common than other outcomes but observed in a few samples was an increase in the use of alcohol, drugs, or cigarettes. Alcohol consumption may increase the most in persons who were already problem drinkers (Pfefferbaum and Doughty 2001; Sims and Sims 1998) or who developed other psychological disorders (North et al. 1999). Disaster exposure may increase the likelihood of relapse (clinical worsening of symptoms) and perceived illness burden in previously disabled populations.

Chronic Problems in Living

Outcomes in the fourth set, *chronic problems in living*, have been assessed rarely, but where they have been assessed, they typically

have been observed (16 samples, 10%). In the months that follow a disaster, disaster victims are more likely than nonvictims to experience hassles or life events that serve as stressors in their own right (see Table 2). Often these secondary stressors revolve around troubled interpersonal relationships and new family strains and conflicts. Some secondary stressors are work-related, such as occupational stress and financial stress, whereas others emerge from transactions between persons and their physical environment, such as environmental worry, ecological stress, and continued disruption during rebuilding. These outcomes are conceptualized sometimes as stressors that influence psychological problems and sometimes as outcomes that are themselves influenced by acute disaster stressors, such as trauma or loss. Thus they have been analyzed as *mediators*, that is, as factors that intervene between acute exposure and chronic psychological effects (see Norris and Uhl 1993). As factors that increase risk for other psychological effects, these outcomes will be revisited later in this review.

Psychosocial Resource Loss

The fifth set of outcomes, *psychosocial resource loss*, was explicitly identified in 15 (9%) of the samples in the primary database (see Table 2). Whereas some studies have used global indices of resource loss, others have observed declines in specific resources, such as perceived social support, social embeddedness, self-efficacy, optimism, and perceived control. Like the preceding set, psychosocial resource losses may be conceptualized best as factors that mediate the effects of acute disaster stressors on symptom outcomes. Thus they are risk factors for other poor outcomes, as well as an outcome in their own right.

As for psychological resources, one's positive beliefs about the self and world are believed to be vulnerable to certain forms of trauma, especially interpersonal violence (e.g., Janoff-Bulman 1985). Although some results challenge this assumption (Lindeman et al. 1996), others support it (Solomon, Iancu, and Tyano 1997), and several studies have shown that optimistic biases (the tendency to believe one is at less risk than others for experiencing undesirable events or outcomes) disappear after disasters, at least for a while (see Table 2). More generally, disaster victims' reported losses have included goal accomplishment, perceived control over life, and optimism.

Social resources appear to be more vulnerable than psychological resources to the impact of disaster. Most tragically, disasters remove significant supporters from victims' networks through death. Temporary or permanent relocation disrupts neighborhood patterns and engenders interpersonal strains and conflict. Declines in social participation and embeddedness have been observed after numerous disasters (see Table 2). Another problem for disaster victims is that potential support providers are victims themselves. As a result, the need for support across all affected may surpass its availability, leaving social networks unable to fulfill their supportive roles. Therefore, disaster victims may revise their previous (perhaps overly optimistic) expectations of the support available to them in times of crisis. Fortunately, declines in social resources are not inevitable. Norris and Kaniasty (1996) demonstrated that when disaster victims receive adequate help relative to their needs (i.e., severity of exposure), they maintain their expectations or perceptions of support.

Problems Specific to Youth

The last set of outcomes was composed of *problems specific to youth*. For young children, these problems included clinginess, dependence, refusing to sleep alone, temper tantrums, aggressive behavior, incontinence, hyperactivity, and separation anxiety (see Table 2). Likewise, studies of adolescents have shown disaster-related elevations in behaviors specific to this age group, such as minor deviance and delinquency. Interestingly, objective school records have suggested that there may actually be a decrease in disruptive behaviors, or a decrease in teachers' reporting of them, after disasters (Shaw, Applegate, and Schorr 1996; Shaw et al. 1995).

MAGNITUDE OF EFFECTS

Overall Severity of Impairment

To provide a rough estimate of the overall impact of the events studied, we classified each sample's results on a 4-point scale. Samples that exhibited minimal impairment, highly specific or selected effects, or very transient effects were assigned a value of 1. Samples that exhibited moderate impairment received a value of 2. Samples were assigned this score if they showed (1) elevations in symptoms over nonpatient norms or significant correlations between severity of exposure and psychological outcomes and (2) rates of psychopathology below 25% in absolute terms. This category covers a wide range of actual effects. Samples that yielded rates of psychopathology between 25% and 50% were assigned a value of 3, and those that yielded rates of psychopathology greater than 50% were assigned a value of 4. Quite often, these assignments were made on the basis of investigators' reports of percentages above scale "cut points" and thus they may not necessarily conform to *Diagnostic and Statistical Manual of Mental Disorders* (DSM) diagnoses. Nonetheless, these last two results are relatively more severe than the first two from a population perspective.

Of the 160 samples in the primary database, 17 received scores of 1 (11%, minimal impairment, indicative of transient stress), 80 received scores of 2 (51%, moderate impairment, indicative of prolonged stress), 34 received scores of 3 (21%, severe impairment, indicative of significant psychopathology or distress), and 29 received scores of 4 (18%, very severe impairment). We used this strategy rather than a formal meta-analysis because the results of many descriptive studies did not lend themselves to derivation of effect sizes.

Analysis Strategy

The ability of sample-level variables to predict this overall severity of impairment was tested in a regression analysis. Sample type was coded as two dummy variables, Youth and Rescue Workers, with adult survivors serving as the reference category. Location of disaster was likewise coded as two dummy variables, Other Developed Country and Developing Country, with the United States serving as the reference category. Type of disaster was also coded as two dummy variables, Technological and Mass Violence, with Natural Disaster as the reference category. The advantage of this method is that all effects were independent of the effects of the other variables in the equation. Together, these variables predicted a sizable amount (32%) of the variance in the severity of the sample's impairment, *Multiple* $R = .57$, R^2 *adjusted* $= .30$, $F(6, 153) = 12.24$, $p < .001$.

Effects of Sample Type

Samples composed of youth were more likely to fall into the severe range of impairment than samples composed of adults, Youth $\beta = .15$, $p < .05$. As shown in Table 3, 52% of the school-age samples experienced severe or very severe effects, compared to 42% of the adult survivor samples. Moreover, the less-affected youth samples tended to include large numbers of children and adolescents who were not directly touched by the disaster (March, Amaya-Jackson, Terry, and Costanzo 1997; Pfefferbaum et al. 2000). The difference between the two adult samples was also apparent, Rescue Worker $\beta = -.30$, $p < .001$. In fact, only 3 (13%) of the rescue/recovery samples were severely impaired (McCarroll, Fullerton, Ursano, and Hermsen 1996; Turner, Thompson, and Rosser 1995; Watts and Wilson 1999) and, usually these effects emerged on some study variables but not all.

Effects of Disaster Location

Location of the disaster also influenced the severity of its effects, Other Developed Country $\beta = .28$, $p < .001$, Developing Country $\beta = .37$, $p < .001$. Severe or very severe impairment was observed in 25% of the U.S. samples, 48% of the samples from other developed countries, and 78% of the samples from developing countries. We expected to find

TABLE 3
Overall Impact by Sample-Level Characteristics

	% Minimal impairment	% Moderate impairment	% Severe impairment	% Very severe impairment	*n*
Type of sample					
Youth	0.0	48.1	22.2	29.6	27
Adult survivor	9.2	48.6	23.9	18.3	109
Rescue or recovery worker	29.2	58.3	8.3	4.2	24
Location of disaster					
United States or its territories	16.5	58.2	14.3	11.0	91
Other developed country	4.3	47.8	21.7	26.1	46
Developing country	0.0	21.7	47.8	30.4	23
Type of disaster					
Natural	10.2	55.7	21.6	12.5	88
Technological	14.8	46.3	18.5	20.4	54
Mass violence	0.0	33.3	27.8	38.9	18

samples from developing countries to be at greater risk for impairment, in part because of the greater severity of many of their events and in part because they must recover in a context of lower resources. The finding that, on average, samples from developed countries other than the United States experienced more adverse consequences was not expected. However, the events experienced by the most impaired samples were quite traumatic, including the bomb-induced Pan American airplane crash in Lockerbie, Scotland (Brooks and McKinlay 1992; Livingston, Livingston, and Fell 1994) and the sinking of the Jupiter cruise ship filled with adolescents from the United Kingdom (e.g., Yule, Bolton, Udwin, O'Ryan, and Nurrish 2000).

Effects of Disaster Type

With the other characteristics held constant, it did appear that severe levels of impairment were most likely to occur in samples that had experienced mass violence, Mass Violence $\beta = .31$, $p < .001$. As shown in Table 3, 67% of the samples who experienced mass violence were severely or very severely impaired, compared to 39% of the samples assessed after technological disasters and 34% of samples assessed after natural disasters. Also important in determining this result was the fact that none of the incidents of mass violence were found to have minimal or fleeting effects when survivors were assessed. As noted in describing results for youth, the samples that were only moderately impaired included large numbers of persons who were affected only indirectly by the violence (Pfefferbaum et al. 2000; Smith et al. 1999).

