The Epidemiology of Post-Traumatic Stress Disorder after Disasters

Sandro Galea[1,2], **Arijit Nandi**[1,3], **and David Vlahov**[1,2,3]

[1] Center for Urban Epidemiologic Studies, New York Academy of Medicine, New York, NY.
[2] Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY.
[3] Department of Epidemiology, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD.

Abbreviations: DSM, *Diagnostic and Statistical Manual of Mental Disorders*; PTSD, post-traumatic stress disorder.

INTRODUCTION

Traumatic experiences are relatively common. More than two thirds of persons in the general population may experience a significant traumatic event at some point in their lives, and up to one fifth of people in the United States may experience such an event in any given year (1–5). Although comparable international data are limited, large proportions of populations in many countries have been exposed to terrorism, forced relocation, and violence, which suggests that the overall prevalence of exposure to traumatic events worldwide may be even higher than that in the United States (6, 7).

Disasters (e.g., floods, transportation accidents) are traumatic events that are experienced by many people and may result in a wide range of mental and physical health consequences (8). In one survey of US residents, 13 percent of the sample reported a lifetime exposure to natural or human-generated disaster (9). In the National Comorbidity Survey, 18.9 percent of men and 15.2 percent of women reported a lifetime experience of a natural disaster (4). Post-traumatic stress disorder (PTSD) is the most commonly studied and probably the most frequent and debilitating psychological disorder that occurs after traumatic events and disasters (8, 10).

The growing threat of terrorism worldwide has heightened our awareness of disasters as a potentially important determinant of population health and suggests a pressing need both to identify key areas of consensus in post-disaster research and to highlight areas that require additional study (11). It is our purpose in this review to contribute to this overall goal by comprehensively and systematically assessing the epidemiologic evidence about PTSD after disasters.

REVIEW OF THE LITERATURE

We limited this review to studies conducted between 1980, when PTSD was first codified as a disorder in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), Third Edition (DSM-III) (12), and 2003. Although we limited this review to studies conducted after 1980, there is a substantial body of literature preceding that date, and this research had a profound influence on the empirical work that is reviewed here. Much of this work sought to understand the psychological sequelae of exposure to traumatic events among persons who had fought in or been the victims of war and violent conflict (13). Early terms that were used to describe the psychological symptoms observed after traumatic events included ''nervous shock'' (14), ''shell shock'' (15, 16), ''traumatic neurosis'' (17), and ''rape-related fear and anxiety'' (18).

Because a number of studies published since 1980 have assessed disasters retrospectively, this review covers disasters occurring over a 40-year period. The earliest disaster included in our review is a 1963 landslide and flood that took place in northeastern Italy (19), and the most recent disaster included is the September 11, 2001, terrorist attacks in New York City (20–32). We identified the published literature using the MEDLINE, PsychINFO, and PILOTS databases, covering both US and international studies that assessed the epidemiology of PTSD after disasters. We also retrieved articles from key reviews (8, 33) that were not included in our own literature review. This review was not intended to cover the full range of consequences of disasters or the epidemiology of PTSD after individual traumatic experiences; we refer the reader to recently published comprehensive reviews of these topics (8, 33, 34). We limited ourselves to studies that either explicitly

Correspondence to Dr. Sandro Galea, Center for Urban Epidemiologic Studies, New York Academy of Medicine, 1216 Fifth Avenue, New York, NY 10029 (e-mail: sgalea@nyam.org).

assessed PTSD as a disorder or used DSM criteria to assess post-traumatic stress symptoms; we did not include several other studies that assessed only psychological symptoms or other psychiatric disorders after disasters. Keywords and terms used for the search included primarily "post-traumatic stress disorder," "PTSD," "disaster," "trauma," and "mental health."

Classifying a traumatic event as a disaster is not always straightforward, and the distinction between individual traumatic experiences and disasters may be unclear. A substantial body of literature, particularly in the fields of sociology and hazard and risk management, has conceptualized disasters and their consequences (35). Much of this work has focused on disasters that are severely damaging and disruptive (36). Different definitions of disasters, at times conflicting, have been offered both by official agencies and by scientists in the field (37, 38). In reviewing the epidemiologic literature about mental health after disasters there are particular challenges that make the use of a single such definition limiting. For example, while commercial airplane crashes are nearly always considered disasters in the literature, personal airplane crashes (which may result in the death of several persons) seldom are. Similarly, although many disaster definitions are predicated, at least in part, on loss of life, some of the most important and best-documented disasters in the past 20 years (e.g., the Three Mile Island nuclear reactor accident (39)) did not involve loss of life. Therefore, for the purposes of this review, we deferred to the characterization of the event in the peer-reviewed literature and considered an event a disaster if it was considered a disaster by the authors of the papers reviewed.

It has already been documented that human-made/technological disasters may have different and more marked consequences than natural disasters (8). As such, we present all findings within these two broad categories of disasters separately. This allows us to draw general inferences from relatively comparable exposures. Within each category, we document findings about the prevalence, correlates, and course of PTSD. A total of 192 references that addressed the epidemiology of PTSD after disasters were included in this review; among these, 106 pertained to technological/natural disasters and 86 pertained to natural disasters.

METHODOLOGICAL ISSUES

In evaluating studies of the epidemiology of PTSD after disasters, the following methodological issues must be considered: 1) the definition and assessment of exposure; 2) the comparability of PTSD assessments across studies; 3) the assessment of PTSD prevalence and incidence; and 4) the cross-disaster comparability of correlates and course.

Complex assessment of exposure

Disasters are mass traumatic events that involve multiple persons and are frequently accompanied by loss of property and economic hardship on a large scale. As such, there may be a wide range of people who may be considered "victims" of a disaster, including those who nearly escape death, those

who are injured, family members of the deceased, and those who witness a catastrophic event. From an epidemiologic standpoint, this range of potential disaster exposures complicates both cross-study comparisons and extrapolation of observations from one disaster context to another. It is difficult to avoid this complication in postdisaster epidemiology, since disasters and exposures to them vary dramatically, even when the disasters are similar. For example, schoolchildren exposed to the American Embassy bombing in Nairobi, Kenya, in 1998 could have seen or heard the event, had a parent who died in the event, or simply been in the vicinity of the incident (40). In contrast, after a terrorist bombing of a bus, exposed persons could include those who were on the bus itself, those who were entering or exiting the bus at the time of the bombing, or the families of victims (41). In the context of large disasters such as the September 11, 2001, terrorist attacks in New York City, it is plausible that all residents of a particular city may be somewhat "exposed" to the disaster, though this clearly introduces a broad range of possible individual exposures (11, 30). Therefore, in reviewing cross-disaster comparisons of studies, adequate attention must be paid to the specific definition of the exposed group being studied.

Comparability of different PTSD assessment methods

PTSD was first recognized as a diagnostic entity in 1980, when it was included in the DSM-III (12). PTSD was classified as an anxiety disorder, and diagnostic criteria for PTSD were introduced. These criteria included a gateway criterion (criterion A) which suggested that certain traumas were "eligible" traumas and that only these events were capable of producing PTSD. The DSM-III diagnosis of PTSD also required the presence of one criterion B symptom pertaining to reexperiencing the trauma, one criterion C symptom pertaining to numbing or decreased responsiveness to the outside world, and two criterion D symptoms pertaining to hyperarousal. Since the introduction of PTSD as a diagnostic category, diagnostic criteria for PTSD have been changed twice. The criteria were expanded in the Revised Edition of the DSM-III (DSM-III-R) (42). The criterion A definition was maintained relatively unchanged, and the required B, C, and D criteria were expanded from four symptoms to seven symptoms. A DSM-III-R diagnosis of PTSD required the individual to have one criterion B reexperiencing symptom, three criterion C avoidance symptoms, and two criterion D hyperarousal symptoms. In addition, a duration criterion of "at least 1 month" was added as criterion E. The Fourth Edition of the DSM (DSM-IV) (43) changed the definition of criterion A. The new definition includes criterion A1 (exposure to a traumatic event) and criterion A2, which is a subjective assessment of the criterion whereby the person reports experiencing horror or helplessness at the trauma. DSM-IV criterion A is broader than that in DSM-III-R and provides a list of examples that is more inclusive. For example, such events as the sudden death of a close relative could potentially qualify as criterion A1 events under the DSM-IV definition. However, less extreme stressors (e.g., an expected death of a relative) are explicitly excluded.

Therefore, in comparing studies that have assessed PTSD across studies over the past 40 years, it is important to keep in mind that changing definitions of PTSD may affect the documented prevalence, correlates, and course of PTSD. Web table 1 (posted on the *Epidemiologic Reviews* website (http://epirev.oupjournals.org/)) presents a comparison of diagnostic criteria for PTSD, including those in the DSM-III, DSM-III-R, and DSM-IV.

In addition, although the diagnosis of PTSD (as with all psychiatric disorders) is ideally made by a trained mental health professional following the criteria established in the DSM, many postdisaster studies make use of structured screening tools that have been shown to be valid instruments for the assessment of PTSD either by clinically trained persons or by laypersons. However, with the possible exception of the Clinician Administered PTSD Scale (44) and the Structured Clinical Interview for DSM-III-R (45), which are both clinician-administered interviews, there is no consensus in the PTSD literature about the best instrument for lay administration. The most commonly used instruments in the PTSD research literature are the Impact of Event Scale (46) and the Diagnostic Interview Schedule (47). Newer measures like the PTSD Check List (48), the National Women's Study PTSD module (49), and the Civilian Mississippi Scale for PTSD (50, 51) have been adapted from some of the older instruments and validated and are becoming more common in PTSD research. Although a full discussion of the implications of the use of different instruments is beyond the scope of this review, we note that differing sensitivities and specificities of screening instruments and their potential role in shaping assessments of PTSD have been well documented (52–55).

PTSD prevalence and incidence

In most instances, disasters take place over a short period of time. For example, a tornado may pass through a town, leaving substantial devastation in its wake. As such, postdisaster studies may be particularly well-suited to providing incidence estimates of PTSD in their aftermath. However, very few studies are designed to follow persons who had been screened for PTSD predisaster to ensure that assessment of incidence is carried out among persons with no previous PTSD. Therefore, although some studies refer to PTSD "incidence," in most instances this is better considered to be PTSD *prevalence* at a given postdisaster time point; we use the term "prevalence" to discuss postdisaster PTSD burden throughout this review, except in cases where incidence was clearly calculated among persons without predisaster PTSD.

There are two further complications in considerations of PTSD prevalence after disasters. First, in some but not all studies, investigators explicitly assess PTSD *related to the disaster*. As such, it can be argued that even if persons had preexisting PTSD linked to a different traumatic experience, the PTSD being documented is *incident* postdisaster PTSD. However, this obscures the fact that the clinical manifestation of the disorder is the same, irrespective of qualifying traumatic event exposure. Second, the postdisaster PTSD literature is predominantly concerned with assessing PTSD

at any time between a particular disaster and the time of the assessment itself. These assessments are typically carried out during the first year after a disaster (41, 56–61), with notable exceptions, particularly in studies where disaster victims have been assessed years and sometimes decades after the disaster occurred (62–64). Therefore, the prevalence of PTSD reported in most studies is properly understood as a period prevalence. However, a few studies have documented "current" PTSD (frequently PTSD prevalence in the previous month or the previous 6 months) (24, 65) which may not be directly comparable to the period prevalences documented in other studies. Unfortunately, the peer-reviewed postdisaster literature is frequently unclear about both the period of PTSD assessment and whether the assessment instruments explicitly linked PTSD to the disaster event. Therefore, it is important to be cautious when interpreting reported postdisaster PTSD prevalence. Although, because of space constraints, we do not explicitly discuss different time frames of assessment of PTSD postdisaster for all of the studies discussed in our review, these considerations guided the observations made here. Web tables 2 and 3 provide more comprehensive detail about papers reviewed to allow for cross-study comparison.

Cross-disaster comparability of PTSD correlates and course

The overwhelming majority of studies that have assessed postdisaster PTSD have used cross-sectional study designs. However, there is substantial heterogeneity in study analysis. Although regression modeling is frequently used to document important correlates of PTSD, the range of correlates tested and the model-building techniques used to assess statistically significant correlates vary dramatically between studies. In addition, model-building techniques are not specified in a substantial proportion of published studies, suggesting a need for caution when drawing general inferences about the universe of important correlates of PTSD after disasters. For example, although we can deduce with some certainty that women are at higher risk of PTSD after disasters (as discussed below), it is unclear whether the *lack* of a significant gender-PTSD association in many studies' final analyses means that 1) in specific disaster contexts, gender is not an important correlate of PTSD or 2) the inclusion of potential mediators (e.g., social support) obscures the gender-PTSD relation in multivariable analyses.

The study of the course of PTSD is complicated both by the relatively small number of longitudinal studies that have been designed to test the course of PTSD and by inconsistent assessment in the studies that have documented the course of PTSD. For example, in one assessment of PTSD in a cohort study of persons exposed to a mass shooting in Killeen, Texas, in 1991, PTSD prevalence was documented 6–8 weeks and 13–14 months after the incident (66). While it is possible to directly compare these findings with those from a study of PTSD conducted after a 1992 courthouse shooting in Missouri that also employed similar assessment time frames (67), it is less feasible to compare these findings with those of a cohort study of firefighters exposed to bush fires in southeastern Australia in 1983 who

were assessed 4, 11, and 29 months after the incident (68). In the absence of sufficient numbers of studies that have replicated methods and timing of postdisaster PTSD assessment, inference about the course of PTSD after disaster is necessarily limited.

FINDINGS

On the *Epidemiologic Reviews* website (http://epirev. oupjournals.org/), we present findings from human-made/ technological disasters (Web table 2) and natural disasters (Web table 3) separately. Web table 4 is a summary table that presents, for easy reference, findings on the prevalence and course of PTSD from studies that presented data on these two parameters. While we intended our tables to be comprehensive and included in them, for reference, all relevant epidemiologic studies of postdisaster PTSD that we identified, we do not discuss all of those studies in this review. Instead we focus on general observations from these studies for the purpose of drawing meaningful overall inferences.

Studies of human-made or technological disasters

Prevalence and incidence. It is useful to consider the prevalence of PTSD as documented in multiple studies after human-made/technological disasters within specific population groups that are typically studied after these incidents. Here we present findings from studies concerning adult victims of disasters, rescue workers, the general population, and children, respectively.

Most studies have focused on adults who were direct victims of the disaster. This includes adults who survived the 1989 air disaster in Kegworth, United Kingdom, in which a Boeing 737 jet crashed into an embankment, killing 47 persons on board (69); commercial fishers from a community near the 1989 Exxon *Valdez* oil spill in Alaska (70); and persons who were in the Murrah Federal Building during the 1995 terrorist bombing in Oklahoma City, Oklahoma (10). Most investigations of adult victims of these disasters suggested a high prevalence of PTSD at first assessment, generally within the first year after the disaster. The prevalence of PTSD in the first year after human-made/ technological disasters has been documented to range between approximately 25 percent and 75 percent. For example, the prevalence of PTSD was 29 percent among persons exposed to the mass shooting episode in Killeen, Texas, in 1991 (71) and among Indianapolis, Indiana, Ramada Inn employees who were on-site when a fighter jet crashed into the hotel in 1987 (72). At the other extreme, the prevalence of PTSD was 73 percent among survivors of the Piper Alpha oil rig disaster in 1988, where a gas leak induced an explosion and fire took the lives of 167 men (73). All three of these assessments were carried out during the first 3 months after the disaster in question. Most studies of adult survivors of disaster have found a PTSD prevalence of 30–60 percent after a disaster (10, 70, 74–78).

Among persons involved in rescue efforts after disasters, the prevalence of PTSD ranges from approximately 5 percent to 40 percent (79–87)—lower than the prevalence documented among direct survivors of disasters. Most studies have found a PTSD prevalence of 5–20 percent among rescue workers during the first year after a disaster (88, 89). A few studies have compared samples of rescue workers and persons directly affected by a disaster, allowing direct comparison between the two groups (89, 90). For example, in a study carried out after the 1995 Oklahoma City bombing, the prevalence of PTSD in the first 34 months after the bombing among firefighters (13 percent) was lower than that among those primarily exposed (23 percent) (89).

Studies that have documented the prevalence of PTSD in the general population after disasters have uniformly documented a lower prevalence of PTSD in the general population than among direct victims and rescue workers (11, 25, 30, 65, 91, 92). The prevalence of PTSD in the general population during the first few years after a disaster has been shown to range from approximately 1 percent to 11 percent (30, 91, 92). For example, in a cross-sectional study of 13 Alaska communities after the Exxon *Valdez* oil spill, the overall population prevalence of PTSD in the first year after the accident was 9.4 percent (92). In two different studies of the general New York City population after the September 11, 2001, terrorist attacks, the prevalence of PTSD was 7.5 percent in a telephone-based sample (24) and 11.2 percent in a World Wide Web-based sample (30) 1–2 months after September 11. The latter study also found an overall 4.3 percent prevalence of PTSD in the US population after the attacks (30). A study that assessed the prevalence of PTSD among two general populations in the former Soviet Union, one closer to the Chernobyl nuclear reactor site and the other further away from the reactor, found that 6.5 years after the 1986 accident, the prevalence of PTSD in the population nearer the site was 2.4 percent, as compared with 0.4 percent in the population 500 miles (800 km) away from the site (91). Studies that have included both samples of direct victims of disaster and persons in the general population have confirmed that the prevalence of PTSD is higher in the former type of group (72, 76, 77). For example, a cohort study of school-children who survived the 1988 crash of the cruise ship *Jupiter* with another ship in Greece and friends or acquaintances from their school, who were not directly involved in the disaster, showed that the prevalence of PTSD was 51.5 percent among the survivors at some time during follow-up, as compared with 3.4 percent among other children in the school (77). There is a substantial body of literature that has assessed post-traumatic stress symptoms and symptom severity after disasters in the general population but has not used validated instruments that allow assessment of PTSD prevalence or incidence (31, 32, 93, 94).

A smaller number of studies have evaluated the prevalence of PTSD among children after disasters (22, 40, 95–102). The assessment measures that have been used in studies of children are inconsistent, and many of the studies of children have documented PTSD symptoms only, limiting cross-study comparisons of the prevalence of PTSD. For example, a cross-sectional study of children conducted after a 1984 sniper attack on a school playground in Los Angeles, California, showed that 38.4 percent of the children had moderate or severe levels of PTSD symptoms 1 month after the incident (100). Following another school shooting in

Winnetka, Illinois, in 1998, the prevalence of PTSD based on DSM-III-R criteria was assessed to be 8 percent among children 8–14 months later (101).

A few studies have been conducted among other specific groups after disasters, including psychiatric or medical patients (23, 103), specific racial/ethnic groups (28), and parents of children who are exposed to disasters (22, 63). There are insufficient numbers of these studies to draw general inferences about the prevalence of PTSD after disasters in these groups.

Correlates of PTSD. A wide range of correlates of PTSD after disasters have been studied, ranging from demographic characteristics to personal psychological factors and event exposures. Female gender has consistently been shown to be a risk factor for the onset of PTSD after disasters (26, 29, 31, 70, 92, 95, 104). Psychological factors such as guilt (73, 101, 105–107), anger (73, 108), external locus of control (109, 110), and weaker coping ability (32, 111–114) have been associated with PTSD onset. A history of prior traumas and stressors (24, 25, 65, 82, 115, 116) and a history of prior or comorbid psychiatric conditions (66, 77, 89, 108, 117–119) have both been associated with PTSD onset across multiple studies, as has low social support (67, 109, 120, 121) and having poor relationships with family members and coworkers (which is probably a proxy for low social support) (70, 95, 122). Media exposure, particularly television watching, has been associated with PTSD (30, 96, 98, 123), although all of the studies demonstrating this association have been cross-sectional, raising issues about the causal direction of the association.

Degree of exposure to a disaster is consistently associated with the likelihood of PTSD (80, 114, 123–131). There is a wide range of potential exposures to disasters, and they vary dramatically between disasters. For example, being blocked while trying to escape flood waters and having prolonged exposure to flood waters were important correlates of PTSD after the 1972 Buffalo Creek, West Virginia, dam collapse (125). After the Winnetka, Illinois, school shooting, correlates of PTSD included fear of being shot (101). After the Bijlmermeer plane crash of 1992, in which an airplane crashed into a residential area of Amsterdam, the Netherlands, having lost a home was an important correlate of PTSD onset (132). Among rescue workers, the length of time spent exposed to the Oklahoma City bombing site was associated with the likelihood of PTSD (89). Range of exposure, as assessed across studies, also provides an opportunity for comparison and suggests that the nature of a person's exposure to a disaster is an important determinant of the likelihood of developing PTSD after a disaster. As we noted above, the prevalence of PTSD after a disaster is highest among persons who were directly exposed to the disaster (frequently characterized as "victims"), lower among rescue workers, and lower yet in the general population. These groups probably represent different levels of exposure to disasters, with direct victims having the highest exposure and associated PTSD prevalence while persons in the general population have the lowest levels of exposure and prevalence. Studies that have assessed multiple groups after the same disaster allow for direct comparison. For example, an assessment of hotel employees who were either on-site or off-site when a fighter jet crashed into

their hotel in 1987 showed that the prevalence of PTSD among employees who were on-site was 29 percent, as compared with 17 percent for off-site employees (72). A number of studies have assessed areas close to and distant from a disaster site, consistently showing that the prevalence of PTSD is higher among persons closer to the disaster than among those further away (30, 91).

Other factors that have been shown to be correlates of PTSD after disasters include low socioeconomic status (21, 67, 82), age (69, 88, 102, 133), race/ethnicity (134), and employment status (25, 135). These factors have not been studied sufficiently for us to draw conclusions about their reproducibility in other postdisaster situations.