Samples who experienced technological disasters were not significantly more distressed, on average, than samples who experienced natural disasters, although the trend was in this direction, Technological $\beta = .14$, $p = .08$. Two facets of the data appeared to reduce the strength of this effect. First, Hurricane Andrew, an unusually serious natural disaster, was followed by an extraordinary amount of research and, second, the most severe natural disasters and almost none of the technological disasters occurred in the poorest parts of the world. To explore the influence of these trends, we created a new dataset wherein studies within a single event were aggregated. For example, the 13 separate studies of Hurricane Andrew that had severity ratings that ranged from 2 to 4 were aggregated to form a single case whose severity rating was the average of the 13, specifically 2.8. There were 102 distinct events represented in this new database. Aggregate severity ratings averaged 2.5 ($SD = 0.9$). Of the 16 events in developing countries,

only 3 were not natural disasters (Koscheyev, Martens, Kosenkov, Lartzev, and Leon 1993; Saroja, Kasmini, Muhamad, and Zulkifli 1995; Sungur and Kaya 2001). Thus it seemed appropriate to retest the difference between natural and technological disasters only for the United States and other developed countries. In these countries, the mean aggregated severity rating for the 35 natural disasters was 2.1 ($SD = 0.6$), whereas the mean aggregated severity rating for the 39 technological disasters was 2.5 ($SD = 0.9$). This difference was statistically significant, $t(72) = 2.26$, $p < .05$, and the effect size (.5) was moderate. However, natural disasters in developing countries yielded a higher mean aggregate severity rating (3.0) than did either type of disaster in developed countries (see Figure 1).

ILLUSTRATIVE U.S. DISASTERS

It was possible to identify well-known events in the research base that engendered atypically low (1.0–1.5), typical (2.0), and atypically high (2.5–4.0) levels of impairment in the samples who experienced them. Were there common denominators among events similarly classified? We restricted this discussion to U.S. disasters to hold context relatively constant and because many of these events were researched by multiple teams of investigators.

Low-Impact Disasters

Loma Prieta Earthquake. The most fleeting effects in the entire database were found by Nolen-Hoeksema and Morrow (1991) 10 days and 7 weeks after the Loma Prieta, California, earthquake. The sample of 137 Stanford students showed no overall change in depression from before to after the earthquake. An analysis of symptoms selected from the depression measure because of their correspondence to PTSD did show a change between pre- and post-measures, but only a modest one. Controlling for pre-earthquake symptoms, severity of exposure predicted postearthquake symptoms at 10 days but not

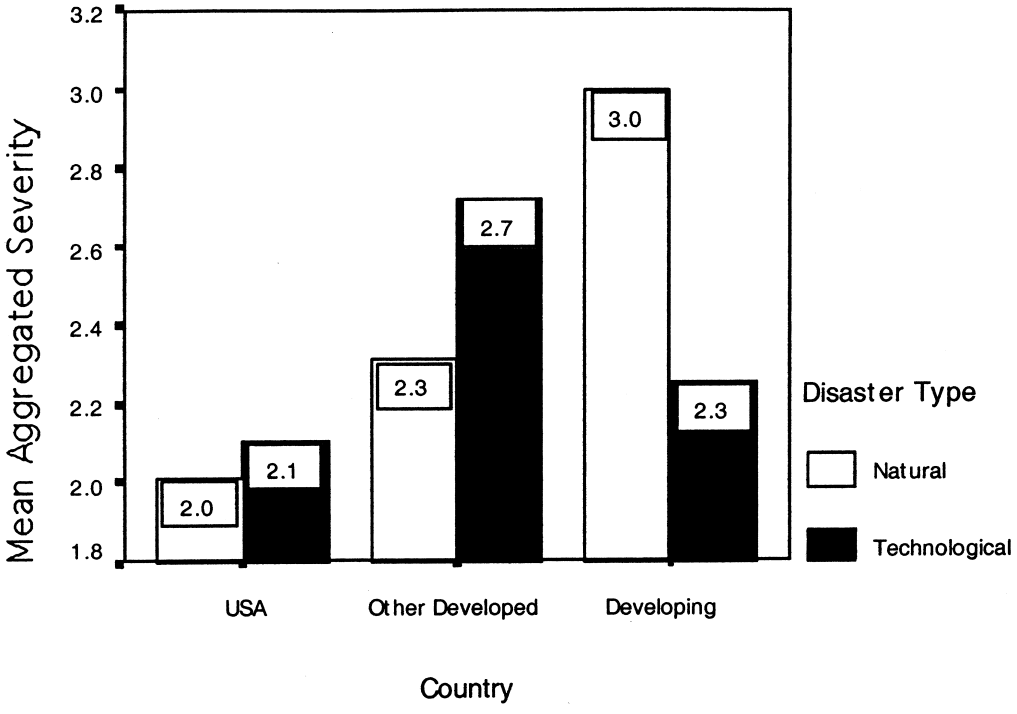

Figure 1.
Aggregate severity ratings of disasters in the database by disaster type and location.

at 7 weeks for the 41 persons who were reassessed. Given this very minimal impact, it seemed important to examine the participants' actual experiences in this earthquake. Half of this sample experienced none of the four stressors assessed and, among those who did experience a stressor, the most frequent was inconvenience. Two other studies of adult survivors after the Loma Prieta earthquake also reported minimal effects. Siegel et al. (2000) conducted a randomized telephone survey of adults in the area and found exposure variables to be virtually unrelated to PTSD scores. They did not report on the distribution of the exposure variables in the sample. Marmar, Weiss, Metzler, Ronfeldt, and Foreman (1996) compared rescue workers (freeway collapse) to a control group of the same occupation and found minimal differences between them.

Six months postearthquake, Bradburn (1991) classified 22 children on the basis of their scores on the Children's PTSD—Reaction Index (CPTSD-RI): 37% showed no symptoms, 36% showed mild symptoms, 27% were moderate, and 0% were severe. Moreover, the symptoms exhibited were largely ones of intrusion; the children did not affirm diminished enjoyment or loss of interest in activities.

Northridge Earthquake. Another fairly well-known natural disaster that appeared to have minimal effects on mental health was the 1994 Northridge earthquake, which caused its greatest damage in a suburban area of Los Angeles. Of the six studies of this event, only one found even moderate levels of impairment. Siegel et al. (2000) found virtually no effects of exposure to this disaster in a large sample of residents of the area who were assessed 6–10 months after the earthquake. The authors did not describe the specifics of the exposure of their sample. In a sample of adults ages 30–102, Knight et al. (2000) found no effects of "time" when they compared past-week depressive symptoms assessed 9–14 months after the earthquake to the average of three scores obtained from the same panel of adults in 1985, 1988, and 1991. Few of the 166 participants experienced serious structural damage or injuries. Ullman and Newcomb (1999) found minimal increases in symptoms in their prospective study that, like that of Knight et al. (2000), took advantage of previously collected survey data. Only 17 of the 225 participants actually lived near the epicenter. A contrasting set of results was derived in a study of 130 adults who were interviewed an average of 3 months after the earthquake (McMillen et al. 2000). In this sample, which was classified as having moderate or typical postdisaster impairment, a substantial percentage (48%) were still experiencing criterion-level intrusion and arousal symptoms and 13% met criteria for postearthquake PTSD. This sample was recruited from the area that experienced the greatest damage and was quite highly exposed, with 25% injured and a median precompensation amount of property damage of $25,000. However, the sample was predominantly well-educated and affluent, which may explain why the effects were no worse than those documented. The overall high resources of the Los Angeles area also may have played a role.

The Northridge earthquake also had fairly mild effects on a sample of 41 children who had been participating in a study of child psychopathology (Asarnow et al. 1999). The earthquake affected their families to varying degrees, yet when the children were assessed with the CPTSD-RI 1 year postdisaster, only 10% of them exhibited PTSD symptoms in the moderate range, and none exhibited scores in the severe range.

Moderate-Impact Disasters

Hurricane Hugo. There were a number of samples that experienced effects at least somewhat more serious or lasting than did these previous samples after disasters struck their communities. An illustrative natural disaster that produced effects predominately in a moderate or subclinical range of severity was Hurricane Hugo. Several studies were conducted in the aftermath of this hurricane. Freedy, Shaw, Jarrell, and Masters (1992) assessed 418 adults 8–12 weeks after the hurricane. Among persons with few losses, only 5% of men and 11% of women showed clinically

significant symptoms. However, among those with greater losses, 34% of men and 44% of women showed clinically significant symptoms. In a survey of 1,000 adults across two stricken and two comparison cities conducted 1 year after the hurricane, disaster-related acute stressors (personal loss, financial loss, and especially injury and life threat) predicted elevations in seven domains of chronic stress (marital stress, parental stress, filial stress, financial stress, occupational stress, ecological stress, and physical stress) as well as symptoms of depression, anxiety, and somatization (Norris and Uhl 1993). Norris and Kaniasty (1996) found that many of the adverse mental health effects of Hurricane Hugo could be explained by deterioration in perceived social support. However, a good amount of help was received, which offset some of Hugo's adverse effects. Overall, rates of PTSD related to this hurricane were low (5% in Norris 1992; 2–6% in Garrison, Weinrich, Hardin, Weinrich, and Wang 1993; 5% in Shannon, Lonigan, Finch, and Taylor 1994).