Course of PTSD. Relatively few studies have included longitudinal assessments allowing evaluation of the course of PTSD after human-made/technological disasters. In a cohort study of male college basketball players who were aboard a chartered aircraft that crash-landed in 1984, the prevalence of PTSD declined from 54 percent in the first month after the incident to 10–15 percent 12 months after the incident (136). This rapid decline has been corroborated in prospective studies of rescue workers after an oil rig accident, a school bus accident, and the *USS Iowa* gun turret explosion (79, 81, 137); among elderly community residents after the Lockerbie disaster, in which a terrorist bomb destroyed Pan Am Flight 103 over southern Scotland in 1988, killing all on board (138); and in a serial cross-sectional study of the general population after the September 11 terrorist attacks (25). However, most studies that have assessed the course of PTSD after disasters among direct victims suggest that PTSD is persistent for a few years after the disaster among victims with early PTSD onset. Seminal studies carried out after the Buffalo Creek dam collapse showed that 25 percent of adults had current PTSD 14 years after the incident, as compared with 59 percent at any time in the 14 years after the incident (75). In a cohort study of victims of the *Jupiter* cruise ship disaster in Greece, 34 percent of persons who had PTSD in the first 5 months after the incident still had PTSD 5–8 years after the incident (77). This long-term course of PTSD among victims of disasters has been corroborated in prospective studies of Pan Am Flight 103 litigants (139), persons exposed to the mass shooting in Killeen, Texas (66), persons affected by the Oklahoma City bombing (10), and survivors of a 1996 subway bombing in Paris, France (135). None of these studies assessed the course of PTSD over a long enough period of time to reliably document whether the course of PTSD represents a monotonic decline over time and whether there is late-onset PTSD, although two of the aforementioned studies (66, 139) did not document any cases of delayed PTSD onset. A recent serial cross-sectional study conducted after the September 11 terrorist attacks suggested that there were different determinants of PTSD persistence as compared with determinants of PTSD onset (25), although this has not been explored in enough studies for generalized inference.

Studies of natural disasters

Many of the observations that can be drawn from studies of natural disasters confirm what was discussed above in the

context of human-made or technological disasters. We summarize here the key observations about PTSD after natural disasters, highlighting differences between the epidemiology of PTSD after natural disasters and PTSD following human-made/technological disasters. We refer the reader to Web table 3 for further details about individual studies.

Prevalence of PTSD. Consistent with previous observations (8), the prevalence of PTSD documented in studies after natural disasters is generally lower than that documented in studies after human-made/technological disasters. However, in studies of natural disasters, it is more difficult to explicitly identify groups of persons who can be considered direct victims. Most research after natural disasters has been carried out after events such as earthquakes, hurricanes, or tornadoes (140–144). While in studies of human-made/technological disasters there is usually an obvious group of direct victims—for example, passengers on an airplane that crashes (136)—this is less often the case in natural disasters such as earthquakes, which affect large areas. As such, among studies of PTSD after natural disasters, study samples predominantly include persons from a broader area affected by the disaster (145–147). This group may plausibly include both persons who were markedly exposed to the disaster (through personal exposure or through the exposure of a family member) and persons who were less directly exposed. Therefore, the lower prevalence of documented PTSD in studies of PTSD after natural disasters as compared with studies of PTSD after human-made/technological disasters is not surprising. Overall, studies carried out after natural disasters report a PTSD prevalence ranging from approximately 5 percent (148) to 60 percent (140) in the first 1–2 years after a disaster, although most prevalences reported are in the lower half of this range (142, 144, 145, 147, 149–157). Higher prevalences have been reported among specific groups, including clinical samples (158) and persons who were in areas heavily affected by the disaster (159–161).

A number of studies of PTSD after natural disasters have studied PTSD among rescue workers, particularly firefighters. After the 1983 bush fires in southeastern Australia, a 50 percent prevalence of PTSD was observed among firefighters during the first 2 years of follow-up (162). A similar high prevalence of post-traumatic morbidity was documented among male firefighters after the Chi-Chi earthquake in Taiwan in 1999 (163).

Post-traumatic stress symptoms have been documented among children after natural disasters in a number of studies. After the Armenian earthquake of 1988, 95 percent of children from a severely exposed city and 26 percent of children from a mildly exposed city had severe levels of post-traumatic stress symptoms 1.5 years after the incident (164); the prevalence of symptoms among mildly exposed children is consistent with assessments of children from three San Francisco Bay Area communities exposed to the Loma Prieta earthquake in 1989 (165), from Florida after Hurricane Andrew in 1992 (166), and from North Carolina after Hurricane Floyd in 1999 (167). A cross-sectional study carried out after the 1999 Chi-Chi earthquake in Taiwan showed a 20 percent prevalence of PTSD among children during the first 6 weeks after the incident (168).

Correlates of PTSD. Correlates of PTSD after natural disasters are comparable to correlates documented after human-made/technological disasters. These include psychological factors such as neuroticism (68, 169, 170), guilt (171), difficulty concentrating (172), coping strategies (62, 173–175), obsessive traits (176), and psychiatric comorbidity (140, 144, 149, 177–182). Women are more likely than men to have PTSD after natural disasters (145, 147, 150, 183–186), and low social support is associated with a higher likelihood of PTSD (166, 187, 188). A greater degree of exposure to a disaster is consistently associated with the likelihood of PTSD (143, 146, 165, 189–202).

Exposure to stressors before or after the incident (150, 189, 203–208) and television viewing (162) have been associated with PTSD after natural disasters, albeit in fewer studies. A few studies have documented an association between parental symptoms of PTSD and symptoms of PTSD among their children (59, 206, 209–213). Race/ethnicity (10, 150, 151, 187), relocation (159, 192), and low socioeconomic status (212, 214) are inconsistently associated with PTSD after natural disasters.

Course of PTSD. There have been few published peer-reviewed studies that have assessed the course of PTSD after natural disasters. Notably, in a cohort study of firefighters conducted after the 1983 Australian bush fire, 21 percent of the firefighters were documented to have persistent PTSD over a 2-year period (162). In contrast to the studies of PTSD after human-made/technological disasters (66, 139) discussed above, this study also documented multiple patterns of PTSD, including delayed-onset PTSD. In a random sample of adults studied after the 1989 earthquake in Newcastle, Australia, the prevalence of PTSD was shown to decrease by approximately one half in the first 2 years after the earthquake (211). A cohort study of residents of Dade County, Florida, exposed to Hurricane Andrew in 1992 found that the prevalence of PTSD increased slightly from 26 percent to 29 percent between 6 months and 30 months after the hurricane and, importantly, that while intrusion and arousal symptoms declined over time, avoidance symptoms increased (207). An increase in PTSD was also documented between 3 months and 9 months after the 1998 Zhangbei-Shangyi earthquake in China (215).

DISCUSSION

Limitations

In preparing this paper, our goal was to carry out a systematic review of the evidence regarding PTSD after disasters that might suggest a direction for research and intervention. However, there were specific decisions made in the conduct of this review and particular limitations of the literature in the field that, to some extent, influenced the conclusions drawn here.

First, we chose to present a comprehensive review, filling a gap in the epidemiologic literature. This approach allowed us to understand and draw inferences from the body of work in the field that is likely to influence other researchers and practitioners. However, in providing a comprehensive review, we considered both studies that were

epidemiologically sound and studies that may have included biases or may have been poorly designed. There are two reasons why we opted not to limit our review exclusively to "well-designed" studies. First, the evidence in the field is published in journals that cross disciplines, and different reporting styles make it virtually impossible to systematically assess all studies according to uniform epidemiologic criteria. Second, given the nature of disasters, it is typically the case that only one or two studies are conducted after a given disaster, frequently by local researchers. In several instances this work has been important, given the unique nature of the event being studied, and has influenced subsequent research. Although we have provided Web tables that comprehensively review the body of work in the field, our discussion in the text has focused primarily on studies that were well-designed and that made unique contributions to the field. We endeavored in the tables to provide sufficient information in a concise format to allow readers to evaluate the contribution of each paper and weigh the evidence for themselves.

Second, as we noted above, the changing diagnostic criteria for PTSD over time make cross-study comparisons challenging. In addition, although disasters occur all over the world and are studied all over the world, there are cross-cultural limitations inherent in the use of assessment instruments that were primarily designed and validated in developed countries, primarily the United States. These factors both limit and suggest caution about inferences that can be drawn from cross-study comparisons across disasters, as in this review. A full assessment of how the changing diagnostic criteria for PTSD have affected prevalence estimates obtained across studies would require comparative analysis of raw data across studies or, at the least, a comparison of symptom profiles across studies. Unfortunately, very few studies have documented specific symptoms, making such comparisons difficult. Similarly, without appropriate validation of assessment instruments in the relevant cultural context, it is impossible to determine whether specific instruments introduce systematic bias when used in a different culture than the one for which they were designed.

Third, our review, intended for an epidemiologic audience, focused on PTSD as a categorical disease outcome; we did not consider other mental (or physical) health consequences of disasters. Our goal was to summarize the epidemiologic literature as it pertains to one disorder that probably remains the most prevalent and debilitating consequence of disasters. In using this approach, we do not mean to suggest that other disorders do not also impose important burdens after disasters or that PTSD frequently occurs in isolation (8). Other psychiatric disorders, such as anxiety and depression, have been documented after disasters, and there has been discussion in the literature about the problems involved in focusing only on PTSD as the outcome of interest after disasters (216, 217). Subsequent reviews would do well to systematically assess the literature on other psychiatric conditions after disasters, as well as (perhaps more importantly) the literature on comorbidity.

Fourth, our review was limited by the extant epidemiologic literature and did not include important factors in PTSD epidemiology about which there is a paucity of empirical research. For example, features of the postdisaster environment, including access to services and social cohesion in the affected communities, may be as important in the long-term course of PTSD after disasters as the disasters themselves (218). However, the epidemiologic literature on these factors is limited, and as such, a fuller discussion of their potential role in the course of PTSD after disasters is not included here. Features of the postdisaster environment that affect the PTSD trajectory may be a particularly fruitful area for future research.

Summary and future research

Studies conducted in the aftermath of disasters during the past 40 years have shown that there is a substantial burden of PTSD among persons who experience a disaster. In particular, the published peer-reviewed literature is consistent in showing that the extent of exposure to a disaster is probably the most important risk factor for the development of disaster-related PTSD. Therefore, persons who are direct victims of a disaster—for example, those who are injured during the disaster—have a greater likelihood of developing PTSD than other groups. In comparison, the prevalence of PTSD after disasters is lower among rescue workers and lower yet in the general population.

Although the prevalence of PTSD has been found to be higher after human-made/technological disasters than after natural disasters, this appears to be largely due to differences in sampling. Most studies conducted after human-made/technological disasters have focused on direct victims (e.g., persons who witnessed the N149 supertanker explosion in 1994 (105)), while a smaller set of studies has assessed PTSD in the general population (e.g., New Yorkers after the September 11 attacks (24)). However, studies of natural disasters typically include samples of people in the overall community who were potentially affected by the disaster (e.g., residents of a city where an earthquake occurred (219)). These samples are likely to include both persons who are direct victims and others in the general population who probably had substantially lower exposure to the disaster.

Arguably, the available information is sufficient to suggest plausible ranges of PTSD prevalence that can be expected in the first year after disasters, within exposure groups. The empirical evidence suggests that the prevalence of PTSD among direct victims of disasters is 30–40 percent, the prevalence among rescue workers is approximately 10–20 percent, and the prevalence in the general population is approximately 5–10 percent. These summary estimates, by definition, are simplifications, and there are abundant studies showing that the prevalence of PTSD is substantially higher or lower than these ranges for particular groups. The scope of the disaster and the group's exposure to the disaster are probably the most important factors in determining the eventual prevalence of PTSD. Simply put, some disasters are more horrifying than others and are accompanied by more injury, property destruction, and threats to individuals. Particularly high prevalences of PTSD have been reported among victims of disasters such as the Buffalo Creek dam collapse (75) and

the Piper Alpha oil rig fire (73), where survivors had been in imminent danger of dying during the disaster and lost colleagues and friends. In contrast, the documented prevalence of PTSD in the general population after the September 11, 2001, terrorist attacks in New York City (24) was not disproportionately higher than that in other studies of PTSD in the general population after disasters (65); this probably reflects the fact that while the September 11 attacks dramatically affected US national discourse, exposure to the disaster for most persons in the general New York City population was relatively limited.

In addition to exposure to an event, a number of risk factors for PTSD have been identified and shown to be important across multiple studies. Women are consistently shown to have a higher prevalence of PTSD after disasters than men (70, 184). Persons with preexisting or concurrent psychiatric comorbidity and persons who have previously experienced traumatic events or substantial stressors (203) also have higher risks of disaster-related PTSD. Low social support has been shown to be a risk factor for PTSD in several studies (166, 187). Although there are a number of psychological characteristics that have been associated with postdisaster PTSD, there is no one psychological profile, with the possible exception of poor coping (32), that emerges as particularly predisposing to postdisaster PTSD after psychiatric comorbidity has been accounted for. The potential role of television viewing as a correlate of postdisaster PTSD is intriguing (123); future research should assess this further using longitudinal study designs. In addition, although the general social and economic context may change after a disaster—including, for example, changes in employment opportunities and social capital—there is a paucity of research that has systematically assessed the role of macro-level factors in shaping postdisaster risk of PTSD. The role of a number of factors, including race/ethnicity and socioeconomic status, in postdisaster PTSD risk remains unclear.

The course of PTSD after disaster has been studied in relatively few studies, making it difficult to draw general conclusions. Studies carried out among direct victims of disasters have demonstrated the persistence of at least one third of cases of early-onset PTSD for more than 2 years after disaster exposure (139); some studies have shown the persistence of PTSD in more than one third of original cases more than a decade after the disaster exposure (75). Existing studies provide conflicting evidence about the trajectory of PTSD after disasters (10, 68, 220). Although there has been a suggestion that the determinants of PTSD persistence are different from the determinants of PTSD onset (25), there is scant evidence addressing this possibility in the disaster literature.

There is little scientific rationale for carrying out additional studies specifically aiming to document the burden of PTSD after disasters. An ample body of work, reviewed here, provides compelling evidence regarding the prevalence of PTSD after disasters. We recognize, of course, that documenting the prevalence of PTSD after a particular disaster may have important implications for delivery of mental health services and that reporting of baseline prevalence is the first step in more ambitious studies. In contrast, there is a paucity of research documenting the incidence of

PTSD after disasters. In large part, this reflects the fact that disasters are unpredictable and establishing population cohorts that may be used to assess PTSD incidence in the event of a disaster is not feasible. However, population cohorts do exist in the United States and in several European countries. Through the establishment of baseline PTSD assessments, these cohorts could be positioned to document PTSD incidence in the event of disaster exposure by some or all of the cohort participants. Although some correlates of PTSD are well established and provide sufficient support for intervention targeted at specific groups after a disaster, there has been little research attempting to understand why certain groups are at higher risk. This is particularly important in the case of immutable factors such as gender. We are aware of only one study that has attempted to explain why gender is a risk factor for PTSD after a disaster (29). Further etiologic work assessing behavioral, psychological, and biologic explanations for the observed associations between specific correlates and PTSD would be helpful and could provide guidance for intervention.

The course of PTSD in the intermediate and long term after disasters remains largely unexplored. This is undoubtedly due to the difficulties inherent in establishing long-term cohort studies that have adequate statistical power to detect different trajectories of PTSD. However, the potential of such research should not be underestimated. While postdisaster PTSD may be associated with decreased quality of life and decreased productivity (6), it is likely that most early-onset PTSD after a disaster will eventually resolve. As such, understanding who is at risk for long-term PTSD after disasters and exploring different PTSD trajectories, such as lapsing-relapsing patterns or late-onset PTSD, is critical. More importantly, identifying factors associated with these PTSD patterns and trajectories has potential for guiding early intervention that may minimize the long-term psychological consequences of disasters, which may impose a greater societal burden than the short-term transient burden of early-onset PTSD. As we noted above, there is a paucity of evidence about the role of the social context in the postdisaster environment in shaping the course of PTSD; this may be a particularly important area for future research. Consideration of the features of the postdisaster environment that may shape the burden of PTSD could provide guidance for interventions designed to improve population mental health after disasters.

Editor's note: *References 221–234 are cited in Web tables 2–4, which are posted on the* Epidemiologic Reviews *website (http://epirev.oupjournals.org/).*

REFERENCES

1. Norris FH. Epidemiology of trauma: frequency and impact of different potentially traumatic events on different demographic groups. J Consult Clin Psychol 1992;60: 409–18.
2. Breslau N, Davis GC, Andreski P, et al. Traumatic events and posttraumatic stress disorder in an urban population of young adults. Arch Gen Psychiatry 1991;48:216–22.
3. Resnick HS, Kilpatrick DG, Dansky BS, et al. Prevalence of civilian trauma and posttraumatic stress disorder in a representative national sample of women. J Consult Clin Psychol 1993;61:984–91.
4. Kessler RC, Sonnega A, Bromet E, et al. Posttraumatic stress disorder in the National Comorbidity Survey. Arch Gen Psychiatry 1995;52:1048–60.
5. Breslau N, Kessler RC, Chilcoat HD, et al. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. Arch Gen Psychiatry 1998;55:626–32.
6. Kessler RC. Posttraumatic stress disorder: the burden to the individual and to society. J Clin Psychiatry 2000;61(suppl 5): 4–12.
7. Corradi J, Fagen PW, Garreton M. Fear at the edge: state terror and resistance in Latin America. Berkeley, CA: University of California Press, 1992.
8. Norris FH, Friedman MJ, Watson PJ, et al. 60,000 disaster victims speak: part I. An empirical review of the empirical literature, 1981–2001. Psychiatry 2002;65:207–39.
9. Burkle FM Jr. Acute-phase mental health consequences of disasters: implications for triage and emergency medical services. Ann Emerg Med 1996;28:119–28.
10. North CS, Nixon SJ, Shariat S, et al. Psychiatric disorders among survivors of the Oklahoma City bombing. JAMA 1999;282:755–62.
11. Galea S, Vlahov D, Resnick H, et al. An investigation of the psychological effects of the September 11, 2001, attacks on New York City: developing and implementing research in the acute postdisaster period. CNS Spectr 2002;7:585–7.
12. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Third edition. Washington, DC: American Psychiatric Association, 1980.
13. Lifton RJ. Death in life: survivors of Hiroshima. New York, NY: Random House, 1967.
14. Erichsen JE. On concussion of the spine: nervous shock and other obscure injuries of the nervous system in their clinical and medico-legal aspects. London, United Kingdom: Green and Company, 1882.
15. Myers CS. Shell shock in France 1914–18. Cambridge, United Kingdom: Cambridge University Press, 1940.
16. Southard EE. Shell-shock and other neuropsychiatric problems presented in five hundred and eighty-nine case histories from the war literature, 1914–1918. Boston, MA: W M Leonard, 1919.
17. Kardiner A. The traumatic neuroses of war. (Psychosomatic medicine monographs 2-3). New York, NY: Paul B Hoeber, 1941.
18. Kilpatrick DG, Veronen LJ, Resick PA. Responses to rape: behavioral perspectives and treatment approaches. Scand J Behav Ther 1977;6:85–90.
19. Favaro A, Zaetta C, Colombo G, et al. Surviving the Vajont disaster: psychiatric consequences 36 years later. J Nerv Ment Dis 2004;192:227–31.
20. Resnick H, Galea S, Kilpatrick D, et al. Research on trauma and PTSD in the aftermath of 9/11. PTSD Res Q 2004;15:1–8.
21. Cardenas J, Williams K, Wilson JP, et al. PTSD, major depressive symptoms, and substance abuse following September 11, 2001, in a Midwestern university population. Int J Emerg Ment Health 2003;5:15–28.
22. Fairbrother G, Stuber J, Galea S, et al. Posttraumatic stress reactions in New York City children after the September 11, 2001, terrorist attacks. Ambul Pediatr 2003;3:304–11.
23. Franklin CL, Young D, Zimmerman M. Psychiatric patients' vulnerability in the wake of the September 11th terrorist attacks. J Nerv Ment Dis 2002;190:833–8.
24. Galea S, Ahern J, Resnick H, et al. Psychological sequelae of the September 11 terrorist attacks in New York City. N Engl J Med 2002;346:982–7.
25. Galea S, Vlahov D, Resnick H, et al. Trends of probable post-traumatic stress disorder in New York City after the September 11 terrorist attacks. Am J Epidemiol 2003;158:514–24.
26. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, alcohol use, and perceived safety after the terrorist attack on the Pentagon. Psychiatr Serv 2003;54:1380–2.
27. Kinzie JD, Boehnlein JK, Riley C, et al. The effects of September 11 on traumatized refugees: reactivation of posttraumatic stress disorder. J Nerv Ment Dis 2002;190:437–41.
28. Murphy RT, Wismar K, Freeman K. Stress symptoms among African-American college students after the September 11, 2001 terrorist attacks. J Nerv Ment Dis 2003;191:108–14.
29. Pulcino T, Galea S, Ahern J, et al. Posttraumatic stress in women after the September 11 terrorist attacks in New York City. J Womens Health 2003;12:809–20.
30. Schlenger WE, Caddell JM, Ebert L, et al. Psychological reactions to terrorist attacks: findings from the national study of Americans' reactions to September 11. JAMA 2002;288:581–8.
31. Schuster MA, Stein BD, Jaycox LH, et al. A national survey of stress reactions after the September 11, 2001, terrorist attacks. N Engl J Med 2001;345:1507–12.
32. Silver RC, Holman EA, McIntosh DN, et al. Nationwide longitudinal study of psychological responses to September 11. JAMA 2002;288:1235–44.
33. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. J Consult Clin Psychol 2000;68:746–66.
34. Ozer EJ, Best SR, Lipsey TL, et al. Predictors of post traumatic stress disorder and symptoms in adults: a metaanalysis. Psychol Bull 2003;129:52–73.
35. Mileti DS. Disasters by design. Washington, DC: Joseph Henry Press, 1999.
36. Tierney K, Lindell MK, Perry RW. Facing the unexpected: disaster preparedness and response in the United States. Washington, DC: Joseph Henry Press, 2001.
37. American Red Cross of King and Kitsap Counties. What is a disaster? Seattle, WA: American Red Cross of King and Kitsap Counties, 2004. (World Wide Web URL: http://www.seattleredcross.org/disaster/definition.htm).
38. Quarantelli EJ. What is a disaster? Six views of the problem. Int J Mass Emerg Disasters 1995;13:221–9.

39. Davidson LM, Baum A. Chronic stress and posttraumatic stress disorders. J Consult Clin Psychol 1986;54:303–8.
40. Pfefferbaum B, North CS, Doughty DE, et al. Posttraumatic stress and functional impairment in Kenyan children following the 1998 American Embassy bombing. Am J Orthopsychiatry 2003;73:133–40.
41. Shalev AY. Posttraumatic stress disorder among injured survivors of a terrorist attack. J Nerv Ment Dis 1992;180:505–9.
42. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Third edition, revised. Washington, DC: American Psychiatric Association, 1987.
43. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Fourth edition. Washington, DC: American Psychiatric Association, 1994.
44. Blake DD, Weathers FW, Nagy LM, et al. A clinician rating scale for assessing current and lifetime PTSD: the CAPS-1. Behav Ther 1990;18:187–8.
45. Spitzer RL, Williams JB, Gibbon M, et al. The Structured Clinical Interview for DSM-III-R (SCID). I: history, rationale, and description. Arch Gen Psychiatry 1992;49:624–9.
46. Weiss D. Psychometric review of the Impact of Events Scale–Revised. In: Stamm BH, ed. Measurement of stress, trauma, and adaptation. Lutherville, MD: Sidran Press, 1996.
47. Centers for Disease Control. Diagnostic Interview Schedule (DIS). In: Health status of Vietnam veterans. Supplement C: medical and psychological procedure manuals and forms. Atlanta, GA: Centers for Disease Control,1989:405–99.
48. Blanchard EB, Hickling EJ, Forneris CA, et al. Prediction of remission of acute posttraumatic stress disorder in motor vehicle accident victims. J Trauma Stress 1997;10:215–34.
49. Kilpatrick DG, Resnick HS, Freedy JR, et al. The post-traumatic stress disorder field trial: evaluation of the PTSD construct—criteria A through E. In: Widiger TA, Frances AJ, Pincus HA, et al, eds. DSM-IV sourcebook. Vol 4. Washington, DC: American Psychiatric Association Press,1998:803–44.
50. Siegel JM, Shoaf KI, Bourque LB. The C-Mississippi Scale for PTSD: a useful measure in post-earthquake communities? Int J Mass Emerg Disasters 2000;18:339–46.
51. Inkelas M, Loux LA, Bourque LB, et al. Dimensionality and reliability of the Civilian Mississippi Scale for PTSD in a postearthquake community. J Trauma Stress 2000;13:149–67.
52. Basoglu M, Salcioglu E, Livanou M, et al. A study of the validity of a screening instrument for traumatic stress in earthquake survivors in Turkey. J Trauma Stress 2001;14:491–509.
53. Norris FH, Perilla JL. The revised Civilian Mississippi Scale for PTSD: reliability, validity, and cross-language stability. J Trauma Stress 1996;9:285–98.
54. Wohlfarth TD, van den Brink W, Winkel FW, et al. Screening for posttraumatic stress disorder: an evaluation of two self-report scales among crime victims. Psychol Assess 2003;15:101–9.
55. Sundin EC, Horowitz MJ. Impact of Event Scale: psychometric properties. Br J Psychiatry 2002;180:205–9.
56. Trappler B, Friedman S. Posttraumatic stress disorder in survivors of the Brooklyn Bridge shooting. Am J Psychiatry 1996;153:705–7.
57. Vila G, Witkowski P, Tondini MC, et al. A study of posttraumatic disorders in children who experienced an industrial disaster in the Briey region. Eur Child Adolesc Psychiatry 2001;10:10–18.
58. Bowler RM, Mergler D, Huel G, et al. Aftermath of a chemical spill: psychological and physiological sequelae. Neurotoxicology 1994;15:723–30.
59. Jones RT, Ribbe DP, Cunningham P, et al. Psychological impact of fire disaster on children and their parents. Behav Modif 2002;26:163–86.
60. Koplewicz HS, Vogel JM, Solanto MV, et al. Child and parent response to the 1993 World Trade Center bombing. J Trauma Stress 2002;15:77–85.
61. Sloan P, Rozensky RH, Kaplan L, et al. A shooting incident in an elementary school: effects of worker stress on public safety, mental health, and medical personnel. J Trauma Stress 1994;7:565–74.
62. Morgan L, Scourfield J, Williams D, et al. The Aberfan disaster: 33-year follow-up of survivors. Br J Psychiatry 2003;182:532–6.
63. Mirzamani M, Bolton D. PTSD symptoms of mothers following occurrence of a disaster affecting their children. Psychol Rep 2002;90:431–8.
64. North CS, McCutcheon V, Spitznagel EL, et al. Three-year follow-up of survivors of a mass shooting episode. J Urban Health 2002;79:383–90.
65. Hanson RF, Kilpatrick DG, Freedy JR, et al. Los Angeles Country after the 1992 civil disturbances: degree of exposure and impact on mental health. J Consult Clin Psychol 1995;63:987–96.
66. North CS, Smith EM, Spitznagel EL. One-year follow-up of survivors of a mass shooting. Am J Psychiatry 1997;154:1696–702.
67. Johnson SD, North CS, Smith EM. Psychiatric disorders among victims of a courthouse shooting spree: a three-year follow-up study. Community Ment Health J 2002;38:181–97.
68. McFarlane AC. The aetiology of post-traumatic morbidity: predisposing, precipitating and perpetuating factors. Br J Psychiatry 1989;154:221–8.
69. Gregg W, Medley I, Fowler-Dixon R, et al. Psychological consequences of the Kegworth air disaster. Br J Psychiatry 1995;167:812–17.
70. Arata CM, Picou JS, Johnson GD, et al. Coping with technological disaster: an application of the conservation of resources model to the Exxon Valdez oil spill. J Trauma Stress 2000;13:23–39.
71. North CS, Smith EM, Spitznagel EL. Posttraumatic stress disorder in survivors of a mass shooting. Am J Psychiatry 1994;151:82–8.
72. Smith EM, North CS, McCool RE, et al. Acute postdisaster psychiatric disorders: identification of persons at risk. Am J Psychiatry 1990;147:202–6.
73. Hull AM, Alexander DA, Klein S. Survivors of the Piper Alpha oil platform disaster: long-term follow-up study. Br J Psychiatry 2002;181:433–8.
74. Dooley E, Gunn J. The psychological effects of disaster at sea. Br J Psychiatry 1995;167:233–7.
75. Green BL, Lindy JD, Grace MC, et al. Chronic posttraumatic stress disorder and diagnostic comorbidity in a disaster sample. J Nerv Ment Dis 1992;180:760–6.
76. Selley C, King E, Peveler R, et al. Post-traumatic stress disorder symptoms and the Clapham rail accident. Br J Psychiatry 1997;171:478–82.
77. Yule W, Bolton D, Udwin O, et al. The long-term psychological effects of a disaster experienced in adolescence: I. The incidence and course of PTSD. J Child Psychol Psychiatry 2000;41:503–11.
78. Brooks N, McKinlay W. Mental health consequences of the Lockerbie disaster. J Trauma Stress 1992;5:527–43.

79. Alexander DA. Stress among police body handlers. Br J Psychiatry 1993;163:806–8.
80. Durham TW, McCammon SL, Allison EJ, et al. The psychological impact of disaster on rescue personnel. Ann Emerg Med 1985;14:664–8.
81. Dyregrov A, Kristoffersen JI, Gjestad R. Voluntary and professional disaster-workers: similarities and differences in reactions. J Trauma Stress 1996;9:541–55.
82. Epstein RS, Fullerton CS, Ursano RJ. Posttraumatic stress disorder following an air disaster: a prospective study. Am J Psychiatry 1998;155:934–8.
83. Ersland S, Weisaeth L, Sund A. The stress upon rescuers involved in an oil rig disaster: ''Alexander L. Kielland'' 1980. Acta Psychiatr Scand 1989;80(suppl 355)38–49.
84. Grieger TA, Staab JP, Cardena E, et al. Acute stress disorder and subsequent post-traumatic stress disorder in a group of exposed disaster workers. Depress Anxiety 2000;11:183–4.
85. Tarabrina NV, Lazebnaia EO, Zelenova ME. Psychological characteristics of post-traumatic stress states in workers dealing with the consequences of the Chernobyl accident. J Russian East Eur Psychol 2001;39:29–42.
86. Lesaca T. Symptoms of stress disorder and depression among trauma counselors after an airline disaster. Psychiatr Serv 1996;47:424–6.
87. Sims A, Sims D. The phenomenology of post-traumatic stress disorder. Psychopathology 1998;31:96–112.
88. Luce A, Firth-Cozens J. Effects of the Omagh bombing on medical staff working in the local NHS trust: a longitudinal survey. Hosp Med 2002;63:44–7.
89. North CS, Tivis L, McMillen JC, et al. Psychiatric disorders in rescue workers after the Oklahoma City bombing. Am J Psychiatry 2002;159:857–9.
90. Turner SW, Thompson J, Rosser RM. The Kings Cross fire: psychological reactions. J Trauma Stress 1995;8:419–27.
91. Havenaar JM, Rumyantzeva GM, van den Brink W, et al. Long-term mental health effects of the Chernobyl disaster: an epidemiologic survey in two former Soviet regions. Am J Psychiatry 1997;154:1605–7.
92. Palinkas LA, Petterson JS, Russell J, et al. Community patterns of psychiatric disorders after the Exxon *Valdez* oil spill. Am J Psychiatry 1993;150:1517–23.
93. Chung MC, Werrett J, Farmer S, et al. Responses to traumatic stress among community residents exposed to a train collision. Stress Med 2000;16:17–25.
94. Smith DW, Christiansen EH, Vincent R, et al. Population effects of the bombing of Oklahoma City. J Oklahoma State Med Assoc 1999;92:193–8.
95. Green BL, Korol M, Grace MC, et al. Children and disaster: age, gender, and parental effects on PTSD symptoms. J Am Acad Child Adolesc Psychiatry 1991;30:945–51.
96. Pfefferbaum B, Nixon SJ, Krug RS, et al. Clinical needs assessment of middle and high school students following the 1995 Oklahoma City bombing. Am J Psychiatry 1999;156:1069–74.
97. Pfefferbaum B, Gurwitch RH, McDonald NB, et al. Posttraumatic stress among young children after the death of a friend or acquaintance in a terrorist bombing. Psychiatr Serv 2000;51:386–8.
98. Pfefferbaum B, Seale TW, McDonald NB, et al. Posttraumatic stress two years after the Oklahoma City bombing in youths geographically distant from the explosion. Psychiatry 2000;63:358–70.
99. Pfefferbaum B, Nixon SJ, Tivis RD, et al. Television exposure in children after a terrorist incident. Psychiatry 2001;64:202–11.
100. Pynoos RS, Frederick C, Nader K, et al. Life threat and posttraumatic stress in school-age children. Arch Gen Psychiatry 1987;44:1057–63.
101. Schwarz ED, Kowalski JM. Malignant memories: PTSD in children and adults after a school shooting. J Am Acad Child Adolesc Psychiatry 1991;30:936–44.
102. Vila G, Porche LM, Mouren-Simeoni MC. An 18-month longitudinal study of posttraumatic disorders in children who were taken hostage in their school. Psychosom Med 1999;61:746–54.
103. Foster RP. The long-term mental health effects of nuclear trauma in recent Russian immigrants in the United States. Am J Orthopsychiatry 2002;72:492–504.
104. Hagstrom R. The acute psychological impact on survivors following a train accident. J Trauma Stress 1995;8:391–402.
105. Elklit A. The aftermath of an industrial disaster. Acta Psychiatr Scand 1997;96(suppl 392):1–25.
106. Nader K, Pynoos R, Fairbanks L, et al. Children's PTSD reactions one year after a sniper attack at their school. Am J Psychiatry 1990;147:1526–30.
107. Schwarz ED, Kowalski JM. Personality characteristics and posttraumatic stress symptoms after a school shooting. J Nerv Ment Dis 1992;180:735–7.
108. Freed D, Bowler R, Fleming I. Post-traumatic stress disorder as a consequence of a toxic spill in Northern California. J Appl Soc Psychol 1998;28:264–81.
109. Weiss DS, Marmar CR, Metzler TJ, et al. Predicting symptomatic distress in emergency services personnel. J Consult Clin Psychol 1995;63:361–8.
110. North CS, Spitznagel EL, Smith EM. A prospective study of coping after exposure to a mass murder episode. Ann Clin Psychiatry 2001;13:81–7.
111. Eriksson N, Lundin T. Early traumatic stress reactions among Swedish survivors of the *M/S Estonia* disaster. Br J Psychiatry 1996;169:713–16.
112. Joseph S, Dalgleish T, Williams R, et al. Attitudes towards emotional expression and post-traumatic stress in survivors of the *Herald of Free Enterprise* disaster. Br J Clin Psychol 1997;36:133–8.
113. Mitchell TL, Griffin K, Stewart SH, et al. ''We will never ever forget . . .'': the Swissair Flight 111 disaster and its impact on volunteers and communities. J Health Psychol 2004;9:245–62.
114. Stewart SH, Mitchell TL, Wright KD, et al. The relations of PTSD symptoms to alcohol use and coping drinking in volunteers who responded to the Swissair Flight 111 airline disaster. J Anxiety Disord 2004;18:51–68.
115. Maes M, Mylle J, Delmeire L, et al. Pre- and post-disaster negative life events in relation to the incidence and severity of post-traumatic stress disorder. Psychiatry Res 2001;105:1–12.
116. Luce A, Firth-Cozens J, Midgley S, et al. After the Omagh bomb: posttraumatic stress disorder in health service staff. J Trauma Stress 2002;15:27–30.
117. Udwin O, Boyle S, Yule W, et al. Risk factors for long-term psychological effects of a disaster experience in adolescence: predictors of post traumatic stress disorder. J Child Psychol Psychiatry 2000;41:969–79.
118. Maes M, Mylle J, Delmeire L, et al. Psychiatric morbidity and comorbidity following accidental man-made traumatic events: incidence and risk factors. Eur Arch Psychiatry Clin Neurosci 2000;250:156–62.
119. Smith EM, North CS, Spitznagel EL. Post-traumatic stress in survivors of three disasters. J Soc Behav Pers 1993;8:353–68.

120. McCarroll JE, Fullerton CS, Ursano RJ, et al. Posttraumatic stress symptoms following forensic dental identification: Mt. Carmel, Waco, Texas. Am J Psychiatry 1996;153:778–82.

121. Dalgleish T, Joseph S, Thrasher S, et al. Crisis support following the *Herald of Free Enterprise* disaster: a longitudinal perspective. J Trauma Stress 1996;9:833–45.

122. North CS, Tivis L, McMillen JC, et al. Coping, functioning, and adjustment of rescue workers after the Oklahoma City bombing. J Trauma Stress 2002;15:171–5.

123. Ahern J, Galea S, Resnick H, et al. Television images and psychological symptoms after the September 11 terrorist attacks. Psychiatry 2002;65:289–300.

124. Tyano S, Iulian I, Zahava S, et al. Seven-year follow-up of child survivors of a bus-train collision. J Am Acad Child Adolesc Psychiatry 1996;35:365–73.

125. Green BL, Lindy JD, Grace MC, et al. Buffalo Creek survivors in the second decade: stability of stress symptoms. Am J Orthopsychiatry 1990;60:43–54.

126. Green BL, Grace MC, Vary MG, et al. Children of disaster in the second decade: a 17-year follow-up of Buffalo Creek survivors. J Am Acad Child Adolesc Psychiatry 1994;33:71–9.

127. Abenhaim L, Dab W, Salmi LR. Study of civilian victims of terrorist attacks (France 1982–1987). J Clin Epidemiol 1992;45:103–9.

128. Cwikel JG, Abdelgani A, Rozovski U, et al. Long-term stress reactions in new immigrants to Israel exposed to the Chernobyl accident. Anxiety Stress Coping 2000;13:413–39.

129. Joseph S, Yule W, Williams R, et al. Correlates of post-traumatic stress at 30 months: the *Herald of Free Enterprise* disaster. Behav Res Ther 1994;32:521–4.

130. Sungur M, Kaya B. The onset and longitudinal course of a man-made post-traumatic morbidity: survivors of the Sivas disaster. Int J Psychiatry Clin Pract 2001;5:195–202.

131. Tucker P, Pfefferbaum B, Nixon SJ, et al. Predictors of post-traumatic stress symptoms in Oklahoma City: exposure, social support, peri-traumatic responses. J Behav Health Serv Res 2000;27:406–15.

132. Carlier IV, Gersons BP. Stress reactions in disaster victims following the Bijlmermeer plane crash. J Trauma Stress 1997;10:328–35.

133. Trautman R, Tucker P, Pfefferbaum B, et al. Effects of prior trauma and age on posttraumatic stress symptoms in Asian and Middle Eastern immigrants after terrorism in the community. Community Ment Health J 2002;38:459–74.

134. March JS, Amaya-Jackson L, Terry R, et al. Posttraumatic symptomatology in children and adolescents after an industrial fire. J Am Acad Child Adolesc Psychiatry 1997;36:1080–8.

135. Jehel L, Paterniti S, Brunet A, et al. Prediction of the occurrence and intensity of post-traumatic stress disorder in victims 32 months after bomb attack. Eur Psychiatry 2003;18:172–6.

136. Sloan P. Post-traumatic stress in survivors of an airplane crash-landing: a clinical and explanatory research intervention. J Trauma Stress 1988;1:211–29.

137. Ursano RJ, Fullerton CS, Kao T, et al. Longitudinal assessment of posttraumatic stress disorder and depression after exposure to traumatic death. J Nerv Ment Dis 1995;183:36–42.

138. Livingston HM, Livingston MG, Fell S. The Lockerbie disaster: a 3-year follow-up of elderly victims. Int J Geriatr Psychiatry 1994;9:989–94.

139. Scott RB, Brooks N, McKinlay W. Post-traumatic morbidity in a civilian community of litigants: a follow-up at 3 years. J Trauma Stress 1995;8:403–17.

140. Madakasira S, O'Brien KF. Acute posttraumatic stress disorder in victims of a natural disaster. J Nerv Ment Dis 1987;175:286–90.

141. De La Fuente R. The mental health consequences of the 1985 earthquakes in Mexico. Int J Ment Health 1990;19:21–9.

142. Cao H, McFarlane AC, Klimidis S. Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake. Soc Psychiatry Psychiatr Epidemiol 2003;38:204–12.

143. Goenjian AK, Molina L, Steinberg AM, et al. Posttraumatic stress and depressive reactions among Nicaraguan adolescents after Hurricane Mitch. Am J Psychiatry 2001;158:788–94.

144. Kaiser CF, Sattler DN, Bellack DR, et al. A conservation of resources approach to a natural disaster: sense of coherence and psychological distress. J Soc Behav Pers 1996;11:459–76.

145. Shannon MP, Lonigan CJ, Finch AJ, et al. Children exposed to disaster: I. Epidemiology of post-traumatic symptoms and symptom profiles. J Am Acad Child Adolesc Psychiatry 1994;33:80–93.

146. Thompson MP, Norris FH, Hanacek B. Age differences in the psychological consequences of Hurricane Hugo. Psychol Aging 1993;8:606–16.

147. Carr VJ, Lewin TJ, Webster RA, et al. Psychosocial sequelae of the 1989 Newcastle earthquake: I. Community disaster experiences and psychological morbidity 6 months post-disaster. Psychol Med 1995;25:539–55.

148. Canino G, Bravo M, Rubio-Stipec M, et al. The impact of disaster on mental health: prospective and retrospective analyses. Int J Ment Health 1990;19:51–69.

149. Eustace K, MacDonald C, Long N. Cyclone Bola: a study of the psychological after-effects. Anxiety Stress Coping 1999;12:285–98.

150. Garrison CZ, Weinrich MW, Hardin SB, et al. Post-traumatic stress disorder in adolescents after a hurricane. Am J Epidemiol 1993;138:522–30.

151. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. J Consult Clin Psychol 1998;66:883–92.

152. Garrison CZ, Bryant ES, Addy CL, et al. Posttraumatic stress disorder in adolescents after Hurricane Andrew. J Am Acad Child Adolesc Psychiatry 1995;34:1193–201.

153. Perilla JL, Norris FH, Lavizzo EA. Ethnicity, culture, and disaster response: identifying and explaining ethnic differences in PTSD six months after Hurricane Andrew. J Soc Clin Psychol 2002;21:20–45.

154. Staab JP, Grieger TA, Fullerton CS, et al. Acute stress disorder, subsequent posttraumatic stress disorder and depression after a series of typhoons. Anxiety 1996;2:219–25.

155. Morgan IA, Matthews G, Winton M. Coping and personality as predictors of post-traumatic intrusions, numbing, avoidance, and general distress: a study of victims of the Perth Flood. Behav Cogn Psychother 1995;23:251–64.

156. McMillen C, North C, Mosley M, et al. Untangling the psychiatric comorbidity of posttraumatic stress disorder in a sample of flood survivors. Compr Psychiatry 2002;43:478–85.

157. Sharan P, Chaudhary G, Kavathekar SA, et al. Preliminary report of psychiatric disorders in survivors of a severe earthquake. Am J Psychiatry 1996;153:556–8.

158. Livanou M, Basoglu M, Salcioglu E, et al. Traumatic stress responses in treatment-seeking earthquake survivors in Turkey. J Nerv Ment Dis 2002;190:816–23.

159. Najarian L, Goenjian AK, Pelcovitz D, et al. The effect of relocation after a natural disaster. J Trauma Stress 2001;14:511–26.

160. Suar D, Mandal MK, Khuntia R. Supercyclone in Orissa: an assessment of psychological status of survivors. J Trauma Stress 2002;15:313–19.

161. Bodvarsdottir I, Elklit A. Psychological reactions in Icelandic earthquake survivors. Scand J Psychol 2004;45:3–13.

162. McFarlane AC. The longitudinal course of posttraumatic morbidity. J Nerv Ment Dis 1988;176:30–9.

163. Chang C, Lee L, Connor KM, et al. Posttraumatic distress and coping strategies among rescue workers after an earthquake. J Nerv Ment Dis 2003;191:391–8.

164. Goenjian AK, Pynoos RS, Steinberg AM, et al. Psychiatric comorbidity in children after the 1988 earthquake in Armenia. J Am Acad Child Adolesc Psychiatry 1995;34:1174–84.

165. Bradburn IS. After the earth shook: children's stress symptoms 6–8 months after a disaster. Adv Behav Res Ther 1991;13:173–9.