Nuclear Accident at Three Mile Island. An example of a moderate-impact technological disaster was the nuclear accident at Three Mile Island (TMI). Three months after the accident, Cleary and Houts (1984) assessed 403 adults who lived within 5 miles of TMI and 1,500 adults who lived between 5 and 55 miles away with a 16-item measure of psychophysiological symptoms. Proximity to the plant was predictive of symptom levels. In a later study conducted 12 and 17 months after the accident, Baum and his colleagues (Baum, Gatchel, and Schaeffer 1983; Fleming, Baum, Gisriel, and Gatchel 1982) assessed four groups of adults by using various cognitive, behavioral, and physiological measures of stress. The TMI group was higher than the three control groups on total symptoms, somatization, anxiety, alienation, and depression. The TMI group also found fewer errors in a proofreading task and had higher epinephrine and norepinephrine levels. Five years postevent, Davidson, Fleming, and Baum (1985) compared 53 adults who lived near TMI to 27 adults who lived near a waste dump and to 35 controls. Both of the exposed groups were higher than controls on symptom and stress measures. However, neither of these studies found much psychopathology related to the accident. Bromet and her colleagues (Bromet, Parkinson, Schulberg, and Gondek 1982; Dew and Bromet 1993; Dew, Bromet, and Schulberg 1987) studied mothers of infants, plant workers, and mental health center clients at points 9, 12, 30, and 42 months after the accident. TMI mothers and patients averaged higher symptom scores than their respective controls across all four interviews, especially in the first two. The two groups of workers did not differ. Rates of GAD and MDD among the mothers were 15–18% if they lived near TMI, 7–11% if they did not. One large-scale study of TMI found only minimal and fleeting effects (Dohrenwend 1983) but, in general, the TMI studies presented a picture of a population that was chronically stressed by the residual uncertainty, but within which only a minority were at risk for severe psychological distress or impairment.

High-Impact Disasters

Hurricane Andrew. When natural disasters cause extraordinary destruction and disruption, as was the case with Hurricane Andrew, their psychological effects may become quite severe. As of 2001, Hurricane Andrew was the most thoroughly researched disaster in the history of the United States. Ironson et al. (1997) assessed adults at 1 and 4 months after the hurricane. In this study, 33% met criteria for PTSD, and the sample differed from laboratory controls on several physiological measures in a direction indicative of lower immune functioning. In a subset of these adults, David et al. (1996) found prevalence rates of 51% for new onset disorder, including 36% for PTSD, 30% for MDD, 11% for GAD, and 10% for PD. In Perilla, Norris, and Lavizzo's (2002) sample of highly exposed residents of the area, 25% of the sample met study criteria for PTSD, and symptom levels varied strongly with severity of exposure. In an analysis of this same sample's data, Norris and Kaniasty (1996) replicated the Hurricane Hugo finding that disaster-related declines in

perceived support explained much of the Andrew sample's symptom level. Again, high levels of received support (actual postdisaster help) reduced the tendency for disaster victims to experience declines in their perceived support. Relative to Hurricane Hugo, however, the "deterioration path" was greater and the "mobilization path" was weaker, producing more adverse mental health consequences, overall.

Children and youth were studied extensively in the aftermath of Hurricane Andrew. Garrison et al. (1995) surveyed 400 adolescents who were representative of a wide geographic range. Overall, in this sample, 7% met criteria for PTSD. Also at 6 months postdisaster, Warheit et al. (1996) assessed a group of approximately 5,000 adolescents who had been surveyed 1 year before the hurricane and found that hurricane-related stress predicted postdisaster depressive symptoms and suicidality even with prehurricane depression and suicidality controlled. La Greca, Silverman, Vernberg, and Prinstein (1996) assessed 442 children at 3 months postdisaster and found that 27% of the sample showed moderate PTSD and 29% showed severe or very severe PTSD symptoms. Shaw et al. (1995) assessed 144 children at 2 months and found that 56% of the children from a high-impact school and 39% of the children from a low-impact school scored in the severe symptom range. Despite some variability, most of the studies of Hurricane Andrew pointed to a high prevalence of psychological disturbance, especially in the neighborhoods where the losses and danger were most severe.

Exxon Valdez Oil Spill. Two technological disasters in the United States stood out in terms of the severity of their effects, the Exxon Valdez oil spill and the Buffalo Creek dam collapse. The 1989 Exxon Valdez oil spill off the coast of Alaska showed that even when technological disasters do not injure or kill human beings, they may have quite serious effects on the stricken community's mental health. Palinkas, Russell, Downs, and Peterson (1992) assessed 559 residents of the area. Among persons who had been highly exposed to the environmental damage, 43% had one or more psychological disorders, compared to 23% of those not exposed. Severity of exposure also predicted declines in social relations and increased conflicts with family members. A study that began 6 years after the spill (Arata, Picou, Johnson, and McNally 2000) suggested that the psychological consequences of this event were long lasting.

Dam Collapse at Buffalo Creek. Gleser et al.'s (1981) study of the 1972 Buffalo Creek dam collapse is a classic work in the field. Two years after the dam collapse, two thirds of the 380 adults and one third of the 273 children were evaluated as moderately or severely impaired, with GAD (60% among adults, 20% among children) and MDD (70% among adults, 25% among children) the most prevalent disorders. Many years later, these data were reanalyzed for probable PTSD, which had not been a DSM diagnosis at the time of the original study (Green et al. 1990, 1991). The rate of PTSD at 2 years was 44% among adults and 32% among children. Rates of PTSD remained high 14 years after this event.

Oklahoma City Bombing. Disasters caused by human intent were overrepresented among the severely impaired samples. Six months after the bombing of the Federal Building in Oklahoma City, North et al. (1999) interviewed 182 injured adults. One third (34%) of the sample met criteria for PTSD, and 45% had some postdisaster disorder. Shariat, Mallonee, Kruger, Farmer, and North (1999) surveyed a larger group ($n = 494$) about a broader array of outcomes 18–36 months after the bombing. The most prevalent new medical conditions were auditory problems (32%), anxiety (28%), and depression (27%). New health problems were substantially higher in the group who had been hospitalized (more seriously injured) after the event. PTSD symptoms were highly prevalent, especially startle responses (70%), event-related distress (60%), difficulty concentrating (56%), and trouble sleeping (49%). In addition, 31% of the sample had a preexisting medical condition that worsened, and 24% reported a change for the worse in their activities of daily living. A few less severe effects appeared to be disproportionately prevalent among both adults (Smith

et al. 1999) and children (Pfefferbaum et al. 2000) throughout the entire metro area.

Duration of Effects

Samples and Methodology. There were 51 samples in the primary database that provided data at two or more time points. Of these, 24 (47%) experienced natural disasters, 21 (41%) experienced technological disasters, and 6 (12%) experienced mass violence. Thirty-two samples (63%) were from the United States, 16 (31%) were from other developed countries, and only 3 (6%) were from developing countries. Adult survivors predominated (32 samples, 63%), but children (7 samples, 14%) and rescue/recovery workers were also represented (12 samples, 24%). The median sample size was 155 (range 21–2500).

Data from these samples were not always described in terms of trends over time. Findings from 34 samples were most relevant for discerning the course of postdisaster symptomatology because they were true panels, meaning that the same individuals were assessed with the same measures at each wave, and effects were observed at some point over the course of the study. These studies are described in Table 4.

Longitudinal Trends. A few exceptions notwithstanding, the general rule was for samples to improve as time passed. Symptoms declined, at least predominantly, over time in 27 panels (79%), did not change in 4 (12%), and increased in 1 (3%), and the findings were mixed in 2 (6%). Declines were also evident in the two studies with cohort designs (Dohrenwend 1983; Krause 1987), but symptoms increased in the study of Koscheyev, Martens, Kosenkov, Lartzev, and Leon (1993) who assessed different (but overlapping) samples of plant operators at four points after the Chernobyl nuclear accident.

The downward trends were (of course) linear in the samples that were assessed twice after the disaster, but they were predominantly, simply linear in only three of the samples who were assessed three or more times after the disaster (see Table 4). Sometimes symptoms declined at first, then stabilized; or stabilized for a while, then began a new downward trend; or showed a quadratic or cyclical pattern. The seven exceptions (21%) to the general rule for symptoms to decline consistently over time were not confined to any one location, sample type, or time frame and did not appear to form an interpretable result. In general, the longitudinal data suggested that the first year is the time of peak symptoms or effects (Bromet, Parkinson, and Dunn 1990; Carr et al. 1997a; McFarlane 1989; Nader, Pynoos, Fairbanks, and Frederick 1990; Phifer and Norris 1989; Phifer, Kaniasty, and Norris 1988; Shaw et al. 1996; Steinglass and Gerrity 1990; Thompson et al. 1993; Ursano, Fullerton, Kao, and Bhartiya 1995).