166. Vernberg EM, La Greca AM, Silverman WK, et al. Prediction of posttraumatic stress symptoms in children after Hurricane Andrew. J Abnorm Psychol 1996;105:237–48.

167. Russoniello CV, Skalko TK, O'Brien K, et al. Childhood posttraumatic stress disorder and efforts to cope after Hurricane Floyd. Behav Med 2002;28:61–71.

168. Hsu C, Chong M, Yang P, et al. Posttraumatic stress disorder among adolescent earthquake victims in Taiwan. J Am Acad Child Adolesc Psychiatry 2002;41:875–81.

169. Carr VJ, Lewin TJ, Kenardy JA, et al. Psychosocial sequelae of the 1989 Newcastle earthquake: III. Role of vulnerability factors in post-disaster morbidity. Psychol Med 1997;27:179–90.

170. Chung MC, Easthope Y, Farmer S, et al. Psychological sequelae: post-traumatic stress reactions and personality factors among community residents as secondary victims. Scand J Caring Sci 2003;17:265–70.

171. Kuo C, Tang H, Tsay C, et al. Prevalence of psychiatric disorders among bereaved survivors of a disastrous earthquake in Taiwan. Psychiatr Serv 2003;54:249–51.

172. McFarlane AC. The phenomenology of posttraumatic stress disorders following a natural disaster. J Nerv Ment Dis 1988;176:22–9.

173. Spurrell MT, McFarlane AC. Post-traumatic stress disorder and coping after a natural disaster. Soc Psychiatry Psychiatr Epidemiol 1993;28:194–200.

174. Benight CC, Swift E, Sanger J, et al. Coping self-efficacy as a mediator of distress following a natural disaster. J Appl Soc Psychol 1999;29:2443–64.

175. Johnsen BH, Eid J, Lovstad T, et al. Posttraumatic stress symptoms in nonexposed, victims, and spontaneous rescuers after an avalanche. J Trauma Stress 1997;10:133–40.

176. Chen CC, Yeh TL, Yang YK, et al. Psychiatric morbidity and post-traumatic symptoms among survivors in the early stage following the 1999 earthquake in Taiwan. Psychiatry Res 2001;105:13–22.

177. McMillen JC, North CS, Smith EM. What parts of PTSD are normal: intrusion, avoidance, or arousal? Data from the Northridge, California earthquake. J Trauma Stress 2000;13:57–75.

178. Pickens J, Field T, Prodromidis M, et al. Posttraumatic stress, depression, and social support among college students after Hurricane Andrew. J College Student Devel 1995;36:152–61.

179. Asarnow J, Glynn S, Pynoos R, et al. When the earth stops shaking: earthquake sequelae among children diagnosed for pre-earthquake psychopathology. J Am Acad Child Adolesc Psychiatry 1999;38:1016–23.

180. Catapano F, Malafronte R, Lepre F, et al. Psychological consequences of the 1988 landslide in Sarno, Italy: a community study. Acta Psychiatr Scand 2001;104:438–42.

181. Goenjian AK, Steinberg AM, Najarian LM, et al. Prospective study of posttraumatic stress, anxiety, and depressive reactions after earthquake and political violence. Am J Psychiatry 2000;157:911–16.

182. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta earthquake. J Pers Soc Psychol 1991;61:115–21.

183. Caldera T, Palma L, Penayo U, et al. Psychological impact of the hurricane Mitch in Nicaragua in a one-year perspective. Soc Psychiatry Psychiatr Epidemiol 2001;36:108–14.

184. Armenian HK, Morikawa M, Melkonian AK, et al. Loss as a determinant of PTSD in a cohort of adult survivors of the 1988 earthquake in Armenia: implications for policy. Acta Psychiatr Scand 2000;102:58–64.

185. Ticehurst S, Webster RA, Carr VJ, et al. The psychosocial impact of an earthquake on the elderly. Int J Geriatr Psychiatry 1996;11:943–51.

186. Durkin ME. Major depression and post-traumatic stress disorder following the Coalinga and Chile earthquakes: a cross-cultural comparison. J Soc Behav Pers 1993; 8:405–20.

187. La Greca AM, Silverman WK, Vernberg EM, et al. Symptoms of posttraumatic stress in children after Hurricane Andrew: a prospective study. J Consult Clin Psychol 1996;64:712–23.

188. Kwon Y, Maruyama S, Morimoto K. Life events and posttraumatic stress in Hanshin-Awaji earthquake victims. Environ Health Prev Med 2001;6:97–103.

189. McFarlane AC, Papay P. Multiple diagnoses in posttraumatic stress disorder in the victims of a natural disaster. J Nerv Ment Dis 1992;180:498–504.

190. Bravo M, Rubio-Stipec M, Canino GJ, et al. The psychological sequelae of disaster stress prospectively and retrospectively evaluated. Am J Community Psychol 1990;18:661–80.

191. Goenjian AK, Najarian LM, Pynoos RS, et al. Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. Am J Psychiatry 1994;151: 895–901.

192. Najarian L, Goenjian AK, Pelcovitz D, et al. Relocation after a disaster: posttraumatic stress disorder in Armenia after the earthquake. J Am Acad Child Adolesc Psychiatry 1996;35:374–83.

193. Lonigan CJ, Shannon MP, Taylor CM, et al. Children exposed to disaster: II. Risk factors for the development of post-traumatic symptomatology. J Am Acad Child Adolesc Psychiatry 1994;33:94–105.

194. David D, Mellman TA, Mendoza LM, et al. Psychiatric morbidity following Hurricane Andrew. J Trauma Stress 1996;9:607–12.

195. Inoue-Sakurai C, Maruyama S, Morimoto K. Posttraumatic stress and lifestyles are associated with natural killer cell activity in victims of the Hanshin-Awaji earthquake in Japan. Prev Med 2000;31:467–73.

196. Laor N, Wolmer L, Kora M, et al. Posttraumatic, dissociative, and grief symptoms in Turkish children exposed to the 1999 earthquakes. J Nerv Ment Dis 2002;190:824–32.
197. Basoglu M, Salcioglu E, Livanou M. Traumatic stress responses in earthquake survivors in Turkey. J Trauma Stress 2002;15:269–76.
198. Chung MC, Easthope Y, Eaton B, et al. Describing traumatic responses and distress of community residents directly and indirectly exposed to an aircraft crash. Psychiatry 1999;62:125–37.
199. Ironson G, Wynings C, Schneiderman N, et al. Posttraumatic stress symptoms, intrusive thoughts, loss, and immune function after Hurricane Andrew. Psychosom Med 1997;59:128–41.
200. Jones RT, Ribbe DP, Cunningham P. Psychosocial correlates of fire disaster among children and adolescents. J Trauma Stress 1994;7:117–22.
201. Shaw JA, Applegate B, Tanner S, et al. Psychological effects of Hurricane Andrew on an elementary school population. J Am Acad Child Adolesc Psychiatry 1995;34:1185–92.
202. Solomon SD, Bravo M, Rubio-Stipec M, et al. Effect of family role on response to a disaster. J Trauma Stress 1993;6:255–69.
203. Koopman C, Classen C, Spiegel D. Predictors of posttraumatic stress symptoms among survivors of the Oakland/Berkeley, Calif., firestorm. Am J Psychiatry 1994;151:888–94.
204. Burnett K, Ironson G, Benight C, et al. Measurement of perceived disruption during rebuilding following Hurricane Andrew. J Trauma Stress 1997;10:673–81.
205. Fukuda S, Morimoto K, Mure K, et al. Posttraumatic stress and change in lifestyle among the Hanshin-Awaji earthquake victims. Prev Med 1999;29:147–51.
206. Lewin TJ, Carr VJ, Webster RA. Recovery from post-earthquake psychological morbidity: who suffers and who recovers? Aust N Z J Psychiatry 1998;32:15–20.
207. Norris FH, Perilla JL, Riad JK, et al. Stability and change in stress, resources, and psychological distress following natural disaster: findings from Hurricane Andrew. Anxiety Stress Coping 1999;12:363–96.
208. Tobin GA, Ollenburger JC. Predicting levels of postdisaster stress in adults following the 1993 floods in the Upper Midwest. Environ Behav 1996;28:340–57.
209. Kilic EZ, Ozguven HD, Sayil I. The psychological effects of parental mental health on children experiencing disaster: the experience of Bolu earthquake in Turkey. Fam Process 2003;42:485–95.
210. Webster RA, McDonald R, Lewin TJ, et al. Effects of a natural disaster on immigrants and host population. J Nerv Ment Dis 1995;183:390–7.
211. Carr VJ, Lewin TJ, Webster RA, et al. Psychosocial sequelae of the 1989 Newcastle earthquake: II. Exposure and morbidity profiles during the first 2 years post-disaster. Psychol Med 1997;27:167–78.
212. Norris FH, Kaniasty K, Conrad ML, et al. Placing age differences in cultural context: a comparison of the effects of age on PTSD after disaster in the United States, Mexico, and Poland. J Clin Geropsychol 2002;8:153–73.
213. Kato H, Asukai N, Miyake Y, et al. Post-traumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanshin-Awaji earthquake in Japan. Acta Psychiatr Scand 1996;93:477–81.
214. Kilic C, Ulusoy M. Psychological effects of the November 1999 earthquake in Turkey: an epidemiological study. Acta Psychiatr Scand 2003;108:232–8.

215. Wang X, Gao L, Shinfuku N, et al. Longitudinal study of earthquake-related PTSD in a randomly selected community sample in North China. Am J Psychiatry 2000;157:1260–6.
216. North CS, Kawasaki A, Spitznagel EL, et al. The course of PTSD, major depression, substance abuse, and somatization after a natural disaster. J Nerv Ment Dis 2004;192:823–9.
217. Groome D, Soureti A. Post-traumatic stress disorder and anxiety symptoms in children exposed to the 1999 Greek earthquake. Br J Psychol 2004;95:387–97.
218. Ajdukovic D. Social contexts of trauma and healing. Med Confl Surviv 2004;20:120–35.
219. Salcioglu E, Basoglu M, Livanou M. Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. J Nerv Ment Dis 2003;191:154–60.
220. McFarlane AC. Posttraumatic phenomena in a longitudinal study of children following a natural disaster. J Am Acad Child Adolesc Psychiatry 1987;26:764–9.
221. Winje D. Long-term outcome of trauma in adults: the psychological impact of a fatal bus accident. J Consult Clin Psychol 1996;64:1037–43.
222. Ursano RJ, Fullerton CS, Vance K, et al. Posttraumatic stress disorder and identification in disaster workers. Am J Psychiatry 1999;156:353–9.
223. Thompson J, Chung MC, Rosser R. The *Marchioness* disaster: preliminary report on psychological effects. Br J Clin Psychol 1994;33:75–7.
224. Shariat S, Mallonee S, Kruger E, et al. A prospective study of long-term health outcomes among Oklahoma City bombing survivors. J Okla State Med Assoc 1999;92:178–86.
225. Leffler CT, Dembert ML. Posttraumatic stress symptoms among US Navy divers recovering TWA Flight 800. J Nerv Ment Dis 1998;186:574–7.
226. Engelhard IM, van den Hout MA, Arntz A, et al. A longitudinal study of ''intrusion-based reasoning'' and post-traumatic stress disorder after exposure to a train disaster. Behav Res Ther 2002;40:1415–24.
227. Marmar CR, Weiss DS, Metzler TJ, et al. Longitudinal course and predictors of continuing distress following critical incident exposure in emergency services personnel. J Nerv Ment Dis 1999;187:15–22.
228. Howard WT, Loberiza FR, Pfohl BM, et al. Initial results, reliability, and validity of a mental health survey of Mount Pinatubo disaster victims. J Nerv Ment Dis 1999;187:661–72.
229. Shaw JA, Applegate B, Schorr C. Twenty-one-month follow-up study of school-age children exposed to Hurricane Andrew. J Am Acad Child Adolesc Psychiatry 1996;35:359–64.
230. Waelde LC, Koopman C, Rierdan J, et al. Symptoms of acute stress disorder and posttraumatic stress disorder following exposure to disastrous flooding. J Trauma Dissoc 2001;2:37–52.
231. Yang YK, Yeh TL, Chen CC, et al. Psychiatric morbidity and posttraumatic symptoms among earthquake victims in primary care clinics. Gen Hosp Psychiatry 2003;25:253–61.
232. Goto T, Wilson JP, Kahana B, et al. PTSD, depression, and help-seeking patterns following the Miyake Island volcanic eruption. Int J Emerg Ment Health 2002;4:157–71.
233. Norris FH, Perilla JL, Ibanez GE, et al. Sex differences in symptoms of posttraumatic stress: does culture play a role? J Trauma Stress 2001;14:7–28.
234. Steinglass P, Gerrity E. Natural disasters and post-traumatic stress disorder: short-term versus long-term recovery in two disaster-affected communities. J Appl Soc Psychol 1990;20:1746–65.

WEB TABLE 1. Summary of diagnostic criteria for Post-traumatic stress disorder in Diagnostic and Statistical Manual III, III-R, and IV

	Diagnostic and Statistical Manual of Mental Disorders (Third Edition) (DSM-III) (12)	Diagnostic and Statistical Manual of Mental Disorders (Third Edition, Revised) (DSM-III-R) (42)	Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (DSM-IV) (43)
Diagnostic Criteria	**Meet diagnostic criteria for PTSD: Criterion A; Criterion B (≥1 symptom); Criterion C (≥1 symptom); Criterion D (≥2 symptoms).**	**Meet diagnostic criteria for PTSD: Criterion A; Criterion B (≥1 symptom); Criterion C (≥3 symptoms); Criterion D (≥2 symptoms); Criterion E.**	**Meet diagnostic criteria for PTSD if: Criterion A (Symptom A and B); Criterion B (≥1 symptom); Criterion C (≥3 symptoms); Criterion D (≥2 symptoms); Criterion E; Criterion F.**
A	**Existence of a recognizable stressor that would evoke significant symptoms of distress in almost anyone.**	**The person has experienced an event that is outside the range of usual human experience and that would be markedly distressing to almost anyone.**[*]	**The person has been exposed to a traumatic event in which both of the following were present:**
A(1)	**Not applicable**	**Not applicable**	**The person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others.**
A(1)	**Not applicable**	**Not applicable**	**The person's response involved intense fear, helplessness, or horror. Note: In children, this may be expressed instead by disorganized or agitated behavior.**
B	**Re-experiencing of the trauma as evidences by at least of the following ways:**	**The traumatic event is persistently reexperienced in at least one of the following ways:**	**Same as DSM-III-R.**
B(1)	**Recurrent and intrusive of an event.**	**Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions.**	**Same as DSM-III-R.**
B(2)	**Recurrent dreams of the event.**	**Recurrent distressing dreams of the event.**	**Same as DSM-III-R.**
B(3)	**Sudden acting or feeling as if the traumatic event were reoccurring, because of an association with an environmental or ideational stimulus.**	**Sudden acting or feeling as if the traumatic event were reoccurring, (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated) because of an association with an environmental or ideational stimulus.**	**Same as DSM-III-R.**
B(4)	**Not applicable**	**Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.**	**Same as DSM-III-R.**

B(5)	Not applicable	Not applicable	Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
C	Numbing of responsiveness to or reduced involvement with external world, beginning some time after the trauma, as shown by at least one of the following:	Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:	Same as DSM-III-R.
C(1)	Markedly diminished interest in one or more significant activities.	Efforts to avoid thoughts or feelings associated with the trauma.	Efforts to avoid thoughts, feelings, or conversations associated with the trauma.
C(2)	Feeling of detachment or estrangement from others.	Efforts to avoid activities or situations that arouse recollections of the trauma.	Efforts to avoid activities, places, or people that arouse recollections of the trauma.
C(3)	Constricted affect.	Inability to recall an important aspect of the trauma (psychogenic amnesia).	Same as DSM-III-R.
C(4)	Not applicable	Markedly diminished interest of participation in significant activities.	Same as DSM-III-R.
C(5)	Not applicable	Feeling of detachment or estrangement from others.	Same as DSM-III-R.
C(6)	Not applicable	Restricted range of affect (e.g., unable to have loving feelings.	Same as DSM-III-R.
C(7)	Not applicable	Sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span).	Same as DSM-III-R.
D	At least two of the following symptoms that were not present before the trauma:	Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:	Same as DSM-III-R.
D(1)	Hyperalertness or exaggerated startle response.	Difficulty falling or staying asleep.	Same as DSM-III-R.
D(2)	Sleep disturbance.	Irritability or outbursts of anger.	Same as DSM-III-R.
D(3)	Guilt about surviving when others have not, or about behavior required for survival.	Difficulty concentrating.	Same as DSM-III-R.
D(4)	Memory impairment or trouble concentrating.	Hyperviligance.	Same as DSM-III-R.
D(5)	Avoidance of activities that arouse recollection of the traumatic event.	Exaggerated startle response.	Same as DSM-III-R.
D(6)	Intensification of symptoms by exposure to events that symbolize or resemble the traumatic event.	Physiologic reactivity upon exposure to events that symbolize or resemble an aspect of the traumatic event (e.g., a woman who	Not applicable

		was raped in an elevator breaks out in a sweat when entering any elevator).	
E	**Not applicable**	**Duration of the disturbance (symptoms in Criteria B, C, and D) is more than one month.**	**Same as DSM-III-R.**
F	**Not applicable**	**Not applicable**	**The disturbance causes clinically significant distress or impairment in social, occupational, or other areas of functioning.**

*Serious threat to one's life or physical integrity; serious threat or harm to one's children, spouse, or other close relatives and friends; sudden destruction of one's home or community; or seeing another person who has recently been, or is being, seriously injured or killed as the result of an accident or physical violence.

WEB TABLE 2. Key studies assessing post-traumatic stress after human-made or technological disasters

Sample; N; (reference no.)	Timeframe*	PTSD Measure	Main Findings
1966 Aberfan Mining Disaster, South Wales—October 21, 1966			
Exposed survivors (n=41) and unexposed matched controls (n=72); N=113; (62)**	33 years	Composite International Diagnostic Interview and the Impact of Events Scale	*Prevalence of PTSD since the disaster*: 46% of survivors compared to 20% of controls (OR‡ = 3.38); *Prevalence of current PTSD at 33 years (scoring ≥35 on IES)*: 29% of survivors
1972 Buffalo Creek Dam Collapse, West Virginia—February 26, 1972			
Children (ages 2-15) exposed to the disaster; N=179; (95)**	2 years	Clinical evaluations retrospectively examined using DSM-III-R criteria	*Prevalence of PTSD*: 37%; *Correlates of PTSD symptoms*: life threat, female gender, mother's overall severity, irritable family atmosphere, depressed family atmosphere
Adults exposed to the disaster; N=193; (75)**	14 years	Modified Structured Clinical Interview for DSM-III; caseness required at least 2 criteria C and 1 criteria D symptom	*Prevalence of PTSD*: 59.4% anytime after incident, 25.0% current at 14 years; *Correlates of PTSD prevalence at 14 years*: blocked during escape from flood waters, being injured, exposure to the elements for a long period, losing a household member
Adults exposed to the disaster; N=120 at 14 years; (125)†	2 and 14 years	Structured Clinical Interview for DSM-III modified to address most DSM-III-R criteria	*Correlates of persistent PTSD*: blocked while trying to escape flood waters, exposure to elements directly after flood, death in household; *Course*: prevalence of disaster-related PTSD decreased from 44% at 2 years to 28% at 14 years; 17% of the sample had persistent PTSD, 28% recovered, 44% did not have PTSD at 2 or 14 years, and 11% were delayed cases
Adults exposed to the disaster as children; N=99; (126)**	17 years	Structured Clinical Interview for DSM-III-R—Non-patient version, with the PTSD section added	*Prevalence of disaster-related PTSD*: 32% anytime after incident, 7% current at 17 years; *Correlates of PTSD symptoms*: injury, loss of pets
1979 Three Mile Island Nuclear Accident—March 1979			
Exposed residents and unexposed controls; N=122; (39)**	58 months	Impact of Events Scale	*Correlates of PTSD symptoms*: being in exposed group, higher levels of chronic stress
1980 Alexander L. Kielland Oil Rig Disaster, North Sea—March 27, 1980			
Exposed professional and non-professional rescue workers; N=134; (83)**	9 months	Impact of Events Scale	*Prevalence of high levels of PTSD severity*: 15% on intrusion scale, 13% on avoidance scale
1983 Apartment Building Explosion, Greenville, North Carolina—March 2, 1983			
Rescue, fire, and medical personnel involved in rescue and treatment on-site (n=53) or at hospital (n=26); N=79; (80)**	5 months	Caseness required at least 1 reexperiencing, 1 avoidance, and 2 arousal symptoms	*Prevalence of PTSD*: 13.9%; *Correlates of PTSD symptoms*: working on-site (vs. at hospital)
1984 School Playground Sniper Attack, Los Angeles—February 24, 1984			
Children from the school directly or indirectly exposed; N=159; (106)**	1 month	Revised children's version of the PTSD Reaction Index,	*Prevalence of moderate to severe PTSD symptomatology*: 38.4%; *Correlates of high levels of PTSD severity*: proximity to shooting, knowledge of victim

		based on DMS-III criteria	
Directly exposed and unexposed children from the Los Angeles school district; N=100; (106)†	1 and 14 months	Revised children's version of the PTSD Reaction Index, based on DMS-III criteria	*Correlates of high levels of PTSD symptomatology at 14 months*: exposure, severity of child's baseline reaction, acquaintance with deceased (among unexposed), guilt feelings (among unexposed); *Course*: 74% of exposed children continued to report symptoms at 14 months compared to only 19% of unexposed children

1984 Airplane Crash Landing, Alabama—Late 1984

Male college basketball players on board the aircraft; N=30; (136)†	12 days; 2, 5, 10, and 12 months	PTSD diagnosed using a structured interview based on DSM-III criteria	*Course*: PTSD prevalence declined from 54% at 12 days to 10-15% at 12 months

1985 Bus-Train Collision, Israel—June 11, 1985

Exposed survivors (n=306) and unexposed controls (n=83); N=389; (124)**	7 years	PTSD Inventory, based on DSM-III-R criteria	*Correlates of PTSD symptoms*: being highly exposed