In many longitudinal studies, levels of symptoms in the early phases of disaster recovery were good predictors of symptom levels in later phases of recovery (Fullerton, Ursano, Tzu-Cheg, and Bhartiya1999; La Greca et al. 1996; McFarlane 1987 1989; Nader et al. 1990; Norris, Perilla, Riad, Kaniasty, and Lavizzo 1999; Udwin, Boyle, Yule, Bolton, and O'Ryan 2000; Waelde et al. 2001). Where examined, delayed onsets of disorders were rare (North, Smith, and Spitznagel 1997; Yule et al. 2000), although there were exceptions to this rule (Sungur and Kaya 2001).

RISK AND PROTECTIVE FACTORS

At the end of a hypothetical continuum is a disaster so unthinkably horrendous that every survivor would show serious and lasting psychological disturbance. At the other end of this continuum is a disaster that uniformly causes so little loss, disruption, and trauma that no survivor would be affected psychologically. For every other disaster, one can expect survivors within the stricken community to vary in their outcomes according to their severity of exposure and personal characteristics.

SEVERITY OF EXPOSURE

Individual-Level Exposure

When the study's design allowed consideration of variations in participants' experiences in the disaster, severity of exposure typi-

cally was operationalized and included in the analysis in some way. A few investigators counted the number of stressors as an index of severity of exposure (Briere and Elliott 2000; Hardin, Weinrich, Hardin, and Garrison 1994; Norris et al. 2001; Palinkas, Downs, Petterson, and Russell 1993; Thompson et al. 1993) and generally found that as the number of stressors increased, the participant's symptoms increased. Other investigators created ordinal measures that reflected their assumptions about the relative severity and comparability of different aspects of exposure (Bravo et al. 1990; Palinkas et al. 1993; Shore, Tatum, and Vollmer 1986), and these measures also generally predicted psychological outcomes. As documented in Table 5, specific stressors that have been found to affect mental health include bereavement, injury to self or family member, life threat, panic during the disaster, horror, property damage or financial loss, and relocation. Conclusions regarding the relative or comparative impact of these stressors are difficult to make for several reasons. First, some stressors, such as injury and threat to life, correlate highly with one another. Second, not all stressors are relevant to all types of disasters; for example, property damage does not necessarily occur in incidents of mass violence and many technological disasters. Third, there are many inconsistencies in the literature regarding which stressors were more pathogenic than others. Nonetheless, studies that had variability on many of these stressors often found injury and threat to life to have stronger or longer lasting consequences for mental health (Gleser et al. 1981; Maes et al. 2000; Norris et al. 1999; Thompson et al. 1993).

The experiences of recovery workers also vary in severity. Among the stressors predicting outcomes were the intensity and duration of interactions with families of deceased victims, identification with the victims, and role conflict (Bartone, Ursano, Wright, and Ingraham 1989; Hodgkinson and Shepherd 1994). Duration of exposure is likewise a risk factor for workers who must handle bodies (Jones 1985) or identify victims (McCarroll et al. 1996). Working with child victims is a risk factor for health care workers (Epstein, Fullerton, and Ursano 1998). Jenkins (1997) found that the distress of dispatchers was primarily attributable to their experiences of threat and loss. Dispatchers on duty the night of Hurricane Andrew did not differ from dispatchers not on duty.

Community-Level Exposure

There is relatively little research on collective loss or trauma, although it has long been held to be a defining feature of disasters. Occasionally, severity of exposure has been assessed at the neighborhood or community level. Measures such as the respondent's proximity to the "epicenter" may be derived geographically but typically are used to group participants who had similar individual experiences and are not intended to reflect extra-individual experience (Bromet et al. 1982; Cleary and Houts 1984; Goenjian et al. 1995, 2001; Inoue-Sakurai et al. 2000; Nader, Pynoos, Fairbanks, and Frederick 1990; Pynoos et al. 1987; Smith, North, McCool, and Shea 1990; Vila et al. 2001; Ullman and Newcomb 1999). Three approaches to ecological assessment were demonstrated in this literature: (1) Participants have been asked to describe conditions in their neighborhoods or communities (e.g., Hanson et al. 1995); (2) data have been aggregated "up" from the individual to the neighborhood or community level (e.g., Perilla et al. 2002); and (3) archival data have been collected that reflect collective loss independent of personal loss (e.g., Norris et al. 1994). In general, such measures tend to have modest effects, yet they often do explain variance in outcomes over and above those of individual-level measures. In fact, in their study of 10 flooded counties, Phifer and Norris (1989) showed that personal loss and community destruction interacted; victims who fared most poorly were those who experienced both high personal loss and high community destruction. Occasionally, the two measures differed in their effects in interesting and informative ways. For example, personal loss was more strongly related to increases in negative affect, but community destruction was more strongly related to decreases in positive affect, reflecting a communitywide tendency to feel less positive about their surroundings,

TABLE 4
Trends over Time in Longitudinal Panel Studies of Disaster Victims and Recovery Workers

Pattern Sample (citation)	First month	Last month	Agent	Sample type	Trend over time
Linear decline between 2 points					
Johnsen et al., 1997	<1	4	avalanche	survivors	Symptoms declined between T1 and T2.
Johnsen et al., 1997	<1	4	avalanche	rescue workers	Symptoms declined between T1 and T2.
Cook and Bickman, 1990	<1	5	flood	adult survivors	Symptoms declined between T1 and T2
Dyregrov et al., 1996	1	13	bus crash	rescue workers	Symptoms declined between T1 and T2.
Nader et al., 1990	1	14	sniper attack	children	Symptoms declined between T1 and T2.
North, Smith, and Spitznagel, 1997	1	12	shooting spree	adult survivors	% cases declined between T1 and T2.
Steinglass and Gerrity, 1990	4	16	flood	adult survivors	Symptoms declined between T1 and T2.
Steinglass and Gerrity, 1990	4	16	tornado	adult survivors	Symptoms declined between T1 and T2.
Bolton et al., 2000	5	96	ship sinking	adolescents	% cases declined between T1 and T2.
Murphy, 1985	11	36	volcano eruption	adult survivors	Symptoms declined between T1 and T2.
Kitayama et al., 2000	12	24	earthquake	children	Symptoms declined between T1 and T2.
Scott et al., 1995	12	36	plane crash/bomb	clinic referrals	Symptoms declined between T1 and T2.
Green et al., 1994	24	204	dam collapse	children	Symptoms declined between T1 and T2.
Green et al., 1990	24	168	dam collapse	adults	Symptoms declined between T1 and T2.
Dalgleish et al., 1996	36	72	ferry sinking	adult survivors	Symptoms declined between T1 and T2.
Linear decline (predominantly) across 3 points					
La Greca et al., 1996	3	10	hurricane	children	Symptoms declined between T1 and T2 (7 mos.) and again between T2 and T3.
Lesaca, 1996	1	3	plane crash	trauma counselors	Effects declined between T1 and T2 and again between T2 and T3.
Thompson et al., 1993	12	24	hurricane	adult survivors	Effects declined in strength and number between T1 and T2 (18 mos.) and T3.
Nonlinear decline across 3 or more points					
Sloan, 1988	<1	12	plane crash	young men	Stress high at T1 (12 days post) but largely dissipated by T2 (2 months), then stable.
Taylor and Frazier, 1982	<1	20	plane crash	body handlers	Stress high at T1 (immediately after), declined between T1 and T2 (3 months) then stabilized.
Watts and Wilson, 1999	1	12	bus crash	recovery workers	% cases declined between T1 and T2 (3 mos.), then stabilized.

Ursano et al., 1995	1	13	ship explosion		body handlers	% cases stable between T1 and T2 (4 mos.); declined between T2 and T3.
Shaw et al., 1996	2	21	hurricane		children	Symptoms stable between T1 and T2 (8 mos.); declined between T2 and T3.
Phifer and Norris, 1989	3	21	flood		older adults	Symptoms peaked at T2 (9 mos.), then declined between T2 and T4.
McFarlane, 1989	4	29	wildfire		firefighters	Effects for summary measures declined in strength between T1 and T2 (11 mos.), stable between T2 and T3.
Epstein et al., 1998	6	18	air disaster		medical workers	% cases peaked at T2.
Carr et al., 1997b	6	24	earthquake		adult survivors	Symptoms declined from T1–T4; nonspecific distress stabilized at T2 (12 mos.), PTSD at T3 (18 mos.)
Bromet, Parkinson, and Dunn, 1990	9	42	nuclear accident		adult survivors	Effects for mothers greater at T1 and T2 (12 mos.) than at T3 (30 mos.) and T4.
No or inconsistent decline						
Sungur and Kaya, 2001	1	18	mass violence	79	adult survivors	Combination of acute, chronic, and delayed cases.
McFarlane, 1987	2	26	wildfire	365	children	PTSD symptoms did not decline between T2 (8 mos.) and T3; this not measured at T1.
Wang et al., 2000	3	9	earthquake	157	adult survivors	Symptoms did not decline between T1 and T2.
Powell and Penick, 1983	3	15	flood	86	adult survivors	Symptoms did not decline between T1 and T2.
Creamer et al., 1993	4	14	shooting	639	adult survivors	Effects large at all 3 timepoints; no time or time by group effect in MANOVA.
Bartone et al., 1989	6	12	plane crash	131	family workers	Symptoms increased between T1 and T2.
Norris et al., 1999	6	30	hurricane	241	adult survivors	Some symptoms declined but some increased between T1 and T2.