1986 Chernobyl Nuclear Reactor Accident, Ukraine—April 26, 1986

Population samples from Gomel (n=1617) and Tver (n=1427); N=3044; (91)**	6.5 years	12-item version of the General Health Questionnaire, based on DSM-III-R criteria	*Prevalence of PTSD*: prevalence was 2.4% in Gomel (near the accident site) compared to 0.4% in Tver (500 miles away)
Male workers who participated in decontamination; N=71; (85)**	6-7 years	PTSD diagnosed according to DSM-III-R criteria	*Prevalence of PTSD*: 20% diagnosed with PTSD, 22% were at risk, and 58% were at no risk or mild risk for PTSD
Immigrants from the Former Soviet Union to Israel from variably exposed and unexposed areas; N=699; (128)**	8 years	Impact of Events Scale	*Correlates of PTSD symptoms*: being in high exposure group, number of stressful life events
Survivors who migrated to the US from the general and clinical populations of Russian immigrants in the New York tri-state area; N=261; (103)**	15 years	Revised Civilian Mississippi PTSD Scale	*Correlates of PTSD symptoms*: being in the clinical subgroup, older age, proximity to disaster, having left the Former Soviet Union (FSU) for environmental reasons, having left the FSU because of discrimination

1987 Herald of Free Enterprise Car Ferry Disaster, Belgium—March 6, 1987

Survivors (n=47) and relatives of victims; (n=28); N=75; (74)**	Within 2 years	PTSD diagnosed according to DSM-III-R criteria	*Prevalence of PTSD*: 36%; *Correlates of PTSD prevalence*: being in non-bereaved group
Adult survivors; N=73; (129)**	30 months	Impact of Events Scale	*Correlates of intrusive symptoms*: greater perception of helplessness, bereavement; *Correlates of avoidance symptoms*: crisis support
Adult survivors; N=73 at 3 years, 37 at 5 years; (112)†	3 and 5 years	Impact of Events Scale	*Correlates of intrusive scores at 5 years*: intrusion scores at 3 years; *Correlates of avoidance symptom scores at 5 years*: negative attitudes at 3 years, avoidance scores at 3 years

Sample	Time	Measure	Findings
Adult survivors; N=73 at 3 years, 37 at 6 years; (121)†	3 and 6 years	Impact of Events Scale	*Correlates of intrusive symptoms at 6 years*: intrusion scores at 3 years; *Correlates of avoidance symptoms at 6 years*: less crisis support, avoidance scores at 3 years; *Course*: intrusive symptoms declined significantly between 3 and 6 years

1987 Jet Fighter Crash into Ramada Inn, Indianapolis—October 20, 1987

Sample	Time	Measure	Findings
Hotel employees who were on-site (n=17) or off-site (n=29); N=46; (72)**	4-6 weeks	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III criteria	*Prevalence of PTSD*: 22% among all employees, 29% among those who were on-site, 17% among those who were off-site

1987 Train Collision Accident, Lerum, Sweden—November 16, 1987

Sample	Time	Measure	Findings
Injured patients from a hospital and a primary care center; N=66; (104)**	10 days	Avoidance and intrusion symptoms	*Correlates of avoidance symptoms*: female gender, perception of threat to life; *Correlates of intrusion symptoms*: perception of threat to life

1987 King's Cross Underground Railway Fire, London—November 18, 1987

Sample	Time	Measure	Findings
Directly exposed persons, including passengers and emergency medical personnel; N=50; (90)**	1-12 months	Impact of Events Scale	*Correlates of PTSD symptoms*: severe exposure to the disaster

1988 School Shooting, Winnetka, Illinois—May 20, 1988

Sample	Time	Measure	Findings
School personnel directly or indirectly exposed; N=24; (107)**	6 months	20-item Reaction Index-Adult Version	*Correlates of PTSD symptoms*: guilt and resentment, insecurity, psychasthenia
Public safety, medical, and mental health emergency services workers who responded to the shooting; N=140; (61)**	6 months	Impact of Events Scale	*Correlates of current intrusion and avoidance symptoms*: perceived qualitative work load; *Course*: intrusion and avoidance symptoms decreased significantly over follow-up for all groups of emergency service workers
Children (n=64) and parents/school personnel (n=66) directly or indirectly exposed; N=130; (101)**	8-14 months	20-item Reaction Index modified to reflect DSM-III-R criteria	*Prevalence of PTSD*: 3% among adults, 8% among children; *Correlates of PTSD among adults*: guilt, fear that perpetrator was still loose that day; *Correlates of PTSD among children*: guilt, thought they would be shot, physical symptoms, more visits to school nurse, recklessness, fears

1988 Piper Alpha Oil Rig Disaster—July 6, 1988

Sample	Time	Measure	Findings
Police officers who searched for and identified human remains; N=48 at 3 months, 25 at 3 years; (79)†	3 months and 3 years	Impact of Events Scale	*Course*: total posttraumatic symptom scores decreased significantly between 3 months and 3 years
Survivors; N=33; (73)**	10 years	Clinician Administered PTSD Scale for DSM-IV, Current and Lifetime Diagnostic Version	*Prevalence of PTSD*: 73% acute diagnosis, 21% current at 10 years; *Correlates of current PTSD prevalence at 10 years*: impairment in social and occupational functioning; *Correlates of PTSD symptoms*: sustained anger, chronic dissociative symptoms, saw death of and/or injury to colleagues, difficulty finding work post-disaster

1988 Fatal School Bus Accident, Norway—August 15, 1988

Sample	Time	Measure	Findings
Professional and volunteer emergency responders; N=43; (81)†	1 and 13 months	Impact of Events Scale	*Prevalence of high levels of PTSD severity at 1 month*: 25% among voluntary workers compared 13% among professional helpers; *Correlates of PTSD symptoms scores at 1 month*: being in voluntary worker group (vs.

			professional); *Course*: symptoms declined significantly between 1 and 13 months
Adults from Stockholm whose child or spouse were among the bus passengers; N=36; (221)†	1, 3, and 5 years	Impact of Events Scale	*Course of high intrusion scores*: 39% at 1 year, 22% at 3 years, 31% at 5 years; *Course of high avoidance scores*: 19% at 1 year, 19% at 3 years, 3% at 5 years

1988 Air Show Midair Collision, Ramstein Air Force Base, Germany—August 28, 1988

Military medical health care who cared for victims; N=355; (82)†	6, 12, and 18 months	Modified version of the Symptom Checklist-9R and the Impact of Events Scale; caseness required meeting DSM-III-R criteria and scoring >19 on the IES	*Correlates of PTSD prevalence*: less education, working with burn patients, stressful events in 6 months post-disaster; *Course*: prevalence decreased from 12.1% at 12 months to 7.3% at 18 months

1988 Jupiter Shipping Disaster, Greece—October 21, 1988

Adolescent survivors (n=217) from 15 UK schools and unexposed friends or acquaintances (n=87) from the same schools; N=304; (77)†	5 months and 5-8 years	Clinician Administered PTSD Scale; PTSD defined according to DSM-IV criteria	*Incidence of PTSD during follow-up*: 51.5% of the survivors compared to 3.4% of unexposed controls; *Onset*: 90% of PTSD cases developed within 6 months; *Course*: 30% of survivors who developed PTSD recovered within a year of onset, 34% still had PTSD at follow-up; 26% of survivors had PTSD for over 5 years
Survivors (ages 11-18) from 15 UK schools; N=217; (117)†	5 months and 5-8 years	Clinician Administered PTSD Scale; PTSD defined according to DSM-IV criteria	*Correlates of PTSD incidence*: seeing blood during sinking (OR = 2.36), being trapped during sinking (OR = 3.73), thought of not escaping (OR = 1.18), fear or panic (OR = 1.54), anxious at baseline (OR = 1.15); *Correlates of longer PTSD duration (≥2 years):* relationship difficulties (OR = 2.35), childhood illness (OR = 5.16), depression symptoms at baseline (OR = 1.08); *Correlates of PTSD severity among those with PTSD*: childhood separation anxiety, not receiving help and support in school after disaster, depression symptoms at baseline
British mothers of adolescent children that were directly involved; N=37; (63)†	3 months and 6 years	Posttraumatic Stress Symptom Scale, based on DSM-III-R criteria	*Course*: prevalence of PTSD was 35.1% at 3 months and 8.1% at 6 years

1988 Clapham Rail Accident, UK—December 12, 1988

Survivors (n=187) and unexposed controls (n=104); N=291; (76)**	10-22 months	Impact of Events Scale; caseness required a score ≥40	*Prevalence of medium to high levels of intrusive PTSD severity*: 37% among exposed vs. 21% among controls; *Prevalence of medium to high levels of avoidance PTSD severity*: 28% among exposed vs. 17% among controls; *Correlates of intrusive PTSD symptoms*: injury severity, feeling at risk of death; *Correlates of avoidance PTSD symptoms*: injury severity, feeling trapped, witnessing death

1989 Kegworth Air Disaster, UK—January 8, 1989

Survivors of the crash; N=68; (69)**	6-12 months	Diagnoses were made according to DSM-III-R criteria	*Prevalence of PTSD*: 40%; *Correlates of PTSD prevalence*: younger age, seeing injured or dead passengers, lower injury severity, increased alcohol consumption

1989 Exxon Valdez Oil Spill, Alaska—March 24, 1989			
Residents of 13 communities highly exposed (n=145), mildly exposed (n=167), or unexposed (n=281); N=593; (92)**	1 year	Modified version of the Diagnostic Interview Schedule-Version 3, based on DSM-III-R criteria	*Prevalence of post-disaster PTSD*: 9.4%; *Correlates of PTSD prevalence*: being in highly exposed group (OR = 2.63), female gender (OR = 2.20)
Commercial fishers from a community economically affected by the incident; N=125; (70)**	6 years	Crime Related Post Traumatic Stress Disorder subscale of the Symptom Checklist 90-Revised; caseness defined using a 0.89 cutoff score	*Prevalence of PTSD*: 34% among males, 40% among females; *Correlates of PTSD prevalence*: avoidance coping, changes in relationships with non-relatives, changes in physical health, investment without gain
1989 Hillsborough Football Stadium Disaster, Sheffield, UK—April 15, 1989			
Police officers involved in at least one distressing situation during the disaster; N=70; (87)**	1-2 years	PTSD assessed using a scale based on DSM-III-R criteria	*Prevalence of PTSD*: 44.3% classified with severe symptom severity, 44.1% classified with moderate symptom severity; *Correlates of PTSD symptoms*: depressive symptoms after the incident, depersonalization
1989 USS Iowa Gun Turret Explosion—April 19, 1989			
Directly exposed volunteer mortuary workers; N=54 at 1 month, 41 at 4 months, 44 at 13 months; (137)†	1, 4, and 13 months	Symptom Checklist-90-R, Impact of Events Scale, and 12 additional items; caseness required meeting DSM-III-R criteria and scoring >19 on the IES	*Course*: PTSD prevalence decreased from 11% at 1 month to 10% at 4 months to 2% at 13 months after the incident
Directly exposed volunteer mortuary workers; N=54 at 1 month, 41 at 4 months, 44 at 13 months; (222)†	1, 4, and 13 months	Symptom Checklist-90-R, Impact of Events Scale, and 12 additional items	*Correlates of post-disaster PTSD*: identifying with the deceased as a friend ("it could have been my friend")
1989 Bus Disaster, Israel—July 6, 1989			
Survivors of the incident; N=12 at 2 days, 12 at 8-10 months; (41)†	2 days and 8-10 months	17-item PTSD checklist based on DSM-III-R criteria	*Prevalence of PTSD at 8-10 months*: 33%
1989 Marchioness Riverboat Disaster, Thames River, UK—August 20, 1989			
Adult survivors, 25 of whom were multiply bereaved; N=27; (223)**	10 months	Impact of Events Scale	*Prevalence of PTSD symptoms*: mean IES score (46.37) was higher than the normal population estimate of 10 and the mean of 34 reported in a study of stress clinic attendees
1989 Loma Prieta Earthquake, San Francisco Bay Area, California—October 17, 1989			
154 emergency services exposed (from I-880 freeway collapse) and a control group of 213 from the San Francisco and San Diego areas; N=367; (109)**	1.5 years for exposed; 3-4 years for controls	Mississippi Scale for Combat-related PTSD (M-PTSD), modified for civilian EMS worker use	*Correlates of PTSD prevalence*: fewer years of EMS experience, less social support, lower levels of psychological adjustment, external locus of control, exposure, more peri-traumatic dissociative experiences
1989 Lockerbie Disaster, Scotland—December 21, 1989			
Adult residents of Lockerbie claiming	10-14 months	Clinical examinations with	*Prevalence of PTSD*: moderate to severe PTSD present in 44% of claimants;

insurance compensation; N=66 (78)**		diagnosis according to DSM-III-R criteria	73% of claimants had PTSD of any degree.
Community sample of adults who claimed insurance compensation; N=25; (139)†	10-14 months an 3 years	Clinical examinations with diagnosis according to DSM-III-R criteria	*Prevalence of PTSD*: prevalence decreased from 72% at 10-14 months to 48% at 3 years; *Course*: 28% remained free of PTSD throughout follow-up; 48% represented persistent cases; 24% of PTSD cases recovered
Elderly residents of Lockerbie; N=31 at 1 year, 19 at follow-up; (138)†	1 and 3 years	Clinical examinations with diagnosis according to DSM-III-R criteria	*Prevalence of PTSD*: Prevalence decreased from 74% at 1 year to 16% at 3 years

1991 Toxic Chemical Railroad Spill, California—July 14, 1991

Exposed residents (n=295) of affected areas and unexposed controls (n=114); N=409; (108)**	3-4 months	Impact of Events Scale; caseness determined using cutoff score of 46	*Prevalence of PTSD*: 14.9% among exposed, 11.4% among controls; *Correlates of PTSD prevalence*: exposure, tension, depression, anger, fatigue, confusion
Exposed residents (n=350) of affected areas and unexposed controls (n=114); N=464; (58)**	3-4 months	Minnesota Multiphasic Personality Inventory 2 PTSD subscale	*Correlates of PTSD*: being in exposed group

1991 Mass Shooting Episode, Killeen, Texas—October 16, 1991

Persons directly or indirectly exposed to the shooting; N=113; (71)**	1 month	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III-R criteria	*Prevalence of PTSD*: 28.6% in total sample (20.3% among men, 35.8% among women); *Correlates of PTSD prevalence*: any pre-disaster psychiatric disorder excluding PTSD (among women), post-disaster depression
Persons directly or indirectly exposed to the shooting; N=136 at 6-8 weeks, 124 at 13-14 weeks; (66)†	6-8 weeks and 13-14 months	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III-R criteria	*Onset*: 68% reported symptom onset the day of the incident, 22% the week after, and 11% later in the month; *Correlates of PTSD prevalence*: female gender, pre-disaster psychopathology (among women), pre-disaster depression, acute post-disaster psychiatric illness or depression; *Course of current PTSD*: prevalence decreased from 27.2% at 6-8 weeks to 17.7% at 13-14 months
Persons directly or indirectly exposed to the shooting; N=136 at 6-8 weeks, 124 at 13-14 weeks, 116 at 3 years; (110)†	6-8 weeks, 13-14 months, and 3 years	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III-R criteria	*Correlates of PTSD prevalence*: abandonment of control (at 6-8 weeks, 13-14 months, and 3 years), passive isolation (at 6-8 weeks); *Course of current PTSD*: 29% at 6-8 weeks, 17% at 13-14 months, 19% at 3 years
Adults directly or indirectly exposed to the shooting; N=136 at 6-8 weeks, 116 at 3 years; (64)†	6-8 weeks, 13-14 months, and 3 years	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III-R criteria	*Correlates of chronic PTSD at 3 years post-disaster*: functional impairment, seeking mental health treatment at baseline; *Course of current disaster-related PTSD*: 26% at 6-8 weeks, 14% at 1 year, 18% at 3 years

1991 Imperial Foods Industrial Fire, Hamlet, North Carolina—September 1991

Students from 2 schools in the affected community; N=1019; (134)**	9 months	Self-Reported Post-Traumatic Symptomatology scale; caseness according to DSM-III-R criteria	*Prevalence of PTSD*: 11.9%; *Correlates of PTSD symptoms*: exposure to disaster, African-American ethnicity, female gender

1992 Los Angeles County Civil Disturbances—April 29, 1992

Household probability sample of	6-8 months	National Women's Study	*Prevalence of current (past 6 months) PTSD*: 4.1%; *Correlates of PTSD*

adults from L.A. County; N=1200; (65)**		PTSD Module, based on DSM-III-R criteria	*prevalence*: lifetime traumatic events (OR = 1.50), past year stressful events (OR = 1.44), past year victimization (OR = 2.02), disturbance exposure (OR = 1.26)
1992 Courthouse Shooting, Missouri—May 5, 1992			
Courthouse employees and offices of exposed individuals; N=80 at 6-8 weeks, 77 at 1 and 3 years; (67)†	6-8 weeks; 1 and 3 years	Diagnostic Interview Schedule/Disaster Supplement	*Prevalence of disaster related PTSD*: 5%; *Onset*: 6 of 8 cases reported symptom onset on the day of the incident; *Correlates of PTSD symptoms at 6-8 weeks*: older age, less than a college education, currently married; *Course*: 6 of 8 cases of PTSD were resolved by 3 years; symptoms decreased significantly between baseline and follow-up
1992 Bijlmermeer Plane Crash, Netherlands—October 4, 1992			
Adult disaster victims from the most severely damaged apartment blocks and adjacent buildings; N=136; (132)**	6 months	17-item Structured Interview for PTSD, adapted for DSM-III-R criteria	*Prevalence of PTSD*: 26%; *Correlates of PTSD prevalence*: losing a loved one, suffering material damage or lost home, being at home during the incident
1993 World Trade Center Bombing—February 26, 1993			
Exposed public school students at the World Trade Center during the explosion (N=22), and 27 unexposed controls; N=49; (60)†	3 and 9 months	Posttraumatic Stress Reaction Index	*Correlates of PTSD symptoms*: being in exposed group; *Course*: prevalence of severe to very severe symptomatology among exposed children decreased from 27% at 3 months to 14% at 9 months
1993 Fire at the Branch Davidian Compound, Waco, Texas—April 19, 1993			
Exposed dentists (n=31) who performed postmortem identifications and unexposed control dentists (n=47); N=78; (120)**	6 months	Impact of Events Scale	*Correlates of PTSD symptoms*: being in exposed group, duration of exposure to remains, younger age (among exposed), spouse and co-worker support (among exposed)
1993 Sivas Religious Uprisings, Turkey—July 2, 1993			
Highly exposed fire survivors (n=27), moderately exposed violent protest survivors (n=34), and mildly exposed health professionals (n=18); N=79; (130)†	1, 6, 12, and 18 months	PTSD defined according to DSM-III-R criteria	*Prevalence of acute PTSD*: 20.3%; *Prevalence of chronic PTSD*: 12.7%, of which 1.3% resolved by 18 months and 11.4% persisted; *Prevalence of delayed-onset PTSD*: 16.5%, of which 11.5% were resolved by 18 months and 5.0% persisted; *Correlates of chronic PTSD*: extent of trauma
1994 Brooklyn Bridge Shooting—March 1, 1994			
Hasidic students (ages 16-22) who survived a shooting attack on their van; N=11; (56)†	8 weeks and 10 months	Posttraumatic Stress Disorder Symptom Scale, based on DSM-IV criteria	*Prevalence of PTSD*: 4 of 11 students (28%) had PTSD at 8 weeks; *Course*: At 10 months, all 4 students with PTSD at 8 weeks showed persistent symptoms of PTSD
1994 Crash of US Air Flight 427, Pennsylvania—September 8, 1994			
21 therapists who provided post-disaster counseling and 20 control	4, 8, and 12 weeks	Symptom checklist measuring 6 DSM-IV PTSD symptoms	*Course:* at 4 and 8 weeks, the exposed group reported significantly more PTSD symptoms than the controls; by 12 weeks, only symptoms of avoidance were

Population; N; (reference)	Time	Instrument	Findings
therapists; N=41; (86)†			more common among the exposed
Exposed disaster workers involved in the body recovery process; N=41; (84)**	6 months	Caseness required meeting DSM criteria and reporting "high" symptom severity on the Impact of Events Scale	*Prevalence of PTSD*: 4.9%, *Correlates of PTSD prevalence*: Acute Stress Disorder in first week after incident

1994 m/s Estonia Car Ferry Disaster, Baltic Sea—September 27, 1994

Adults survivors of the disaster; N=42; (111)**	3 months	Post Traumatic Symptom Scale (using cutoff value of 20) and the Impact of Events Scale (using cutoff of 3)	*Prevalence of PTSD*: 64.3% using both instruments; *Correlates of PTSD symptoms*: loss of a spouse, weaker coping abilities, symptoms of peri-traumatic dissociation

1994 N149 Supertanker Explosion—October, 1994

Workers (257 males, 12 females) differentially exposed to the disaster; N=270; (105)**	6.5 months	Impact of Events scale; caseness required scoring ≥19	*Prevalence of PTSD*: 41%; *Correlates of PTSD symptoms*: older age, experiencing accidents at the shipyard before the explosion, being in less exposed group, described families' reactions as "impressed", survivor guilt, less social support

1994 Plane Crash in Coventry, UK—December 21, 1994

Directly and indirectly exposed residents; N=82; (198)**	6 months	15-item Impact of Events Scale	*Correlates of PTSD symptoms*: being in directly exposed group, not receiving professional help (among directly exposed), worrying about safety (among directly exposed), present feelings when heard planes flying over (among indirectly exposed)