Note. Abbreviation: T = Time; mos. = months.

TABLE 5
Acute Disaster Stressors Shown to Correlate with Postdisaster Mental and Physical Health

Stressor	Illustrative studies
Bereavement	Armenian et al. 2000; Brooks and McKinlay 1992; Carlier and Gersons 1997; Fullerton, Ursano, Tzu-Cheg and Bhartiya 1999; Gleser, Green, and Winget 1981; Goenjian et al. 1995, 2001; Green, Grace, and Gleser 1985; March, Amaya-Jackson, Terry, and Costanzo 1997; Murphy 1984; Pfefferbaum et al. 2000; Thompson, Chung, and Rosser 1995.
Injury to self or family member	Armenian et al. 2000; Briere and Elliott 2000; Caldera, Palma, Penayo, and Kullgren 2001; Catapano et al. 2001; Elklit 1997; Gleser et al. 1981; Goenjian et al. 2001; Green et al. 1985; Ironson et al. 1997; Lewin, Carr, and Webster 1998; Maes, Mylle, Delmiere, and Atamura 2000; Norris, Kaniasty, Conrad, Inman, and Murphy 2002; Norris, Perilla, Riad, Kaniasty, and Lavizzo 1999; Selley et al. 1997; Shariat, Mallonee, Kruger, Farmer, and North 1999; Thompson, Carr, and Webster 1993; Udwin, Norris, and Hanacek 2000.
Life threat, fear	Briere and Elliott 2000; Carr, Lewin, Webster 1997; Creamer et al. 1993; Dew and Bromet 1993; Garrison, Weinrich, Hardin, Weinrich, and Wang 1993; Gleser et al. 1981; Goenjian et al. 2001; Green et al. 1985; Hanson, Kilpatrick, Freedy, and Saunders 1995; Ironson et al. 1997; La Greca, Silverman, Vernberg, and Prinstein 1996; Lewin, Carr, and Webster 1998; Norris, Kaniasty, Conrad, Inman, and Murphy 2002; Norris, Perilla, Riad, Kaniasty and Lavizzo 1999; Thompson et al. 1993; Thompson, Chung, and Rosser 1995; Udwin, Boyle, Yule, Bolton, and O'Ryan 2000; Weisaeth 1989b.
Panic during the disaster	Chung, Werrett, Farmer, Easthope, and Chung 2000; Lonigan, Shannon, Taylor, Finch, and Sallee 1994; McFarlane 1989; Udwin et al. 2000.
Peritraumatic responses	Epstein, Fullerton, and Ursano 1998; Eriksson and Lundin 1996; Staab, Grieger, Fullerton, and Ursano 1996; Tucker, Dickson, Pfefferbaum, McDonald, and Allen 1997.
Horror	Brooks and McKinlay 1992; Gleser et al. 1981; Maes et al. 2000; Udwin et al. 2000.
Separation from family	Armenian et al. 2000; Garrison et al. 1993; Lonigan et al. 1994; McFarlane 1987.
Property damage or financial loss	Armenian et al. 2000; Bland et al. 1996; Briere and Elliott 2000; Brooks and McKinlay 1992; Caldera et al. 2001; Carlier and Gersons 1997; Catapano et al. 2001; Clayer, Bookles-Pratz, and Harris 1985; Ironson et al. 1997; Kitayama et al. 2000; La Greca et al. 1996; Lonigan et al. 1994; McFarlane 1987, 1989; Murphy 1984; Norris et al. 1999; Phifer and Norris 1989; Sharan, Chaudhary, Kavathekar, and Saxena 1996; Thompson et al. 1993; Waelde, Koopman, Rierdan, and Spiegel 2001.
Relocation	Bolin and Klenow 1988; Gleser et al. 1981; La Greca et al. 1996; Lonigan et al. 1994; Murphy 1984; Najarian, Goenjian, Pelcovitz, Mandel, and Najarian 1996; Najarian, Goenjian, Pelcovitz, Mandel, and Najarian 2001; Riad and Norris 1996.
Collective exposure	Hanson et al. 1995; Knight, Gatz, Heller, and Bengtson 2000; Norris, Phifer, and Kaniasty 1994; Perilla, Norris, and Lavizzo 2002.

less enthusiastic, less energetic, and less able to enjoy life. These effects could still be observed 2 years after the flood. Similarly, personal loss was more strongly related to declines in perceptions of kin support, but community destruction was more strongly related to declines in perception of non-kin support and social participation (Kaniasty, Norris, and Murrell 1990). These findings provide an excellent reminder that disasters impact upon whole communities, not just selected individuals (see also Smith et al. 1999).

GENDER

Effects

Not every study looked for gender effects, and not every study that looked for them found them. However, the null effects were not easily interpreted. Some studies did not have a sufficiently balanced gender distribution or a large enough sample size to provide reasonably powerful tests of gender effects. Thus, we based our conclusions only on those studies that reported a gender difference of some nature, and considered the proportion that found an effect in one direction or another. We followed essentially the same logic when considering the effects of age, ethnicity, and other potential risk factors.

Forty-nine articles described a statistically significant gender difference in postdisaster stress, distress, or disorder. Of these, 46 (94%) found female survivors to be more adversely affected. References for illustrative studies are provided in Table 6. These differences were found among children and adolescents, as well as among adults. Among adults, such differences were found in other developed countries and developing countries, as well as in the United States. Among adults in the United States, the effects emerged after technological disasters and mass violence, as well as after natural disasters. The three exceptions had important commonalities in that (1) they pertained to floods characterized more by chronic disruption than sudden, terrifying onset; (2) they were categorized in the lower end of the severity distribution; and (3) all controlled for predisaster symptoms.

Outcomes on which female survivors fared worse than male survivors crossed all six sets of outcomes. An exception was that men were more likely than women to abuse alcohol (Dooley and Gunn 1995; Gleser et al. 1981; North, Smith, and Sptiznagel 1994). Women were particularly at risk for developing PTSD; after many disasters, women and girls were at least twice as likely to develop PTSD as men and boys (e.g., De la Fuente 1990; Green et al. 1990; North et al. 1999; Steinglass and Gerrity 1990).

Moderators and Mediators of Gender Effects

Effects of gender were often greatest within the samples that had other risk factors for severe impairment, either because of the type or location of the disaster. Norris et al. (2001) specifically tested whether culture interacted with gender in predicting outcomes in their comparative analysis of Hurricanes Andrew and Paulina. Consistent with their predictions, Mexican culture exacerbated gender differences and African American culture attenuated them. Webster, McDonald, Lewin, and Carr (1995) found that sex differences in the effects of the Newcastle earthquake in Australia were greatest within the non–English speaking, immigrant portion of their sample.

Women's and girls' excess risk appears to begin at the stage of subjective interpretation of events rather than at the stage of objective exposure to disaster stressors (Garrison et al. 1993; Gleser et al. 1981). Anderson and Manuel (1994) assessed reactions of college students to the Loma Prieta earthquake in California. Only 1 day had passed. Women estimated that the earthquake lasted significantly longer (78 seconds) than did men (48 seconds). Six months after Hurricane Mitch in Nicaragua (Goenjian et al. 2001), girls were higher than boys on a subjective (but not objective) measure of hurricane exposure, and this difference appeared to account for the sex difference in outcomes.

TABLE 6
Risk and Protective Factors That Influence Postdisaster Outcomes

Variable	Illustrative studies and findings
Gender	*If female, more distress* Anderson and Manuel 1994; Bolton, O'Ryan, Udwin, Boyle, and Yule 2000; Caldera, Palma, Penayo, and Kullgren 2001; Carr, Lewin, Kenardy, et al., 1997; Catapano et al. 2001; Creamer, Burgess, Buckingham, and Pattison 1993; Dooley and Gunn 1995; Freedy et al. 1992; Garrison et al. 1995; Gleser, Green, and Winget 1981; Goenjian et al. 2001; Green et al. 1991; Hagstrom 1995; Hardin, Weinrich, Weinrich, Hardin, and Garrison 1994; Ironson et al. 1997; Jones and Ribbe 1991; Karanci, Alkan, Aksit, Sucuoglu, and Balta 1999; Khoury et al. 1997; Lindeman, Saari, Verkasalo, and Prytz 1996; Lonigan, Shannon, Taylor, Finch, and Sallee 1994; Maes et al. 1998; March, Amaya-Jackson, Terry, and Costanzo 1997; Norris, Kaniasty, Conrad, Inman, and Murphy 2002; North, Smith, and Spitznagel 1994; North et al. 1999; Palinkas, Downs, Petterson, and Russell 1993; Sharan, Chaudhary, Kavathekar, and Sazena 1996; Shore, Tatum, and Vollmer 1986; Steinglass and Gerrity 1990; Udwin, Boyle, Yule, Bolton, and O'Ryan 2000; Warheit, Zimmerman, Khoury, Vega, and Gil 1996. *If male, more distress* Ginexi, Weins, Simmens, and Hoyt 2000; Phifer, 1990; Smith, Robins, Przybeck, Goldring, and Solomon 1986.
Age	*If older adult, more distress* Norris et al. 2002 (Polish); Ticehurst, Webster, Carr, and Lewin 1996. *If middle-aged adult, more distress* Gleser et al. 1981; Logue, Hansen, and Struening 1981; Norris et al. 2002 (American); Phifer 1990; Shore et al. 1986; Thompson, Norris, and Hanacek 1993. *If younger adult, more distress* Epstein, Fullerton, and Ursano 1998; Jones 1985; McCarroll, Fullerton, Ursano, and Hermsen 1996; Norris et al. 2002 (Mexican); Palinkas et al. 1993.
Ethnicity	*If ethnic minority, more distress* Bolton and Klenow 1988; Garrison, Weinrich, Hardin, Weinrich, and Wang 1993; Green et al. 1990; Jones, Frary, Cunningham, Weddle and Kaiser 2001; La Greca, Silverman, and Wasserstein 1998; March et al. 1997; Palinkas et al. 1993; Perilla, Norris, and Lavizzo 2002; Webster, McDonald, Lewin, and Carr 1995. *If ethnic minority, less distress* Garrison et al. 1995; Shannon, Lonigan, Finch, and Taylor 1994.

Socioeconomic status	*Lower income or education, more distress* Armenian et al. 2000; Bolin and Klenow 1988; Caldera, Palma, Penayo, and Kullgren 2001; Catapano et al. 2001; Epstein et al. 1998; Ginexi, Weihs, Simmens, and Hoyt 2000; Gleser et al. 1981; Hanson, Kilpatrick, Freedy, and Saunders 1995; Lewin, Carr, and Webster 1998; Norris et al. 2002; Phifer 1990; Vila et al. 2001.
Marital status	*If married, more distress* Brooks and McKinlay 1992; Gleser et al. 1981; Solomon 2002. *If unmarried, more distress* Fullerton, Ursano, Tzu-Cheg, and Bhartiya 1999; Ursano, Fullerton, Kao, and Bhartiya 1995.
Presence of children	*If mother, more distress* Bromet, Parkinson, Schulberg, and Gondek 1982; Gleser et al. 1981; Havenaar et al. 1997; Solomon, Bravo, Rubio-Stipec, and Canino 1993.
Parental distress	*If child of distressed parents, more distress* Cornely and Bromet 1986; Gleser et al. 1981; McFarlane 1987; Rustermli and Karanci 1996; Swenson, et al. 1996; Vila et al. 2001; Wasserstein and La Greca 1998. *If adult and have family member with psychological problems, more distress* Catapano et al. 2001; Gleser et al. 1981.
Secondary stressors	*Higher life events or chronic stress, more distress* Carr, Lewin, Kenardy, et al. 1997; Cowan and Murphy 1985; Creamer et al. 1993; Epstein et al. 1998; Freedy, Saladin, Kilpatrick, Resnick, and Saunders 1994; Garrison et al. 1995; Hanson, Kilpatrick, Freedy, and Saunders 1995; Hardin et al. 1994; Kwon, Maruyama, and Morimoto 2001; La Greca, Silverman, Vernberg, and Prinstein 1996; Maes, Mylle, Delmeire, and Janca 2001; McFarlane 1987, 1989; Norris, Perilla, Riad, Kaniasty, and LaVizzo 1999; Norris and Uhl 1993; Udwin et al., 2000.
Predisaster mental health	*Higher predisaster symptoms or problems, higher distress* Asarnow et al. 1999; Bravo, Rubio-Stipec, Canino, Woodbury, and Ribera 1990; Bromet et al. 1982; Creamer et al. 1993; Dew and Bromet 1993; Knight, Gatz, Heller, and Bengston 2000; Norris and Murrell 1988; North et al. 1999; Phifer 1990; Robins et al. 1986; Udwin et al. 2000; Warheit et al. 1996.
Personality	*Higher neuroticism, trait worry, or trait anxiety, higher distress* Carr, Lewin, Kenardy et al. 1997; La Greca et al. 1996, 1998; Lonigan et al. 1994; McFarlane 1989; Morgan, Matthews, and Winton 1995; Segerstrom, Solomon, Kemeny, and Fahey 1998.

(*continued*)

TABLE 6
(Continued)

Variable	Illustrative studies and findings
Ways of coping	*More active coping, less distress* Benight, Ironson et al. 1999; Freedy et al. 1992; Morgan et al. 1995; North, Spitznagel, and Smith 2001; Smith 1996; Karanci et al. 1999.
	More active coping, more distress Collins, Baum, and Singer 1983; Carr, Lewin, Webster, Hazell, Kenardy, and Carter 1995; Spurrell and McFarlane 1993.
	More reconciliation and acceptance, less distress North et al. 2001.
	More social withdrawal, disengagement, and distancing coping, more distress Chung, Easthope, Chung, and Clark-Carter 2001; Freedy et al. 1992; Jeney-Gammon, Daugherty, Finch, Belter, and Foster 1993; Jenkins 1997; La Greca et al. 1996; Spurrell and McFarlane 1993; Vernberg, La Greca, Silverman, and Prinstein, 1996.
	More emotional expressiveness and social support seeking, more distress Arata, Picou, Johnson, and McNally 2000; Jenkins 1997; Spurrell and McFarlane 1993.
	More avoidance coping, more distress Asarnow et al. 1999; Carr et al. 1995; Chung et al. 2001; Cleary and Houts 1984; Smith 1996; Spurrell and McFarlane 1993.
	More assignment of blame, more distress Jeney-Gammon et al. 1993; La Greca et al. 1996; Solomon, Regier, and Burke 1989; Solomon and Thompson 1995; Spurrell and McFarlane 1993; Vernberg et al. 1996.
Psychological resources	*More self-efficacy, mastery, or self-esteem, less distress* Benight, Ironson et al. 1999; Benight, Swift, et al. 1999; Dew and Bromet 1993; Hardin et al. 1994; Murphy 1988; Norris et al. 1999.
	More hardiness, less distress Bartone, Ursano, Wright, and Ingraham 1989; Fullerton et al., 1999.

	Higher perceived control, less distress Karanci et al. 1999; March et al. 1997; Norris et al. 1999; Ullman and Newcomb 1999.
	Future temporal orientation, higher optimism, or trait hopefulness, less distress Carr, Lewin, Kenardy et al. 1997; Cruess et al. 2000; Dougall, Hyman, Hayward, McFeeley, and Baum 2001; Holman and Silver 1998; Lutgendorf et al. 1995; Nunn, Lewin, Walton, and Carr 1996.
	Higher sense of coherence, less distress Eriksson and Lundin 1996.
Social resources	*Higher social embeddedness, less distress* Carr, Lewin, Kenardy, et al. 1997; Cleary and Houts 1984; Jenkins 1997; Kaniasty and Norris 1993; Norris et al. 1999; Udwin et al. 2000.
	More received social support, less distress Bolin 1982; Dalgleish, Joseph, Thrasher, Tranah, and Yule 1996; Drabek and Key 1984; Elklit 1997; Joseph, Williams, and Yule 1992; Kwon et al. 2001; Norris and Kaniasty 1996; Sanchez, Korbin, and Viscarra 1995; Udwin et al. 2000.
	Higher perceived social support, less distress Bartone et al. 1989; Bromet et al. 1982; Cowan and Murphy 1985; Creamer et al. 1993; Dougall et al. 2001; Fleming, Baum, Gisriel, and Gatchel 1982; Fullerton et al. 1999; Hardin et al. 1994; Jones 1985; Kaniasty and Norris 1993; Khoury et al. 1997; La Greca et al. 1996; Lutgendorf et al., 1995; Norris and Kaniasty 1996; Ullman and Newcomb 1999; Vernberg et al. 1996; Warheit et al. 1996; Weiss, Marmar, Metzler, and Ronfeldt 1995.
Resource loss	*More resource loss, more distress* Arata et al. 2000; Asarnow et al. 1999; Benight, Ironson, et al. 1999; Benight, Swift, et al. 1999; Freedy et al. 1992; Freedy et al. 1994; Ironson et al. 1997; Kaniasty and Norris 1993; Norris and Kaniasty 1996; Norris et al. 1999; Smith and Freedy 2000.