1995 Oklahoma City Bombing—April 19, 1995

Oklahoma City public school students; N=3218; (96)**	7 weeks	Impact of Events Scale-Revised	*Correlates of PTSD symptoms*: higher proportion of bombing-related television viewing in month after attack, reporting a sibling or parent killed, female gender
Students from 11 public middle schools in Oklahoma City; N=2381; (99)**	7 weeks	22 items adapted from the Impact of Events Scale-Revised	*Correlates of PTSD symptoms*: television exposure (among students with no physical or emotional exposure)
Exposed adults from Oklahoma City (n=1010) and unexposed controls from Indianapolis (n=750); N=1760; (94)**	3-4 months	6 questions about PTSD symptoms	*Prevalence of PTSD symptoms*: in Oklahoma City, 76.1% reported at least one PTSD symptom (compared to 62.7% in Indianapolis) and 43.1% reported at least 4 PTSD symptoms (compared to 32.1% in Indianapolis)
Adults from Oklahoma City seeking mental health assistance; N=85; (131)**	6 months	Impact of Events Scale-Revised	*Correlates of PTSD symptoms*: being injured, feeling nervous or afraid, perceived life endangerment, being upset by others' behaviors, reporting that counseling helped, reporting that work helped
Exposed children who reported the death of a friend or acquaintance (n=27) and unexposed matched children (n=27); N=54; (97)**	8-10 months	22 items adapted from the Impact of Events Scale-Revised	The mean PTSD symptom score for the group that lost a friend was significantly higher than for the group that lost an acquaintance; however, neither the group who lost a friend nor the group who lost an acquaintance scored significantly higher than the unexposed group
Adults survivors of the bombing	6 months and	Diagnostic Interview	*Prevalence of PTSD at 6 months*: 34.3%; *Onset:* Among PTSD cases, 74%

selected from a registry; N=182 at 6 months, 141 at 1 year; (10)†	1 year	Schedule/Disaster Supplement, based on DSM-III-R criteria	reported same day onset, 18% within the first week, and 4% within the first month; *Correlates of PTSD prevalence at baseline*: female gender, pre-disaster psychiatric disorder, injury, injury or death of family member or friend; *Course*: 89% of persons with PTSD since the bombing were still symptomatic at 6 months
Adult Asian and Middle Eastern immigrants living in Oklahoma City; N=45; (133)**	1.5-2 years	21 Items from the Posttraumatic Stress Scale	*Correlates of PTSD symptoms*: PTSD symptoms from prior trauma, older current age, younger age at time of prior trauma
Sixth grade public school students from a community 100 miles from Oklahoma City; N=69; (98)**	2 years	22 items adapted from the Impact of Events Scale-Revised	*Prevalence of PTSD*: 44% using least stringent criteria, 4% using most stringent criteria; *Correlates of PTSD symptoms*: difficulty functioning, exposure to TV/radio coverage of bombing (current and in aftermath), proportion of reading devoted to bombing-related material (current and in aftermath), having a friend who knew someone injured or killed
Adult survivors of the bombing; N=494; (224)**	1.5-3 years	PTSD measured using DSM-IV criteria	*Prevalence of PTSD*: 4%
Firefighters involved in rescue and recovery (n=181) and primary victims (n=88); N=269; (89)**	34 months	Diagnostic Interview Schedule	*Prevalence of PTSD*: prevalence among firefighters was lower than among primary victims (13% vs. 23%); *Correlates of PTSD prevalence among firefighters*: time spent at the bombing site, time spent in "the pit", pre-disaster PTSD diagnosis
Firefighters involved in rescue and recovery; N=181; (122)**	34 months	Diagnostic Interview Schedule for DSM-III-R	*Correlates of PTSD prevalence*: functional impairment, less pride in job, less positive job satisfaction, reporting more negative effects of the bombing on job satisfaction, less likely to get along with their boss and coworkers, changes in relationships

1995 Elementary School Hostage Situation, Paris, France—December 3, 1995

Directly (taken hostage) and indirectly exposed children (ages 6-10); N=47; (102)†	2, 4, 7, and 18 months	Diagnoses using Kiddie-SADS-L according to DSM-IV criteria	*Course of PTSD among exposed*: 4% at 4 months, 12% at 7 months, 5% at 18 months; *Course of PTSD among indirectly exposed*: 10% at 4 months, 6% at 7 months, 0% at 18 months

1996 Train Collision Disaster, UK—March 8, 1996

Adults residents of the surrounding community present during incident; N=49; (93)**	7 months	Impact of Events Scale	*Prevalence of high PTSD symptom severity*: 57%; *Correlates of PTSD symptoms*: awake watching TV, having refreshments, writing or entertaining friends at time of incident; heard train approaching, heard very loud "bang", or feeling vibration at time of impact; shocked and terrified feelings directly after incident; feeling anxious or worried, nervous when a train passed, angry about what happened at interview
Adult residents from households 30 to 100 feet from the crash; N=66; (170)**	7 months	Impact of Events Scale	*Prevalence of high PTSD symptom severity*: 51%; *Correlates of intrusion and avoidance symptoms*: neuroticism

1996 TWA Flight 800 Crash, New York—July 17, 1996

Exposed Navy divers (n=66) who	3-6 months	Impact of Events Scale	*Prevalence of PTSD symptoms: t*here were no significant differences between

participated in recovery and unexposed divers (n=59); N=125; (225)**			PTSD symptom scores when comparing exposed and unexposed divers

1996 Ground Slump Industrial Disaster, Briey Region, France—October 14 and November 18, 1996

Exposed, indirectly exposed, and unexposed children; N=127; (57)**	6-7 months	Impact of Events Scale; caseness determined using cutoff score of 42	*Correlates of PTSD symptoms*: being in exposed group (vs. indirectly or unexposed group), lower socioeconomic status, younger age, higher levels of parental distress

1996 Subway Bombing, Paris, France—December 1996

Victims of the bomb attack; N=32; (135)†	6 and 32 months	Questionnaire of Posttraumatic Stress and the Impact of Events Scale; caseness based on DSM-III-R criteria	*Correlates of higher PTSD symptoms at 32 months*: physical injuries, non-managerial employment position, psychometric drug use before the incident; *Course of current PTSD*: prevalence decreased from 39% at 6 months to 25% at 32 months

1998 American Embassy Bombing, Nairobi, Kenya—August 7, 1998

Nairobi school children exposed to the bombing; N=562; (40)**	8-14 months	22-item Posttraumatic Stress Scale	*Correlates of PTSD symptoms*: more severe peri-traumatic reaction, PTSD symptoms relating to other prior traumatic experiences

1998 Omagh Bombing, Northern Ireland—August 15, 1998

Employees of the local health service; N=1064; (116)**	4 months	Posttraumatic Stress Disorder Symptom Scale, based on DSM-III-R criteria	*Correlates of PTSD symptoms*: involvement in the bombing, involvement in both a civilian and professional capacity, previous experiences of trauma, past emotional difficulties
Doctors working in the aftermath of the bombing; N=17 at 4 and 17 months; (88)†	4 and 17 months	PTSD Symptom Scale, based on DSM-IV criteria	*Correlates of PTSD symptoms*: younger age; *Course*: prevalence of PTSD among doctors increased from 6% at 4 months to 12% at 17 months

1998 Swissair Flight 111 Airline Crash, Canada—September 2, 1998

Recovery and instrumental volunteer responders; N=13; (114)**	3 years	Modified PTSD Symptom Scale, based on DSM-IV criteria	*Prevalence of current PTSD at 4 months*: 46%; *Correlates of PTSD prevalence*: exposure to human remains; *Correlates of greater PTSD severity*: use of alcohol to cope, use of alcohol to forget
Volunteer disaster workers; N=13; (113)**	3 years	Modified PTSD Symptom Scale, based on DSM-IV criteria	*Correlates of PTSD prevalence*: exposure to human remains, more time performing recovery, behavioral disengagement coping, restraint coping, alcohol-drug disengagement coping, suppression of competing activities coping

2001 Train Collision Disaster, Belgium—March 27, 2001

Residents of adjacent town exposed to the train collision; N=29; (226)†	1 and 3.5 months	Posttraumatic Symptom Scale; PTSD defined according to DSM-IV criteria	Course: prevalence decreased from 28% at 1 month to 24% at 3.5 months

September 11, 2001 Terrorist Attacks, New York City and Washington, DC—September 11, 2001

African-American undergraduates; N=219; (28)**	2-3 days	Modified version of the PTSD Checklist-Civilian Version; caseness required scoring at least 50 out of 85	*Prevalence of PTSD*: 5%; Correlates of PTSD symptoms: having parents not currently together, later college year

Sample	Timing	Measure	Results
Nationally representative sample; N=560 adults, 170 children; (31)**	3-5 days	For adults, 5 questions from the PTSD checklist; for children, 5 questions from the Diagnostic Interview Schedule for Children, Version 4;	*Prevalence of substantial stress reaction*: 44% among adults, 35% among children; *Correlates of PTSD symptoms among adults*: female gender, minority status, prior emotional or mental health problems, proximity to World Trade Center, northeast region residence, more hours of TV coverage viewed on day of attacks; *Correlates of PTSD symptoms among children*: female gender
Patients from 3 community-based outpatient psychiatric and primary care practices in Rhode Island; N=308; (23)**	2-3 weeks	Modified Posttraumatic Diagnostic Scale	*Prevalence of PTSD*: 28%; *Correlates of PTSD prevalence*: psychiatric (vs. medical patient) (OR = 3.17), feeling that the attacks worsened preexisting condition, wanting to speak to clinician about attacks, scheduling appointment to talk about attacks
Random sample of Manhattan adults living south of 110th street; N=988; (24)**	5-8 weeks	National Women's Study PTSD questionnaire	*Prevalence of PTSD*: 7.5%; *Correlates of PTSD prevalence*: Hispanic ethnicity (OR = 2.6), experiencing ≥2 stressors in the 12 months before Sept. 11 (OR = 5.5), panic attack (OR = 7.6), residence south of Canal St. (OR = 2.9), loss of possessions due to the attacks (OR = 5.6)
Random sample of Manhattan adults living south of 110th street; N=988; (29)**	5-8 weeks	National Women's Study PTSD questionnaire	*Correlates of PTSD prevalence*: after adjusting for potential confounders, the association between female gender and PTSD diminished from OR = 2.2 to OR = 1.2
Manhattan adults living south of 110th street; N=988; (123)**	5-8 weeks	National Women's Study PTSD questionnaire	*Correlates of PTSD prevalence*: reporting seeing people falling from the World Trade Center more than 7 times on television (OR = 3.1)
Nationally representative adult sample with oversample of several metropolitan areas; N=2273; (30)**	1-2 months	Specific stressor version of PTSD Checklist; caseness required scoring ≥50	*Prevalence of PTSD*: 11.2% among NYC residents, 4.3% nationally; *Correlates of PTSD prevalence*: being in NYC metro area on Sept. 11, TV coverage viewed per day, graphic Sept. 11 events viewed on TV; *Correlates of PTSD symptoms (NYC sample only)*: younger age, female gender, being in the WTC on Sept. 11, hours of TV coverage viewed per day
Sample of Vietnamese, Cambodian, Laotian, Bosnian, and Somalian refugees with PTSD from a US psychiatric program; N=129; (27)**	Within 2 months	Not reported	Refugees with PTSD showed a strong reaction to the events of Sept. 11, including significant increases in the frequency of recurrent nightmares and intrusive memories, suggesting that the events of Sept. 11 may have reactivated traumatic memories.
NYC parents and their children; N=434; (22)**	4 months	Posttraumatic Stress Disorder Reaction Index—Child Revision	*Prevalence of severe to very severe PTSD symptomatology*: 18% of children; *Correlates of severe to very severe PTSD symptomatology*: parental PTSD since Sept. 11 (OR = 4.50), seeing parents cry (OR = 3.19), disaster images on television (OR = 3.18), living in Manhattan
Nationally representative adult sample of persons residing outside of New York City; N=2729 at 9-23 days, 933 at 2 months, 787 at 6 months; (32)†	9-23 days and; 2 and 6 months	Impact of Events Scale-Revised	*Correlates of PTSD symptoms during follow-up*: female gender (OR = 1.42), prior mental disorder (OR = 1.60), behavioral disengagement (OR = 1.68), denial coping (OR = 1.33), sought social support (OR = 1.47), self-blame (OR = 1.66), self-distraction coping (OR = 1.31), acceptance (OR = 0.71); *Course*: prevalence of PTSD decreased from 17.0% at 2 months to 5.8% at 6 months
Random samples of Manhattan residents (at 1 month) and all adults in NYC (at 4 and 6 months); N=988 at 1 month, 2001 at 4	1, 4, and 6, months	National Women's Study PTSD questionnaire	*Current PTSD prevalence at 6 months among those with PTSD since Sept. 11*: 19.7%; *Correlates of PTSD since Sept. 11 at 6 months*: marital status, social support, previous lifetime traumatic events, pre-disaster life stressors, post-disaster life stressors, living south of 14th St., seeing attacks in person, being

months, 1570 at 6 months; (25)§			directly affected; *Correlates of current PTSD prevalence at 6 months among those with PTSD since Sept. 11*: job loss as results of attacks; *Course*: current PTSD prevalence in Manhattan decreased from 7.5% at 1 month to 1.7% at 4 months to 0.6% at 6 months
Undergraduate volunteer participants at an urban university in the Midwest; N=305; (21)**	4-6 months	Self-report checklist based on DSM-IV PTSD criteria	*Prevalence of PTSD*: 5.9%; *Correlates of PTSD symptoms*: female gender, unmarried marital status, less education, prior history of mental health problems or psychological trauma, viewing television coverage of events, substance use since Sept. 11
Sample of survivors of the Sept. 11 terrorist attack on the Pentagon; N=77; (26)**	7 months	Impact of Events Scale-Revised	*Prevalence of PTSD*: 14%; *Correlates of PTSD prevalence*: female gender, emotional response, peri-traumatic dissociation, lower perceived safety, increased alcohol use
Multiple Disaster Aggregate Samples			
Survivors from 21 terrorist attacks that occurred in France between 1982 and 1987; N=254; (127)**	From 4 months to >3 years	11 items based on DSM-III criteria for PTSD	*Prevalence of PTSD in total sample*: 18.1%; *Correlates of PTSD prevalence*: being severely injured (30.1% among severely injured, 8.3% among moderately injured, 10.5% among uninjured)
Persons from 2 disasters in Vlaanderen, Belgium: 128 survivors of a ballroom fire (Dec. 1994) and 55 survivors from a motor vehicle accident (Feb. 1996); N=183; (118)**	7-9 months after each disaster	Composite International Diagnostic Interview PTSD module, based on DSM-III-R criteria for PTSD	*Incidence of PTSD*: 45.9%; *Correlates of PTSD incidence*: major depression, generalized anxiety disorder, agoraphobia without panic, any disorder other than PTSD
Persons from 2 disasters in Vlaanderen, Belgium: 127 survivors of a ballroom fire (Dec. 1994) and 55 survivors from a motor vehicle accident (Feb. 1996); N=182; (115)**	7-9 months after each disaster	Composite International Diagnostic Interview PTSD module, based on DSM-III-R criteria for PTSD	*Correlates of PTSD prevalence*: number of adverse life events post-disaster (OR = 1.84), severity of adverse life events post-disaster (OR = 1.18), loss of control (OR = 2.86), female gender (OR = 2.35)
46 hotel employees directly and indirectly exposed to a plane crash (Indianapolis, Oct. 1987); 19 employees from 2 businesses directly and indirectly exposed to a shooting spree (Arkansas, Dec. 1987); 42 survivors of a tornado (Florida, Apr. 1988); N=106; (119)**	4-6 weeks after each disaster	Diagnostic Interview Schedule/Disaster Supplement; caseness required meeting DSM-III criteria	*Prevalence of PTSD*: 12.3% in total sample (21.7% in plane-hotel crash sample; 11.1% in shooting sample; 2.4% in tornado sample); *Correlates of PTSD symptoms*: being in the plane-hotel crash sample, directly exposed, more pre-disaster psychiatric diagnoses (among indirectly exposed)

*Timing of assessment(s) after the disaster
** Cross-sectional study design.
‡ OR, odds ratio.
† Prospective cohort study design.
§ Serial cross-sectional study design.

WEB TABLE 3. Key studies assessing post-traumatic stress after natural disasters

Sample; N; (reference no.)	Timeframe*	PTSD Measure	Main Findings
1963 Vajont Landslide and Tidal Wave Flood Disaster, Northeast Italy—October 9, 1963			
Survivors still living in the disaster area 36 years later; N=39 (19)**	36 years	Structured Clinical Interview for DSM-IV	*Prevalence of PTSD*: 26% lifetime, 21% current; *Correlates of lifetime PTSD prevalence*: direct exposure to the tidal wave (greater exposure); *Course*: among the 10 persons with lifetime PTSD, 8 displayed a current diagnosis at 36 years
1983 Australian Bushfire, Southeastern Australia—February 16, 1983			
Firefighters highly exposed to the bushfire; N=469 at 4 months, 395 at 11 months, 337 at 29 months; (68)†	4, 11, and 29 months	12-item General Health Questionnaire; a half cutoff was used to determine caseness	*Correlates of PTSD prevalence at 4 months*: property loss, neuroticism, history of psychological disorder, life events before the fire; *Correlates of PTSD prevalence at 11 months*: property loss, panic during fire, neuroticism; *Correlates of PTSD prevalence at 29 months*: neuroticism, history of psychological disorder, life events between 11 and 29 months; *Course*: 32% prevalence at 4 months, 27% at 11 months, 30% at 29 months
Community sample of firefighters exposed to the bushfire; N=314; (162)†	4, 11, and 29 months	12-item General Health Questionnaire; a half cutoff was used to determine caseness	*Prevalence of PTSD anytime during follow-up*: 50.2%; *Prevalence of acute PTSD*: 9.2%; *Prevalence of chronic PTSD*: 21% (10.2% persistent chronic, 5.7% resolved chronic); *Prevalence of delayed-onset PTSD*: 19.7%; *Correlates of acute PTSD*: avoid thinking about problems; *Correlates of persistent chronic PTSD*: adverse life events before fire, avoid thinking about problems, psychological history, adversity since fire, distress from television reminders of fire, life events between 11 and 29 months; *Correlates of resolved chronic PTSD*: avoid thinking about problems, psychological history; *Correlates of delayed-onset PTSD*: distress from television reminders of fire, avoid thinking about problems
Students from 6 primary schools in highly exposed region; N=808 at 2 months; (220)†	2, 8, and 26 months	Parent and teacher symptom scales	*Correlates of PTSD symptoms at 26 months*: greater exposure, family separation at 2 months, loss of income, maternal fears of future fires, maternal intrusive thoughts, life events during follow-up; *Course*: symptom levels did not decrease significantly between 8 and 26 months
Exposed firefighters at risk (n=112) and not at risk (n=35) for PTSD; N=147; (189)†	4, 11, 29, and 42 months	Diagnostic Interview Schedule, based on DSM-III criteria	*Prevalence of PTSD at 42 months*: 34.0% considered definite cases, 13.6% considered borderline cases; *Correlates of PTSD*: property loss, greater exposure; *Correlates of chronic PTSD (PTSD not resolved at 42 months)*: panic disorder after incident, phobic disorder after incident
Exposed firefighters at risk (n=112) and not at risk (n=35) for PTSD; N=147; (173)†	4, 11, 29, and 42 months	Diagnostic Interview Schedule, based on DSM-III criteria	*Correlates of PTSD prevalence*: use of problem focused coping, use of wishful thinking coping; *Correlates of chronic PTSD and delayed onset PTSD (vs. no PTSD)*: use of wishful thinking coping, use of keeping to self coping
Firefighters at risk for PTSD based on exposure, General Health Questionnaire scores, and Impact of Events Scale; N=50; (172)†	4, 8, 11, 29, and 42 months	General Health Questionnaire, Impact of Events Scale, structured interviews, and the Diagnostic Interview	*Correlate of chronic PTSD at 42 months (vs. recovered cases)*: difficulty concentrating; *Course*: 8 of 15 cases of definite or borderline PTSD at 8 months were still symptomatic at 42 months

Sample	Time	Measure	Findings
1984 Tornadoes, Northeastern North Carolina—March 28, 1984			
Adults survivors from areas damaged by the tornadoes; N=116; (140)**	5 months	Modified version of the Hopkins Symptom Checklist; caseness required meeting DSM-III criteria	*Prevalence of acute PTSD*: 59%; *Correlates of PTSD* prevalence: depression and somatization
1985 Earthquake, Mexico City, Mexico—September 19, 1985			
Adult survivors from 75 shelters in the Mexico City area; N=573; (141)**	Within 10 weeks	A questionnaire based on DSM-III criteria for PTSD	*Prevalence of PTSD*: 32%
1985 Flooding and Mud Slides, Puerto Rico—October 1985			
Adults from disaster exposed and unexposed communities; N=912; (148)**	2 years	Diagnostic Interview Schedule/Disaster Supplement	*Prevalence of PTSD*: 3.7% among the exposed compared to 0.7% among the unexposed
Adults from disaster exposed and unexposed communities; N=912; (190)**	2 years	Diagnostic Interview Schedule/Disaster Supplement	*Correlates of lifetime PTSD symptoms*: pre-disaster levels of lifetime PTSD symptoms, degree of disaster exposure
1988 Cyclone Bola, New Zealand—March 1988			
Adult survivors who were evacuated and/or applied for financial assistance; N=118; (149)**	5 years	Civilian Mississippi Scale; caseness determined using a cutoff score of 96	*Prevalence of PTSD*: 12%; *Correlates of PTSD prevalence*: psychological distress as the time of the cyclone, current psychological distress, previous traumatic events, dissatisfaction with post-disaster assistance, dissatisfaction with post-disaster social support
1988 Yun Nan Earthquake, Yun Nan Province, China—November 6, 1988			
Adults from 3 differentially damaged localities (substantial, moderate, and light damage); N=1295; (142)**	5 months	Diagnostic Interview Schedule, updated to reflect DSM-III-R criteria	*Prevalence of PTSD among those meeting GHQ caseness*: 23.4% in substantially damaged locality, 13.1% in moderately damaged, 16.3% in the lightly damaged; *Estimated disaster-related PTSD in entire sample*: 13.5% in substantially damaged locality, 6.2% in moderately damaged, 7.1% in the lightly damaged
1988 Earthquake in Armenia—December 7, 1988			
Elderly adults and non-elderly adults from 3 Armenian cities (2 highly exposed, 1 mildly exposed); N=179; (191)**	1.5 years	Posttraumatic Stress Disorder Reaction Index	*Prevalence of severe to very severe PTSD symptomatology*: 49.7%; *Correlates of PTSD symptoms*: greater exposure, loss of a family member
Children from 8 schools in 3 Armenian cities (severely exposed, moderately exposed, and mildly exposed); N=218; (164)**	1.5 years	Posttraumatic Stress Disorder Reaction Index	*Prevalence of severe to very severe PTSD symptomatology*: 95% in severely exposed city, 71% in moderately exposed city, 26% in mildly exposed city; *Correlates of PTSD symptoms*: greater exposure, loss of family member, separation anxiety, female gender
Adult employees of the Ministry of Health living in the earthquake region; N=1785; (184)**	2 years	Questionnaire based on DSM-III-R criteria adapted from the Diagnostic Interview Schedule/Disaster Supplement	*Prevalence of PTSD*: 49.6%; *Correlates of PTSD prevalence*: protective factors included more education (OR‡ = 0.6), male gender (OR = 0.6), being accompanied during the earthquake (OR = 0.6), making new friends after the earthquake (OR = 0.6); risk factors included greater exposure (OR = 7.0), financial loss (OR = 2.5), death in the family (OR = 2.6)