AGE AND PRIOR EXPERIENCE

Effects of Age in Youth

Previously we showed that samples of schoolage youth tend to be more severely affected by disasters than samples of adults. Prior to that age, children may not be highly affected. The four preschool samples that were omitted from that analysis were affected very little overall (Bromet et al. 2000; Cornely and Bromet 1986), although there were some behavioral problems observed in the short run (Durkin, Khan, Davidson, Zaman, and Stein 1993; Saylor, Swenson, and Powell 1992). Nineteen articles documented age differences in outcomes within samples. Only 3 of these articles involved youth. Whereas Green et al. (1991) found children below the age of 8 to be less distressed after the Buffalo Creek dam collapse than youth 8–15 years of age, Lonigan, Shannon, Taylor, Finch, and Sallee (1994) and Shannon et al. (1994) found the effects of Hurricane Hugo to be stronger among youth ages 9–12 than among youth 13–16. Thus, it may be safest to conclude that the jury is still out on the effects of age within the younger portion of the population.

Effects of Age in Adulthood

The research is more consistent with regard to the effects of age among adults. The 16 articles that involved adults provided results for 17 distinct samples (see Table 6). In only two samples were older persons at greater risk than others. These were Ticehurst, Webster, Carr, and Lewin's (1996) sample of adults who experienced the Newcastle earthquake in Australia and Norris et al.'s (Norris, Kaniasty, Conrad, Inman, and Murphy 2002) sample of adults who experienced the 1997 Polish floods. In all the remaining samples (88%), effects declined with age. In every American sample in which middle-aged adults were differentiated from younger and older adults, the former were most adversely affected.

Age as a Proxy for Maturity and Experience

Explanations of the resilience often observed among older adults have focused on the maturity and experience that comes with age. Norris and Murrell (1988) tested the "inoculation hypothesis" in a sample of adults ages 55 and older who experienced severe flooding. With preflood anxiety controlled, the interaction between prior exposure and the severity of exposure to the recent flood was significant, with less experienced older adults affected more strongly. Likewise, Knight et al. (2000) found that, with predisaster depression controlled, prior experience with earthquakes (range 1–5) predicted lower depression in a sample of adults ages 30–102 who experienced the Northridge earthquake. Although there are findings to the contrary (Thompson et al. 1993), the two studies that have found protective effects of experience share some important characteristics. First, a high proportion of each sample was composed of older adults. Second, the samples experienced little trauma (life threat, injury, bereavement) but rather exposure to physical destruction and property loss. Third, the measure of experience matched the current stressor exactly. People who have experienced disasters in their communities show higher levels of hazard preparedness (Norris, Smith, and Kaniasty 1999) and are more likely to evacuate when authorities suggest they do so (Riad, Norris, and Ruback 1999). Thus the benefits of prior experience may be mediated by specific knowledge and skills and the likelihood of taking appropriate actions when disasters strike. This protective effect is not captured by lifetime measures of exposure to trauma and especially not by prior PTSD, which are actually risk factors for postdisaster PTSD.

The sample-level finding that rescue and recovery workers cope better with disasters than do direct adult victims lends further support to a protective role of experience. Professional recovery workers showed fewer avoidance symptoms than volunteer workers in a study by Dyregrov, Kristoffersen, and

Gjestad (1996). Also, it has been found that training or experience increases the resilience of recovery workers (Ersland, Weisaeth, and Sund 1989; McCarroll et al. 1996) although past trauma per se does not (Dougall, Herberman, Delahanty, Inslicht, and Baum 2000).

Burdens of the Middle-Aged

A different explanation for the observation that middle-age is a risk factor for distress has emerged. The excess risk of middle-aged adults after Hurricane Hugo was explained by their greater chronic stress and burdens (Thompson et al. 1993). Of greatest importance here was the balance or reciprocity of the support exchanged. Both younger and older groups maintained a good balance between the amount received and the amount provided. Middle-aged people received considerable support but they provided even more.

Cross-Cultural Results

A caveat with regard to all of these findings was presented by Norris et al. (2002) in their cross-cultural study of age effects in American, Mexican, and Polish adults. Among Americans, age had a curvilinear relation with PTSD such that middle-aged respondents were most distressed. This was consistent with the other findings from the United States described earlier. Among Mexicans, however, age had a linear and negative relation with PTSD such that younger people were most distressed. Forming yet a third pattern, age had a linear and positive relation with PTSD in Poland, such that older people were most distressed after the disaster. The authors interpreted the findings in light of anthropological research showing that the family life cycle is different in each of these societies. For our purposes here, the important lesson from this comparison is that there was no one consistent effect of age; rather, it depended upon the social, economic, cultural, and historical context of the disaster-stricken setting. Moreover, Kato, Asukai, Miyake, Minakawa, and Nishiyama (1996) suggested that the effects of age may change over time following disasters.

ETHNICITY

Effects

Compared to gender and age, there is relatively little information about the effects of ethnicity within samples. All of the 11 relevant studies were conducted in the United States. Ethnic groups who are of minority group status most often fared more poorly than persons who are of majority group status (see Table 6). In fact, of the five relevant adult samples, 100% showed differences in this direction, at least at some point in the recovery process. In the six samples of youth, majority groups fared better in four cases (Garrison et al. 1995; La Greca, Silverman, and Wasserstein 1998; March et al. 1997; Shannon et al. 1994), whereas minority groups fared better in the other two cases (Garrison et al. 1993; Jones, Frary, Cunningham, Weddle, and Kaiser 2001).

Explanatory Findings

Perilla, Norris, and LaVizzo (2002) tested whether *differential exposure* or *differential vulnerability* best explained their results showing that Latinos and non-Hispanic blacks were more adversely affected by Hurricane Andrew than non-Hispanic whites. Consistent with the differential exposure hypothesis, non-Hispanic whites were less often personally traumatized and far less exposed to neighborhood trauma than Latinos or non-Hispanic blacks. The severity of their exposure accounted for much of minority group members' higher posttraumatic stress. However, the synergistic effect of trauma and ethnicity indicated that differential vulnerability also would have to be considered and, in fact, some of minorities' disproportionate distress was explained by their higher levels of fatalism (external control) and acculturative stress (dis-

comfort in dealing with members of other ethnic groups). The mediating role of fatalism is consistent with a large literature showing that external control is a risk factor for poor psychological outcomes following stressful life events. It is reasonable to speculate that the intergroup tensions manifested in acculturative stress could hinder help-seeking or otherwise exacerbate the effects of other stressors. Theoretically, it was important to demonstrate that differential exposure and vulnerability can work in tandem and are thus not necessarily rival explanations. It is equally important to recognize that these processes did not provide a complete explanation of minorities' elevated risk. Their historical marginalization may have affected their psychological functioning in ways that were not captured well by measures collected at the individual level.

SOCIOECONOMIC STATUS

Fourteen studies found effects of socioeconomic status (SES) indicators, such as education, income, literacy, or occupational prestige, on postdisaster mental health. Many studies simply cannot examine SES because participants are all of the same or similar occupation (e.g., Holen 1991; McFarlane 1989; Weisaeth 1989a) or income (Lima et al. 1991; McMillen et al. 2000). In 13 of the 14 (93%) studies, lower SES was consistently associated with greater postdisaster distress (see Table 6). The exception was Dew and Bromet's (1993) comparison of Three Mile Island mothers who exhibited uniformly low or high symptoms across the entire 10 years of the study. The latter group of mothers had less education but higher household income than the former. Similar to the findings for gender, the data regarding SES were impressive for the range of countries in which such effects were evidenced. For the most part, the influence of SES was tested as a main effect in these studies rather than as a variable that modifies the impact of exposure. However, Phifer (1990) and Ginexi, Weihs, Simmens, and Hoyt (2000) showed that the adverse effects of exposure grow stronger as SES decreases.

FAMILY FACTORS

Marriage: Risk Factor or Protective?

Family factors are important in a variety of complex and systemic ways in the aftermath of disasters (see Table 6). Nineteen relevant articles emerged in the review. Some data suggested that married status is actually a risk factor (Brooks and McKinlay 1992), especially for women (Gleser et al. 1981; Solomon 2002), whereas the reverse is sometimes true for men (Fullerton et al. 1999; Ursano et al. 1995). Marital stress has been found to increase after disasters (Norris and Uhl 1993). Solomon found that women who perceived themselves as having excellent spouse support were more vulnerable than were women with weaker spouse ties. She interpreted these findings as indicating that social ties and obligations can be a source of stress for married women. After the dam collapse in Buffalo Creek, as well, married women were higher on overall symptom severity than unmarried women, although men did not differ according to marital status (Gleser et al. 1981). This study also looked at how spouses affected each other. With the effects of severity of exposure and other demographics controlled, husbands' symptom severity predicted their wives', and vice versa, but the former relationship was stronger than the latter. Maternal and paternal symptom scores also correlated with each other in Vila et al.'s (2001) study of families affected by an industrial accident in France, and psychological problems of family members predicted respondents' distress in Catapano et al.'s (2001) study of the Sarno, Italy, landslide.

Effects of Parenthood

Being a parent also adds to the stressfulness of disaster recovery. In Gleser et al.'s (1981) study, the presence of children correlated positively with symptoms for all but unmarried women. In Solomon et al.'s (Solomon, Bravo, Rubio-Stipec, and Canino 1993) analysis of data from the St. Louis flood/dioxin contamination, parents were more affected on measures of anxiety and total symptoms than

were adults with no children. Following the nuclear accident at Three Mile Island, mothers of young children composed a special at-risk group because of their concerns over the long-term unseen effects of exposure (Bromet et al. 1982). In a large survey conducted more than 6 years after the nuclear accident in Chernobyl, residual effects in the population emerged only among women with children under 18 years of age (Havenaar et al. 1997). In the face of uncertain health threats, mothers may become excessively concerned over their children's health. Eleven years after the accident, mothers who had been evacuated from Chernobyl to Kiev rated their children as more impaired on health and cognitive measures than did other mothers in Kiev, but the children themselves did not differ in independent assessments (Bromet et al. 2000; Litcher et al. 2000).

Effects of Parents on Children

Children, understandably, are highly sensitive to postdisaster distress and conflict in the family (Wasserstein and La Greca 1998). After the dam collapse in Buffalo Creek, parental psychopathology predicted adverse outcomes in the children (Gleser et al. 1981). Irritability and supportiveness of the family atmosphere (scored on the basis of interviewers' ratings) were also important; less irritable and more supportive parents had healthier children, and parents with less psychopathology offered more support. That parental distress is a strong, and sometimes even the strongest, predictor of their children's distress has been replicated in a number of studies (see Table 6).

SECONDARY STRESSORS

Effects and Issues in Interpreting Them

Quite independent of their role in disaster studies, recent life events and chronic stressors have been studied extensively as predictors of distress. Life events refer to discrete changes, usually measured by checklists, whereas hassles, strains, and chronic stress are terms that refer to ongoing stressful life circumstances. A number of studies have found that recent life events and stress are good predictors of disaster victims' symptom levels (see Table 6). These effects sometimes have been interpreted as indicating that other life events are more important than disasters, but there are reasons, both methodological and substantive, to reject this interpretation. First, a large body of research on life events shows that they are likely to be confounded with pre-event mental health, meaning that their effects are inflated in the absence of pre-event measures. Some measures inflate this problem further by including items such as "new health problems" and "new emotional problems" as life events. Moreover, life-event measures are not necessarily conceptually distinct from resource loss measures.

Secondary Stressors as Mediators

Norris and Uhl (1993) tested the notion that chronic stressors may mediate (explain) the long-term effects of acute disaster stressors on psychological symptoms. One year after Hurricane Hugo, effects on symptoms of financial loss and personal loss were mediated completely by increases in marital, filial, and financial stress, whereas effects of injury and life threat were mediated partially by marital, filial, financial, and ecological stress. Norris et al. (1999) further examined the role of recent life-event stress longitudinally by using data collected 6 and 30 months after Hurricane Andrew. Life events and other recent stressors were strong predictors of symptoms at each time point. Stability and change in psychological symptoms were largely explained by stability and change in stress and resources. These findings show that attention needs to be paid to the stress levels in stricken communities long after the disaster has happened and passed.

PREDISASTER FUNCTIONING

Twenty-six articles reported effects of predisaster functioning on postdisaster outcomes. Whether they are assessed retrospec-

tively or before the disaster, predisaster psychological symptoms are almost always among the best predictors of postdisaster symptoms (see Table 6). This is not always a meaningful or interesting finding in and of itself because it does not imply (though it sometimes seems to be taken as to imply) that people did not change. Hypothetically, everyone in the sample could become more symptomatic and as long as they maintained their same rank order, the correlation would be very high. However, controlling for predisaster symptoms when assessing the effects of exposure yields the strongest design possible in this field of research.

All this said, survivors with prior mental health problems do appear to be at greater risk than other survivors for new or renewed problems after disasters. For example, Bromet et al. (1982) found that Three Mile Island mothers who were most symptomatic were those who had a psychiatric history before the accident. North et al. (1999) found that victims of the Oklahoma City bombing with predisaster disorder were more likely to experience PTSD specifically related to the bombing, with a rate of 46%, than were victims with no prior disorder, for whom the rate of bombing-related PTSD was 26%. Making a similar point, Phifer (1990) tested the effects on postflood depression of interactions between continuous measures of predisaster depression and severity of exposure in a sample of older adults. He found that respondents with higher preflood depression were more strongly affected by the flood than respondents with lower preflood depression. A variation on the same theme is that prior clinical cases exposed to disasters are more likely to experience a relapse than cases not so exposed (Shore et al. 1986). The personality factor of neuroticism, the opposite of stability, also has been found to be a strong predictor of postdisaster symptoms, as have trait worry and trait anxiety (see Table 6).

PSYCHOSOCIAL RESOURCES

A good deal of research on psychosocial resources has been conducted. We reviewed 83 articles that examined ways of coping, beliefs, or social support as moderators or mediators of disaster effects, often in combination with each other (see Table 6).

Ways of Coping

The notion that individuals influence their psychological outcomes for better or worse according to their ways of coping is an attractive one that seems to survive despite little supporting evidence. Of the significant relations between coping efforts and symptoms in the studies reviewed, far fewer showed an inverse relationship (more coping, less distress) than showed a positive relationship (more coping, more distress). The data most consistently suggest that avoidance coping is problematic, as is the assignment of blame. Taken as a whole, this work suggests that coping efforts should be conceptualized as a response to distress, or even as an indicator of it (Spurrell and McFarlane 1993). Most individuals use many different types of coping simultaneously, making it difficult to isolate their unique effects. What works in one situation may not in another, what works for one individual may not for another, and what works at one point in time may not at another. The inherent confounding (distress leads to increased coping) makes it very difficult to capture the reciprocal effect (coping leads to reduced distress), especially in cross-sectional designs. It is of note that a recent prospective analysis (North, Spitznagel, and Smith 2001) found three types of coping (active outreach, informed pragmatism, reconciliation) to be associated with decreased risk for psychiatric disorders over time.

Psychological Resources and Beliefs

In contrast to those for coping efforts, findings are quite consistent regarding the benefits of beliefs about one's abilities to cope, as reflected in such constructs as coping self-efficacy, mastery, self-esteem, optimism, and hope. What matters, apparently, is not how individuals actually cope but rather how they perceive their capacities to cope and control outcomes. The perception that one is capable

of managing the specific demands related to the disaster has been strongly predictive of good psychological outcomes (Benight, Ironson et al. 1999; Benight, Swift, Sanger, Smith, and Zeppelin 1999). Children who used coping strategies consensually viewed by their peers as efficacious were less depressed 5 months after Hurricane Hugo than were children using strategies considered as less efficacious (Jeney-Gannon, Daugherty, Finch, Belter, and Foster 1993). Lower distress also has been linked to higher self-efficacy (not disaster specific), perceived control, self-esteem, trait hopefulness, future temporal orientation, and optimism (see Table 6). Hardiness (dispositional resilience) has protected family assistance workers (Bartone et al. 1989) and other adults (Fullerton et al. 1999) from the effects of disaster-related bereavement.

Social Support

Social support researchers often differentiate among social embeddedness, received social support, and perceived social support. Social embeddedness, the structural component of social support describing the size, activeness, and closeness of the network, has been found to protect disaster victims from psychological distress in several studies (see Table 6). Likewise, several studies have shown that received support, the actual help received from others, matters for the mental health of disaster victims. However, effects of received support sometimes have been limited to certain types of outcomes (Carr et al. 1995) or to certain types of support (Solomon 1985) or have been absent altogether (Morgan, Matthews, and Winton 1995; Murphy 1988). Norris and Kaniasty (1996) found that the effects of received support on distress were mediated by perceived support, which is defined as the general sense of belongingness and belief in the availability of support, rather than actual receipt. The ability of perceived social support to protect disaster victims' health and mental health has been demonstrated repeatedly. Sometimes, however, effects of perceived support have been inconsistent across sample subgroups (Palinkas et al. 1992; Solomon, Smith, Robins, and Fischbach 1987; Tyler and Hoyt 2000) or over time (Cook and Bickman 1990), suggesting that there may be limits to its effectiveness that are not yet well understood.

Resource Loss

As noted previously, resources may themselves be vulnerable to disaster-related stress, a phenomenon that severely limits the protection they can afford. The increasing attention given to these dynamics in the aftermath of disasters has been influenced strongly by the theory of Conservation of Resources (e.g., Hobfoll and Lilly 1993) which defines resources broadly to include objects (e.g., housing), conditions (e.g., marriage), personal characteristics (e.g., self-esteem), and energies (e.g., time, money). Scored simply as a count of losses tallied from an inventory, resource loss has correlated highly with symptom severity in several studies (see Table 6). In tests of their "Social Support Deterioration Model," Kaniasty and Norris (1993; Norris and Kaniasty 1996) have shown more specifically that declines in perceived social support explain much of the impact of natural disasters on psychological symptoms.

SUMMARY AND CONCLUSIONS

For a summary of these results, a discussion of their implications, and a complete list of references, see Norris, Friedman, and Watson (this volume).