Sample	Time	Measure	Findings
Exposed children who immediately relocated (n=24), exposed children who remained (n=25), and unexposed controls (n=25); N=74; (192)**	2.5 years	Diagnostic Interview for Children and Adolescents-Revised, based on DSM-III-R criteria	*Prevalence of PTSD*: 32% in exposed group who remained, 28% in exposed group who relocated, 4% in unexposed group
Exposed mothers who immediately relocated (n=24), exposed mothers who remained (n=25), and unexposed controls (n=25); N=74; (159)**	2.5 years	17 items that asked about each of the 17 DSM-III-R PTSD symptoms	*Prevalence of PTSD*: 92% in exposed group who remained, 89% in exposed group who relocated, 12% in comparison group

1989 Hurricane Hugo, South Carolina—September 10-25, 1989

Sample	Time	Measure	Findings
Exposed undergraduate psychology students; N=193; (144)**	1 month	Caseness required meeting DSM-III-R criteria	*Prevalence of PTSD*: 15%; *Correlates of PTSD symptoms*: resource loss, depression
Exposed preadolescent, early adolescent, and late adolescent children: N=5687; (193)**	3 months	Reaction Index; caseness required meeting DSM-III-R criteria	*Correlates of PTSD prevalence*: trait anxiety, degree of home damage reported, greater reported hurricane severity, being in an unfamiliar location during hurricane, continued displacement, parental job loss due to hurricane, feeling sad, anxious, worried, scared, alone, or angry during the hurricane
Exposed students from Berkeley County, South Carolina middle and high schools; N=5687; (145)**	3 months	Self-report version of the Reaction Index for Children; caseness required meeting DSM-III-R criteria	*Prevalence of PTSD*: 5.42%; *Correlates of PTSD prevalence*: female gender, younger age (pre-adolescent), decrease in school performance
Exposed students from 3 high schools in South Carolina; N=1264; (150)**	1 year	16-item symptom scale based on DSM-III-R criteria	*Prevalence of PTSD*: 4.0% (1.5% among Black males, 4.7% among Black females, 3.8% among White males, 6.2% among White females); *Correlates of PTSD prevalence*: greater exposure (OR = 1.26), violent traumatic events in year after incident (OR = 2.62), White ethnicity (OR = 2.03), female gender (OR = 2.17)
Exposed and unexposed adults from South Carolina, North Carolina, and Georgia; N=831; (146)†	12, 18, and 24 months	5-item scale asking about the occurrence of stress symptoms (e.g., easily startled, numb emotions)	*Correlates of PTSD symptoms at 12 months*: injury, life threat, financial loss, personal loss, scope of impact; *Correlates of PTSD symptoms at 18 months*: injury, life threat, personal loss, scope of impact; *Correlates of PTSD symptoms at 24 months*: injury, life threat, financial loss, scope of impact

1989 Loma Prieta Earthquake, San Francisco Bay Area, California—October 17, 1989

Sample	Time	Measure	Findings
Stanford University undergraduates; N=250 at 14 days pre-disaster, 137 at 10 days post-disaster, 41 at 7 weeks; (182)†	14 days pre-disaster; 10 days and 7 weeks post-disaster	Items from the Interview to Diagnose Depression consistent with DSM-III-R criteria for PTSD	*Correlates of PTSD symptoms at 10 days*: pre-disaster PTSD symptoms, perceived stressors, ruminative responses; *Correlates of PTSD symptoms at 7 weeks*: pre-disaster PTSD symptoms, ruminative responses; *Course*: PTSD symptoms increased significantly from 14 days pre-disaster to 10 days post-disaster; symptoms did not decrease significantly between 10 days and 7 weeks post-disaster
Exposed children from 3 Bay Area communities; N=22; (165)**	6-8 months	Posttraumatic Stress Reaction Index for Children	*Prevalence of PTSD severity*: 27% reported moderate levels of PTSD symptoms and 36% reported mild levels of PTSD symptoms; *Correlates of PTSD symptoms*: proximity to highly damaged area (section of collapsed highway)
Exposed emergency services	1.5 and 3.5	Impact of Events Scale-	*Correlates of PTSD symptoms at 3.5 years*: greater peri-traumatic dissociation

personnel who responded to the I-880 Freeway collapse and unexposed rescue workers and civilians; N=322; (227)†	years	Revised	

1989 Newcastle Earthquake, Newcastle, Australia—December 28, 1989

Random sample of adult Newcastle residents; N=3007; (147)**	6 months	Impact of Events Scale	*Prevalence of PTSD among those exposed to high levels of threat*: 18.3%; *Correlates of PTSD symptoms*: female gender, older age, threat experiences, disruption experiences, avoidance coping
Random sample of elderly and non-elderly Newcastle adults; N=3007; (185)**	6 months	Impact of Events Scale	*Correlates of PTSD symptoms*: female gender, being in elderly group, greater exposure; *Correlates of PTSD symptoms among the elderly*: female gender, threat and disruption experiences due to the earthquake, use of support services, behavioral and avoidance coping
250 adult immigrants from non-English speaking backgrounds and 250 Australian-born matched controls; N=500; (210)**	6 months	Impact of Events Scale	*Correlates of PTSD symptoms*: less education, female gender, being in immigrant group, greater exposure to earthquake, avoidance coping, interaction between female gender and immigrant status, interaction between female gender and older age at time of immigration
Random sample of adult Newcastle residents (n=539) with oversample of highly exposed (n=306); N=845; (211)†	27, 50, 86, and 144 weeks	Impact of Events Scale; cut-off score of 25 identified those with a high likelihood of PTSD	*Course*: between 6 months and 2 years PTSD prevalence decreased from 11% to 3% in the low exposure group, from 19% to 8% in the group experiencing disruption, from 23% to 13% in the group experiencing threat, and from 40% to 19% in the group experiencing both disruption and threat; *Correlates of PTSD scores*: older age, life events 6 months before incident, being injured, greater initial exposure, life events since incident, ongoing disruptions since incident
Random sample of adult Newcastle residents (n=539) with oversample of highly exposed (n=306); N=845; (169)†	27, 50, 86, and 144 weeks	Impact of Events Scale	*Correlates of PTSD symptoms*: older age, neuroticism, greater initial exposure, avoidance coping, ongoing disruptions since incident
Survivors with high levels of threat or disruption exposure; N=515; (206)†	27, 50, 86, and 144 weeks	Impact of Events Scale; cut-off score of 25 identified those with a high likelihood of PTSD	*Prevalence of PTSD*: 18.8% acute PTSD, 14.4% persistent PTSD; *Correlates of acute PTSD*: emotional problems in 6 months pre-disaster, life events in months 6 pre-disaster, threat earthquake exposure, neuroticism, avoidance coping, life events and ongoing disruptions since the earthquake; *Correlates of persistent PTSD*: older age, female gender, less education, emotional problems in 6 months pre-disaster, life events in 6 months pre-disaster, threat earthquake exposure, neuroticism, active and avoidance coping, life events and ongoing disruptions since the earthquake

1990 Wildfire, Southern California—June 27, 1990

Exposed children and adolescents (n=23) from homes damaged or destroyed and unexposed children (n=10); N=33; (200)**	6 weeks	Diagnostic Interview for Children and Adolescents-Revised	*Correlates of PTSD symptoms*: exposed children and adolescents met significantly more PTSD symptom criteria than controls
Children from families that experienced severe or low loss;	6 weeks	Diagnostic Interview for Children and Adolescents	*Prevalence of PTSD*: 2 of 13 children who experienced severe levels of loss had PTSD; *Correlates of PTSD symptoms*: resource loss, number of PTSD

N=22; (59)**

			symptoms reported by parent
1991 Mount Pinatubo Volcanic Disaster, Philippines—June 12, 1991			
Displaced tribal and non-tribal adult survivors from 3 resettlement sites; N=351; (228)**	6 years	17-item PTSD Checklist; caseness required meeting DSM-IV criteria for PTSD	*Prevalence of PTSD*: 27.6%
1991 Oakland/Berkeley Firestorm—October 20, 1991			
Direct survivors, college students forced to evacuate, and graduate students not forced to evacuate; N=154 at 7-9 months; (203)†	1 month and 7-9 months	Civilian Version of the Mississippi Scale for Combat-Related PTSD and the Impact of Events Scale	Correlates of PTSD symptoms (Mississippi Scale): dissociative symptoms, recent life stress, symptoms of loss of personal autonomy; *Correlates of PTSD symptoms (Impact of Events Scale)*: dissociative symptoms, recent life events, symptoms of loss of personal autonomy, contact with the fire, previous life events
1992 Hurricane Andrew, August 16-28, 1992			
Exposed children from an elementary school in southern Dade county, Florida; N=92; (151)†	15 months pre-disaster; 3 and 7 months post-disaster	Posttraumatic Stress Disorder-Reaction Index for Children	*Correlates of PTSD symptoms at 3 months*: greater exposure, anxiety 15 months pre-disaster, greater student inattentiveness 15 months pre-disaster, worse academic skills 15 months pre-disaster; *Correlates of PTSD symptoms at 7 months*: greater exposure, African American ethnicity, anxiety 15 months pre-disaster; *Correlates of persistent PTSD symptoms*: African American ethnicity, anxiety 15 months pre-disaster; *Course of severe to very severe PTSD*: prevalence decreased from 13% at 3 months to 3% at 7 months
Exposed college psychology students; N=220; (178)**	1 month	Reaction Index	*Correlates of PTSD symptoms*: being in more highly impacted group, depression
Volunteer subjects from communities damaged by the hurricane; N=180; (199)**	1-4 months	PTSD in past week assessed using DSM-III-R criteria	*Prevalence of PTSD*: 33%; *Correlates of PTSD prevalence*: hurricane damage, perceived loss, greater injury, perceived life threat
Children from 3 elementary schools severely affected by the hurricane; N=568; (166)**	3 months	Posttraumatic Stress Disorder Reaction Index for Children, based on DSM-III-R criteria	*Prevalence of severe to very severe PTSD symptomatology*: 30%; *Correlates of PTSD symptoms*: perceived life threat, number of life threatening experiences, loss-disruption experiences, female gender, less social support from teachers, less social support from classmates, blame and anger coping, social withdrawal, positive coping
Children in grades from 3 elementary schools in southern Dade county Florida exposed to the hurricane; N=442; (187)†	3, 7, and 10 months	Posttraumatic Stress Disorder Reaction Index for Children, based on DSM-III-R criteria	*Correlates of PTSD symptoms at 10 months*: perceived life threat, life threatening experiences, loss/disruption events in 10 months post-disaster, African American ethnicity, Hispanic ethnicity, less social support from teacher, blame and anger coping; *Correlates of persistent PTSD symptoms*: loss and disruption post-disaster, African American ethnicity, Hispanic ethnicity, intervening life events, low levels of parental social support; *Correlates of persistent PTSD symptoms between 3 and 10 months*: *Course*: prevalence decreased from 39.1% at 3 months to 24.0% at 7 months to 18.1% at 10 months
Exposed adolescent residents from Dade County, Florida; N=400; (152)**	6 months	Diagnostic Interview Schedule, based on DSM-III-R criteria	*Prevalence of PTSD*: 9.2% among females, 2.9% among males; *Correlates of PTSD prevalence*: older age (OR = 1.41), undesirable life events after the incident (OR = 1.38)
Exposed residents (134 Latino, 135	6 months	30-item Revised Civilian	*Prevalence of PTSD*: 24% in total sample (38% among Spanish-preferring Latinos,

Black, 135 White) from 5 neighborhoods in Dade county, Florida; N=404; (153)**		Mississippi Scale; caseness required meeting DSM-IV criteria for PTSD	23% among African Americans, 19% among English-preferring Latinos, 15% among Whites); ethnic differences in PTSD prevalence remained in the highly traumatized groups after controlling for levels of personal and neighborhood trauma
Residents from areas most severely affected; N=61; (194)**	6-12 months	Structured Clinical Interview for DSM-III-R	*Prevalence of new-onset PTSD*: 36%; *Correlates of PTSD prevalence*: severe damage to home
Adult survivors involved in rebuilding; N=96; (204)†	1-4 and 9-12 months	17 questions that asked about the frequency of DSM-III-R PTSD symptoms	*Correlates of PTSD symptoms at 9 months*: intensity of disruption over past month of repair phase
Highly exposed students from an elementary school in the hurricane pathway and mildly exposed controls; N=106 at 8 weeks; (201)†	8 weeks for total sample; 32 weeks for highly exposed	Posttraumatic Stress Disorder Reaction Index, based on DSM-III-R criteria	*Prevalence of severe to very severe PTSD symptomatology at 8 weeks*: 56.4% among highly exposed compared to 38.6% among mildly exposed; *Course*: prevalence of severe to very severe PTSD symptomatology among the highly exposed decreased from 55.3% at 8 weeks to 38.3% 32 weeks
Exposed elementary school students; N=30; (229)†	2, 8, and 21 months	Posttraumatic Stress Disorder Reaction Index, based on DSM-III-R criteria	*Course*: Between 2 and 8 months, PTSD symptoms improved in 30% of the sample, showed no change in 53%, and worsened in 17%; between 2 months and 21 months after the incident, 46.7% improved, 46.7% showed no change, and 6.6% worsened
Exposed residents of Dade County, Florida; N=404 at 6 months, 241 at 28-30 months; (207)†	6 and 28-30 months	30-item Revised Civilian Mississippi Scale; caseness required meeting DSM-IV criteria for PTSD	*Correlates of avoidance symptoms at 6 months*: minority status, life events post-disaster, less self-esteem, less perceived control; *Correlates of avoidance symptoms at 28-30 months*: avoidance scores at 6 months, female gender, past year trauma, acculturative stress, less self-esteem, less social embeddedness; *Correlates of intrusion symptoms at 6 months*: female gender, minority status, Latino ethnicity, younger age, being married, threat to life, life events post-disaster; *Correlates of intrusion symptoms at 28-30 months*: intrusion scores at 6 months, less self-esteem, life-events post-disaster; *Correlates of arousal symptoms at 6 months*: female gender, African American ethnicity, property damage, life events post-disaster; *Correlates of arousal symptoms at 28-30 months*: arousal scores at 6 months, injury, life events post-disaster, less self-esteem; *Course*: PTSD prevalence increased from 25.7% at 6 months to 28.6% at 28-30 months; symptoms of intrusion and arousal declined significantly over follow-up, but symptoms of avoidance increased
1992 Typhoons in US Pacific, Guam—August 28, 1992-November 1992			
Population survey of US military personnel and spouses exposed to all 5 typhoons; N=320; (154)**	8 months after 1st typhoon	Validated symptom scale and the Impact of Events Scale; caseness required meeting DSM-IV criteria and scoring >19 on the IES	*Prevalence of PTSD*: 5.9%; *Correlates of PTSD prevalence*: diagnosis of Acute Stress Disorder at 1 week after first typhoon

1993 Floods, Perth, Scotland—January 17, 1993			
Exposed adults residents who suffered material loss in the flood; N=44; (155)**	Not reported	Questionnaire asking about the frequency of DSM-III-R PTSD symptoms	*Prevalence of PTSD*: 25%; *Correlates of PTSD symptoms*: emotion-focused coping, thought suppression coping
1993 Great Midwest Floods—1993			
Exposed adults from Des Moines and West Des Moines; N=106; (208)**	4 months	6 modified questions from the University of Michigan version of the Composite International Diagnostic Interview	*Correlates of PTSD symptoms*: more anxiety after the flood, temporary or permanent loss of employment because of the flood, renting property, lower likelihood of identifying positive outcomes
Exposed St. Louis area residents; N=162; (156)**	2-7 months	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III-R criteria	*Prevalence of flood-related PTSD*: 22%; *Correlates of PTSD prevalence*: prior psychiatric history, non-PTSD post-disaster disorder
1993 Marathwada Earthquake, Western India—September 30, 1993			
Adults from 23 households within 15 km of the epicenter; N=56; (157)**	1 month	PTSD diagnosis according to DSM-III-R criteria	*Prevalence of PTSD*: 23%
1994 Northridge Earthquake, Los Angeles Area—January 17, 1994			
Survivors from the area of greatest property damage; N=130; (177)**	3 months	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III criteria	*Prevalence of PTSD*: 13%; *Correlates of PTSD prevalence*: history of psychiatric disorder (OR = 5.30), female gender (OR = 6.49), post-disaster non-PTSD psychiatric disorder (OR = 6.24)
Children from a family-genetic study diagnosed with a preexisting psychopathology; N=63; (179)**	1 year	Children's Posttraumatic Stress Disorder Reaction Index	*Correlates of PTSD symptoms*: preexisting anxiety disorder, use of cognitive coping, current general anxiety, current depression, social adjustment problems with friends
1994 Avalanche, Norway—March 3, 1994			
Norwegian soldiers buried by the avalanche, involved in the rescue effort, or unexposed; N=133 at 2 weeks, 94 at 4 months; (175)†	2 weeks and 4 months	Impact of Events Scale and the Posttraumatic Stress Scale-10; caseness required a PTSS-10 score ≥5	*Correlates of PTSD symptoms at 2 weeks*: being in buried, involvement in rescue, lower coping scores; *Course*: prevalence of PTSD in the total sample decreased from 6% at 2 weeks to 3% at 4 months; (prevalence increased from 9% to 12% among those buried, decreased from 10% to 0% among rescuers, and decreased from 4% to 2% among the unexposed)
1995 Hanshin-Awaji Earthquake, Japan—January 17, 1995			
Elderly adults and non-elderly adults from a Shelter in Kobe; N=142 at 3 weeks, 123 at 8 weeks; (213)§	3 and 8 weeks	10 items from the Posttraumatic Symptoms Scale	*Course*: between 3 and 8 weeks, the average number of symptoms experienced did not decrease significantly among non-elderly adults, but did decrease significantly among elderly adults
Adult employees of 5 manufacturing companies in the exposed area; N=380; (188)**	13-15 months	17-item questionnaire based on DSM-IV criteria	*Correlates of PTSD symptoms*: poor perceived physical health, earthquake-related life events, no emotional support network (males only), older age (males only), being unmarried (males only)
Male workers employed by companies located in the exposed area; N=155; (195)**	14-18 months	19-item questionnaire based on DSM criteria; caseness required scoring ≥9	*Prevalence of PTSD*: 9.0%; *Correlates of PTSD symptoms*: living in areas of higher seismic intensity

Random selection of male residents of the town closest to the epicenter; N=108; (205)**	20 months	19-item questionnaire based on DSM-IV criteria for PTSD	*Correlates of PTSD symptoms*: reporting worse lifestyle/health practices after the earthquake

1995 Hurricane Opal, Florida—October, 1995

Exposed adult residents; N=67; (174)**	4-5 months	Impact of Events	*Correlates of PTSD symptoms*: coping self efficacy; coping self efficacy mediated the relation between loss of resources and PTSD symptoms

1997 Floods, Central Valley, Northern California—Early 1997

Residents from rural/agricultural areas devastated by the floods; N=131 at 1-3 months, 74 at 1 year; (230)†	1-3 months and 1 year	17-item PTSD Checklist; PTSD caseness required meeting DSM-IV criteria	*Prevalence of PTSD at 1 year*: 10%; *Correlates of PTSD symptoms*: greater exposure to loss, acute stress disorder symptoms between 1 and 3 months

1998 Zhangbei-Shangyi Earthquake, North Hebei Province, China—January 10, 1998

Adults from a highly exposed and a moderately exposed village; N=181 at 3 months, 157 at 9 months; (215)†	3 and 9 months	DSM-IV diagnoses made using an instrument based on the Composite International Diagnostic Interview PTSD module	*Prevalence of current PTSD at 3 months*: 14.4% (22.7% among moderately exposed compared to 8.5% among highly exposed); *Prevalence of current PTSD at 9 months*: 17.8% (22.7% among moderately exposed compared to 14.3% among highly exposed; *Course*: prevalence increased between 3 and 9 months

1998 Sarno Landslide, Southern Italy—May 5, 1998

Exposed adults (n=272) from the most severely affected area and unexposed controls (n=72); N=344; (180)**	1 year	Self-Rating Scale for PTSD, derived from Structured Interview for PTSD; caseness required meeting DSM-IV criteria	*Prevalence of PTSD*: 27.6% among exposed compared to 1.4% among unexposed; *Correlates of PTSD prevalence*: physical injury, injuries suffered by family members, family problems, leaving the house in the past 3 months, depressive symptoms, anxiety symptoms

1998 Hurricane Mitch, Nicaragua—October 1998

Adolescents from 3 public schools in 3 differentially exposed cities; N=156; (143)**	6 months	Child Posttraumatic Stress Disorder Reaction Index; casesness required scoring ≥40	*Prevalence of PTSD*: 90% in the most devastated city and 14% in the least devastated city; *Correlates of PTSD symptoms*: being in more devastated city, objective hurricane related experiences, subjective hurricane related experiences, current thoughts of revenge
Consecutive exposed adult patients from 4 primary health centers; N=496; (183)†	6 and 12 months	Harvard Trauma Questionnaire; caseness defined using a cutoff of 50/51	*Prevalence of PTSD at 6 months*: 5.9%; *Correlates of PTSD symptoms*: death or injury of relative, destruction of house, female gender, previous mental health problems, illiteracy, never married; *Course*: 12 of 23 (52%) PTSD cases identified at 6 months and followed-up at 12 months still had PTSD

1999 Chi-Chi Earthquake, Taiwan—September 21, 1999

Survivors who consecutively sought psychiatric service; N=525; (176)**	1 month	17-item checklist based on DSM-IV criteria for PTSD	*Correlates of reexperiencing PTSD symptoms*: female gender, injury of relatives, nervous traits, obsessive traits; *Correlates of avoidance PTSD symptoms*: nervous traits, obsessive traits; *Correlates of arousal PTSD symptoms*: female gender, older age, destruction of property, nervous traits, obsessive traits
Students from 2 junior high schools who remained in the worst affected area, Chungliao; N=323; (168)**	6 weeks	Children's Interview for Psychiatric Syndromes based on DSM-IV criteria	*Prevalence of PTSD*: 21.7%; *Correlates of PTSD prevalence*: physical injury (OR = 2.35), death of a close family member with whom the student lived (OR = 5.58)

Survivors from Pu-Li, one of the most damaged towns, screened at a local hospital; N=663; (231)**	3-4 months	17-item checklist based on DSM-IV PTSD criteria; caseness required greater than 2 reexperiencing, 4 avoidance, and 3 arousal symptoms	*Prevalence of PTSD*: 11.3%; *Correlates of PTSD prevalence*: female gender (OR = 2.69), older age (OR = 7.83), severe destruction to home (OR = 2.93)
Male professional firefighters involved in rescue work following the collapse of a building in Taipei City; N=84; (163)**	5 months	Impact of Events Scale; caseness required scoring ≥26	*Prevalence of PTSD*: 21.4%; *Correlates of PTSD prevalence*: longer job experience (OR = 6.87), distancing coping (OR = 2.20), use of escape-avoidance coping (OR = 1.43), positive reappraisal coping (protective) (OR = 0.59)
		1999 Turkey Earthquakes, Marmara region, Turkey—August 17, 1999 and November 12, 1999	
Exposed school-aged children (n=202) displaced to a prefabricated village and unexposed children (n=101); N=303; (196)**	4-5 months	Child Version of the Posttraumatic Stress Reaction Index	*Correlates of PTSD symptoms*: being in exposed group, lack of sleep in days after earthquake, past traumatic experiences, personal losses, traumatic dissociation and grief
Adult survivors from 3 "tent cities" and 2 prefabricated housing sites in the disaster region; N=1000; (197)**	3-9 months in camps; 7-14 months in housing sites	17-item Traumatic Stress Symptom Checklist based on DSM-IV criteria; caseness determined using cutoff of 25	*Prevalence of PTSD*: 43%; *Correlates of PTSD symptoms*: fear during the earthquake, female gender, trapped under rubble, death of a family member, past psychiatric illness, participated in rescue work, longer time between earthquake and assessment, less education
35 randomly selected families (30 fathers, 35 mothers, 49 children) living in a tent city 30 km from the epicenter of the 2nd earthquake; N=114; (209)**	6 months after 2nd quake	For children, the Child Posttraumatic Stress Disorder Reaction Index; for adults, the 17-item Self-rating Scale for Posttraumatic Stress Disorder, based on DSM-III-R criteria	*Prevalence of PTSD among parents*: 44.1% among mothers, 34.5% among fathers; *Correlates of PTSD symptoms among children*: PTSD in father, female gender, paternal depression symptoms
Consecutive self-referred adult survivors from a community center for psychological treatment; N=1027; (158)**	14 months	17-item Traumatic Stress Symptom Checklist based on DSM-IV criteria; caseness determined using cutoff of 25	*Prevalence of PTSD*: 63%; *Correlates of PTSD symptoms*: fear during the earthquake, female gender, less education, loss of friends or neighbors, shorter time between earthquake and assessment, material loss
Adult survivors from 3 prefabricated housing sites within 10 km of the epicenter; N=568; (219)**	20 months	17-item Traumatic Stress Symptom Checklist based on DSM-IV criteria; caseness determined using cutoff of 25	*Prevalence of PTSD*: 39%; *Correlates of PTSD symptoms*: fear during the earthquake, female gender, older age, participation in rescue work, loss of friends or neighbors, history of psychiatric illness
Adult survivors from randomly sample households in Bolu (45 km from	18 months after 2nd	17-item Traumatic Stress Symptom Checklist based	*Prevalence of PTSD*: prevalence was 41.9% in Duzce (the epicenter), 18.6% in Bolu (45 km from the epicenter); *Correlates of PTSD prevalence*: fear during

Sample	Time	Instrument	Findings
the 2nd earthquake) and Duzce (at the epicenter); N=430; (214)**	quake	on DSM-IV criteria; caseness determined using cutoff of 25	the earthquake, loss of friends and neighbors, female gender, less education, living in rented accommodation

1999 Hurricane Floyd—September 1999

Sample	Time	Instrument	Findings
Fourth grade students from a North Carolina public school destroyed by the hurricane; N=150; (167)**	6 months	Child Version of the Posttraumatic Stress Reaction Index	*Prevalence of severe to very severe PTSD symptomatology*: 34.6%; Correlates of severe to very severe PTSD symptomatology: female gender (OR = 2.7), flooding of home (OR = 3.0); *Correlates of PTSD symptoms*: social withdrawal coping, self-criticism coping, blaming others coping, problem solving coping, emotional regulation coping

1999 Taiwan Earthquake, Nantou Country, Taiwan—September 21, 1999

Sample	Time	Instrument	Findings
Bereaved survivors from 109 households from 2 townships; N=120; (171)**	2 months	Mini-International Neuropsychiatric Interview, with diagnosis according to DSM-IV criteria	*Prevalence of PTSD*: 37%; *Correlates of PTSD prevalence*: number of psychosocial stressors (OR = 3.03), initial feelings of guilt (OR = 3.69)

1999 Orissa Supercyclone, Orrisa, India—October 1999

Sample	Time	Instrument	Findings
Exposed adults (n=65) from the devastated area and unexposed adults (n=65); N=130; (160)**	3 months	Clinical interviews with diagnosis according to DSM-IV criteria	*Prevalence of PTSD*: 89% among exposed compared to 11% among unexposed

2000 Icelandic Earthquakes, Southwest Iceland—June 17, 2000 and June 21, 2000

Sample	Time	Instrument	Findings
Probability sample of exposed (n=52) and unexposed (n=29) adults; N=81; (161)**	3 months	Harvard Trauma Questionnaire, based on DSM-III-R criteria; caseness required HTQ scores >2	*Prevalence of PTSD*: 24% in the exposed region compared to 0% in the unexposed region; *Correlates of PTSD symptoms*: anxiety caused by small tremors, anxiety about a major new earthquake, emotional coping, weaker ability to express feelings and thoughts

2000 Miyake Island Volcanic Eruption, Japan—2000

Sample	Time	Instrument	Findings
Adult evacuees from the Island; N=231; (232)**	10 months	Impact of Events Scale-Revised	*Correlates of PTSD symptoms*: help-seeking from physicians, help seeking from counselors, help seeking from social workers

Multiple Disaster Aggregate Samples

Sample	Time	Instrument	Findings
288 adults from Coalinga, California exposed to an earthquake (May 1983), 116 adults from a housing project in Santiago, Chile exposed to an earthquake (March 1985), and 3131 unexposed controls; N=3535; (186)**	8 months in Santiago; 15 months in Coalinga	13-item instrument; caseness required satisfying DSM-III criteria	*Prevalence of PTSD*: 19.3% in Santiago (23.8% among females, 5.9% among males), 2.7% in Coalinga (3.5% among females, 0.8% among males), 2.2% among unexposed (3.1% among females, 1.0% among males)
30 Armenian adults from a city severely exposed to an earthquake (Dec. 1988), 29 adults from a city mildly exposed to the same earthquake, and 19 Armenian adults exposed to	1.5 and 4.5 years	PTSD Reaction Index; caseness required scoring ≥40	*Correlates of PTSD symptoms at 1.5 years*: being in severely exposed earthquake or political violence group, depressive symptoms, anxiety symptoms; *Correlates of PTSD symptoms at 4.5 years*: being in severely exposed earthquake or political violence group, PTSD symptoms at 1.5 years, depression symptoms at 1.5 years, anxiety symptoms at 1.5 years, depression symptoms at 4.5 years, anxiety symptoms at 4.5 years; *Course*: between 1.5 and 4.5 years prevalence

Sample	Timing*	Measure	Results
severe political violence (Feb. 1988); N-78; (181)†			decreased from 86.7% to 73.3% among severely exposed earthquake survivors, decreased from 13.8% to 6.9% among mildly exposed earthquake survivors, and increased from 89.5 to 94.7% among survivors of political violence
US sample of adults (135 Whites, 135 Blacks) exposed to Hurricane Andrew (1992) and Mexican sample of adults (n=200) exposed to Hurricane Paulina (1997); N=470; (233)**	6 months	Revised Civilian Mississippi Scale; caseness required meeting DSM-IV criteria for PTSD	*Prevalence of PTSD*: prevalence was higher among females than males (19.4% vs. 5.9% among US Whites, 23.2% vs. 19.7% among US Blacks, 43.8% vs. 14.4% among Mexicans); *Correlates of PTSD symptoms*: younger age, less education, greater exposure, female gender, interaction of Mexican ethnicity and female gender; *Correlates of lower PTSD symptoms*: interaction between African American ethnicity and female gender; *Correlates of PTSD prevalence*: greater exposure, African American ethnicity, female gender, interaction of Mexican ethnicity and female gender
US sample of adults (n=270) exposed to Hurricane Andrew (1992), Mexican sample of adults (n=200) exposed to Hurricane Paulina (1997), and Polish sample of adults (n=285) exposed to flood (1997); N=755; (212)**	6 months in the US and Mexico; 1 year in Poland	Revised Civilian Mississippi Scale	*Correlates of PTSD symptoms in US sample*: female gender, greater exposure, middle-aged, age and exposure interaction; *Correlates of PTSD symptoms in Mexican sample*: female gender, greater exposure, less education, younger age; *Correlates of PTSD symptoms in Polish sample*: female gender, greater exposure, less education, older age, age and female gender interaction
St. Louis sample of adults exposed or unexposed (n=543) to flooding and/or dioxin contamination (1982) and Puerto Rican sample of adults exposed or unexposed (n=912) to flooding and mudslides (Oct. 1985); N=1455; (202)**	1 year in St. Louis; 2 years in Puerto Rico	Diagnostic Interview Schedule/Disaster Supplement, based on DSM-III criteria	*Correlates of PTSD symptoms*: exposure to disaster (Puerto Rico sample only), greater support burden (Puerto Rico sample only)
Non-bereaved adults (n=39) either forced to leave their homes after a tornado in Albion, PA (May 1985) or exposed to a flood in Parsons, WV (n=76) (Nov. 1985); N=115 at 4 months; (234)†	4 and 16 months	Impact of Events Scale and the Diagnostic Interview Schedule; caseness for the IES required scoring >19	*Course of PTSD incidence (according to DIS)*: incidence decreased in Parsons from 14.5% at 4 months to 4.5% at 16 months; incidence over the 16 month period in Albion was 21.0%; *Course of high levels of PTSD symptomatology (according to the IES)*: prevalence decreased from 76% at 4 months to 49% at 16 months after the tornado in Albion and from 41% to 24% after the flood in Parsons

*Timing of assessment(s) after the disaster
** Cross-sectional study design.
‡ OR, odds ratio.
† Prospective cohort study design.
§ Serial cross-sectional study design.

WEB TABLE 4. Summary of studies assessing the prevalence and course of PTSD after disasters

Disaster (reference no.)	Instrument*	T1[‡]	Prevalence at T1	T2[‡]	Prevalence at T2	T3[‡]	Prevalence at T3
			Studies of directly exposed adult samples				
Human-made or technological disasters							
Aberfan mining disaster; (62)	CIDI, IES	33 years, anytime	46%	32 years, current	29%		
Piper Alpha oil rig disaster; (73)	CAPS, DSM-IV	Acute	73%	10 years, current	21%		
Toxic chemical spill; (108)	IES	3-4 months	14.9%				
Exxon Valdez Oil Spill; (92)	DIS, DSM-III-R	1 year	9.4%				
Exxon Valdez Oil Spill; (70)	SCL-90R	6 years	34% (males), 40% (females)				
Buffalo Creek dam collapse; (125)	SCI, DSM-III-R	2 years	44%	14 years	28%		
Buffalo Creek dam collapse; (75)	SCI, DSM-III	14 years, anytime	59.4%	14 years, current	25%		
Buffalo Creek dam collapse; (126)	SCI, DSM-III-R	17 years, anytime	32%	17 years, current	7%		
M/S Estonia disaster; (111)	PTSS, IES	3 months	64.3%				
Jupiter shipping disaster; (63)	PTSS, DSM-III-R	3 months	35.1%	6 years	8.1%		
Herald of Free Enterprise disaster; (74)	DSM-III-R	Within 2 years	36%				
Airplane crash landing; (136)	SCI, DSM-III	12 days	54%	12 months	10-15%		
Jet fighter crash; (72)	DIS/DS, DSM-III	4-6 weeks	22%				
Bijlmermeer plane crash (132)	DSM-III-R	6 months	26%				
Kegsworth air disaster; (69)	DSM-III-R	6-12 months	40%				
Lockerbie disaster; (78)	DSM-III-R	10-14 months	44%				
Lockerbie disaster; (139)	DSM-III-R	10-14 months	72%	3 years	48%		
Lockerbie disaster; (138)	DSM-III-R	1 year	74%	3 years	16%		
Bus disaster; (41)	PCL, DSM-III-R	8-10 months	33%				
Train collision; (226)	PTSS, DSM-IV	1 month	28%	3.5 months	24%		
Mass shooting episode; (71)	DIS/DS, DSM-III-R	1 month	28.6%				
Mass shooting epidsode; (66)	DIS/DS, DSM-III-R	6-8 weeks	27.2%	13-14 months	17.7%		
Mass shooting episode (110)	DIS/DS, DSM-III-R	6-8 weeks	29%	13-14 months	17%	3 years	19%
Mass shooting episode (64)	DIS/DS, DSM-III-R	6-8 weeks	26%	1 year	14%	3 years	18%
Courthouse shooting; (67)	DIS/DS	6-8 weeks	4.1%				
School shooting; (101)	RI; DSM-III-R	8-14 months	3%				
Oklahoma City bombing; (10)	DIS/DS, DSM-III-R	6 months	34.3%				
Subway bombing; (135)	IES, DSM-III-R	6 months, current	39%	32 months, current	25%		

September 11 terrorist attacks on Pentagon; (26)	IES-R	7 months	14%		
Oklahoma City bombing (224)	DSM-IV	1.5-3 years	4%		
Oklahoma City bombing; (122)	DIS	34 months	23%		
Sivas religious uprisings(130)	DSM-III-R	Acute	20.3%		

Natural disasters

Mount Pinatubo volcanic eruption; (228)	PCL, DSM-IV	6 years	27.6%		
Norway avalanche; (175)	IES, PTSS	2 weeks	9%	4 months	12%
Sarno landslide; (180)	DSM-IV	1 year	27.6%		
Vajont landslide and flood; (19)	SCI, DSM-IV	36 years, anytime	26%	26 years, current	21%
Flooding and mud slides; (148)	DIS/DS	2 years	3.7%		
Great Midwest floods; (156)	DIS/DS, DSM-III-R	2-7 months	22%		
Northern California floods; (230)	PCL, DSM-IV	1 year	10%		
North Carolina tornadoes; (140)	HSC, DSM-III	Acute	59%		
Orissa supercyclone; (160)	DSM-IV	3 months	89%		
Pacific typhoons; (154)	IES, DSM-IV	8 months	5.9%		
Cyclone Bola; (149)	MS	5 years	12%		
Hurricane Hugo; (144)	DSM-III-R	1 month	15%		
Hurricane Andrew; (153)	MS-R, DSM-IV	6 months	24%		
Hurricane Andrew; (207)	MS-R, DSM-IV	6 months	25.7%	28-30 months	28.6%
Hurricane Andrew; (194)	SCI, DSM-III-R	6-12 months	36%		
Marathwada earthquake; (157)	DSM-III-R	1 month	23%		
Taiwan earthquake; (171)	DSM-IV	2 months	37%		
Mexico City earthquake; (141)	DSM-III	Within 10 weeks	32%		
Icelandic earthquakes; (161)	HTQ, DSM-III-R	3 months	24%		
Northridge earthquake; (177)	DIS/DS, DSM-III	3 months	13%		
Chi-Chi earthquake; (231)	DSM-IV	3-4 months	11.3%		
Zhangbei-Shangyi earthquake; (215)	DSM-IV	3 months, current	14.4%	9 months, current	17.8%
Turkey earthquakes; (197)	TSSC, DSM-IV	3-14 months	43%		
Newcastle earthquake; (147)	IES	6 months	18.3%		
Hanshin-Awaji earthquake (195)	DSM	14-18 months	9%		
Turkey earthquakes; (214)	TSSC, DSM-IV	18 months	41.9% near, 18.6% far		
Turkey earthquakes; (219)	TSSC, DSM-IV	20 months	39%		
Armenian earthquake (184)	DIS/DS, DSM-III-R	2 years	49.6%		

Studies of rescue, emergency, medical, or clean-up personnel samples

Human-made or technological disasters

Chernobyl nuclear accident; (85)	DSM-III-R	6-7 years	20%				
Swissair Flight 111 crash; (114)	PTSS, DSM-IV	4 months, current	46%				
US Air Flight 427 crash; (84)	DSM	6 months	4.9%				
Air show midair collision; (82)	IES, DSM-III-R	12 months	12.1%	18 months	7.3%		
USS Iowa Gun Turret Explosion (137)	SCL-90R, IES, DSM-III-R	1 month	11%	4 months	10%	13 months	2%
Building explosion; (80)	DSM-III	5 months	13.9%				
N149 supertanker explosion; (105)	IES	6.5 months	41%				
Omagh bombing; (88)	PTSS, DSM-IV	4 months	6%	17 months 12%			
Oklahoma City bombing; (89)	DIS	34 months	13%				

Natural disasters

Norway avalanche; (175)	IES, PTSS	2 weeks	10%	4 months	0%		
Australian bushfire; (68)	GHQ	4 months	32%	11 months	27%	29 months	30%
Australian bushfire; (162)	GHQ	29 months, anytime	50.2%				
Australian bushfire; (189)	DIS, DSM-III	42 months	34%				
Chi-Chi earthquake; (163)	IES	5 months	21.4%				

Studies of indirectly exposed, general population, or community samples

Human-made or technological disasters

Chernobyl nuclear accident; (91)	GHQ, DSM-III-R	6.5 years	2.4% near, 0.4% far				
Los Angeles civil disturbances (65)	NWS, DSM-III-R	6-8 months, current	4.1%				
School hostage situation; (102)	DSM-IV	4 months	10%	7 months	6%	18 months	0%
September 11 terrorist attacks; (28)	PCL	2-3 days	5%				
September 11 terrorist attacks; (24)	NWS	5-8 weeks	7.5%				
September 11 terrorist attacks; (25)	NWS	1 month, current	7.5%	4 months, current	1.7%	6 months, current	0.6%
September 11 terrorist attacks; (30)	PCL	1-2 months	11.2% in NYC, 4.3% nationally				
September 11 terrorist attacks; (32)	IES-R	2 months	17%	6 months	5.8%		

Studies of directly exposed children, adolescent, or student samples

Human-made or technological disasters

Buffalo Creek dam collapse; (95)	DSM-III-R	2 years	37%			
Jupiter shipping disaster; (77)	CAPS, DSM-IV	5-8 years, anytime	51.5%			
Industrial fire (134)	PTSS, DSM-III-R	9 months	11.9%			
1993 World Trade Center bombing;	RI	3 months	27%	9 months	14%	

(60)							
Brooklyn Bridge shooting (43)	PTSS, DSM-IV	8 weeks	28%				
School hostage situation; (102)	DSM-IV	4 months	4%	7 months	12%	18 months	5%
School shooting; (101)	RI; DSM-III-R	8-14 months	8%				
Natural disasters							
Hurricane Hugo; (145)	RI, DSM-III-R	3 months	5.42%				
Hurricane Andrew; (187)	RI, DSM-III-R	3 months	39.1%	7 months	24%	10 months	18.1%
Hurricane Mitch; (143)	RI-C	6 months	90% (near), 14% (far)				
Hurricane Andrew; (152)	DIS, DSM-III-R	6 months	2.9% (males), 9.2% (females)				
Hurricane Hugo; (150)	DSM-III-R	1 year	4%				
Chi-Chi earthquake; (168)	DSM-IV	6 weeks	21.7%				
Armenian earthquake; (192)	DICA-R, DSM-III-R	2.5 years	32%				

Studies of specific populations (i.e. clinical/psychiatric patients)

Human-made or technological disasters							
September 11 terrorist attacks; (23)	PDS	2-3 weeks	28%				
Natural disasters							
Hurricane Mitch; (183)	HTQ	6 months	5.9%				
Turkey earthquakes; (158)	TSSC, DSM-IV	14 months	63%				

*CAPS=Clinician Administered PTSD Scale; CIDI=Composite International Diagnostic Interview; DICA-R=Diagnostic Interview for Children and Adolescents-Revised; DIS=Diagnostic Interview Schedule; DIS/DS=Diagnostic Interview Schedule/Disaster Supplement; DSM=Diagnostic and Statistical Manual; GHQ=General health questionnaire; HSC=Hopkins Symptom Checklist; HTQ=Harvard Trauma Questionnaire; IES=Impact of Events Scale; IES-R=Impact of Events Scale-Revised; MS=Mississippi Scale; MS-R=Mississippi Scale-Revised; NWS=National Women's Study PTSD questionnaire; PCL=PTSD Checklist; PTSS=Posttraumatic Symptom Scale; RI=Reaction Index; RI-C=PTSD Reaction Index-Child Version; SCI=Structured Clinical Interview; SCL=Symptom Checklist; TSSC=Traumatic Stress Symptom Checklist

‡T1=time of first assessment after the disaster, T2=time of second assessment after the disaster, T3=time of the third assessment after the disaster; cells left empty indicate that no assessment exists for either the second or third assessment; only studies where there was a clear first assessment of prevalence after the disaster are included in the table.