

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/258131444>

# Disaster Studies

Article in *Current Sociology* · September 2013

DOI: 10.1177/0011392113484456

CITATIONS

96

READS

16,753

1 author:



Michael K Lindell

University of Washington Seattle

229 PUBLICATIONS 22,661 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Project

Evacuation research [View project](#)



Project

Uncertainty visualization [View project](#)

# Current Sociology

<http://csi.sagepub.com/>

---

## Disaster studies

Michael K Lindell

*Current Sociology* 2013 61: 797 originally published online 30 May 2013

DOI: 10.1177/0011392113484456

The online version of this article can be found at:

<http://csi.sagepub.com/content/61/5-6/797>

---

Published by:



<http://www.sagepublications.com>

On behalf of:



International Sociological Association

**Additional services and information for *Current Sociology* can be found at:**

**Email Alerts:** <http://csi.sagepub.com/cgi/alerts>

**Subscriptions:** <http://csi.sagepub.com/subscriptions>

**Reprints:** <http://www.sagepub.com/journalsReprints.nav>

**Permissions:** <http://www.sagepub.com/journalsPermissions.nav>

>> [Version of Record](#) - Aug 19, 2013

[OnlineFirst Version of Record](#) - May 30, 2013

[What is This?](#)



## Disaster studies

Current Sociology Review

61(5-6) 797-825

© The Author(s) 2013

Reprints and permissions:

sagepub.co.uk/journalsPermissions.nav

DOI: 10.1177/0011392113484456

csi.sagepub.com

**Michael K Lindell**

Texas A&M University, USA



### Abstract

Disaster studies address the social and behavioral aspects of sudden onset collective stress situations typically referred to as mass emergencies or disasters. These situations can be created by natural hazards, technological accidents, violent intergroup conflicts, shortages of vital resources, and other major hazards to life, health, property, well-being, and everyday routines. Disaster studies address the impacts of these events on all social units ranging from individuals and households to nation-states. All aspects of the life history of such events, both actual and threatened, are examined in terms of the ways in which populations at risk conduct hazard and vulnerability analyses as well as plan and implement mitigation, preparedness, response, and recovery actions.

### Keywords

Crisis, convergence, disaster, emergence, emergency, improvisation, mitigation, preparedness, recovery, response, vulnerability

### Basic definitions

There are three categories of definitions of disaster – classic, hazards/disasters, and socially focused (Perry, 2006). According to Fritz (1961: 655), a disaster is ‘an event concentrated in time and space, in which a society or one of its subdivisions undergoes physical harm and social disruption, such that all or some essential functions of the society or subdivision are impaired.’ Physical harm and social disruption occur because an event exceeds normal protections (Kreps, 1984). Events that are concentrated in time and space distinguish an earthquake that might cause 50 deaths in a few minutes from automobile accidents that cause approximately 34,000 per year in the US (NSC, 2011).

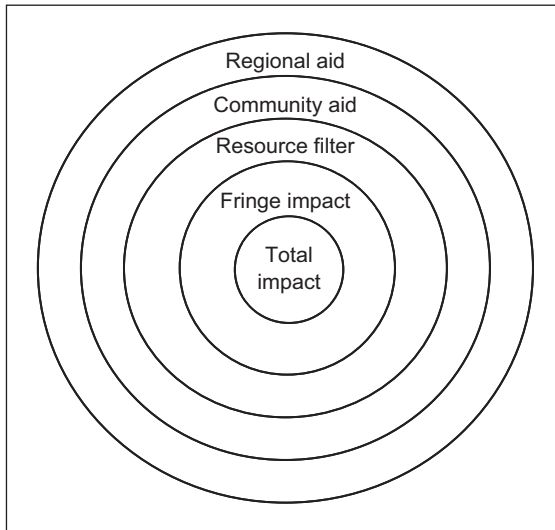
A disaster’s concentration in time obviously defines three temporal periods – pre-impact, trans-impact, and post-impact. However, some disasters have multiple (e.g., earthquake aftershocks) or secondary (e.g., hazardous materials releases) impacts so identifying the

---

### Corresponding author:

Michael K Lindell, Hazard Reduction and Recovery Center, 3137 TAMU Texas A&M University, College Station, TX 77843-3137, USA.

Email: mlindell@tamu.edu



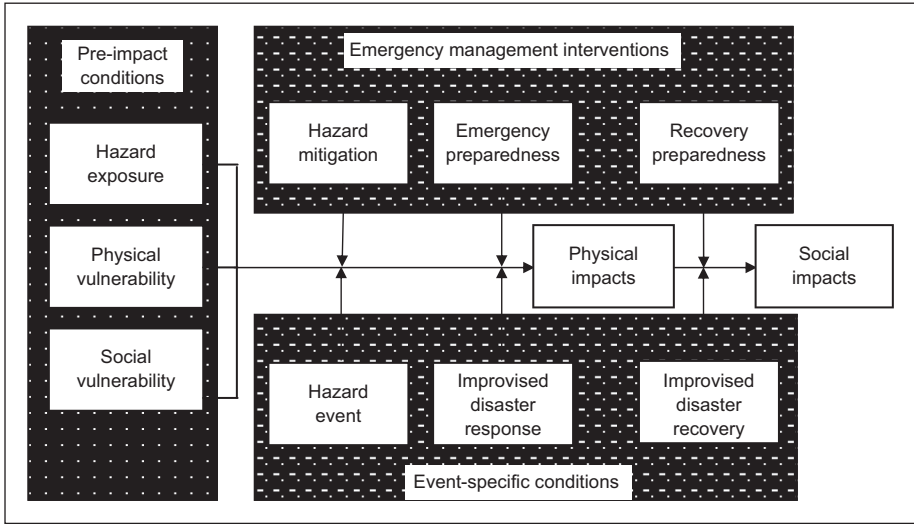
**Figure 1.** Disaster impact zones.

Source: Dynes (1970).

time at which impact occurs can be difficult. Alternatively, disaster phases are defined in terms of hazard mitigation, disaster preparedness, emergency response, and disaster recovery (NGA, 1978). However, these terms are not accepted worldwide and, in any event, are functions rather than phases. Nor are they mutually exclusive because mitigation and preparedness generally take place concurrently in the pre-impact period. There are also overlaps in the post-impact period, with some neighborhoods of a disaster-stricken community conducting emergency response operations while others are initiating disaster recovery. Finally, mitigation is frequently implemented during the disaster recovery period.

According to Wallace (1956), a disaster's concentration in space defines a series of impact zones (Figure 1). These zones are problematic to identify in practice because they are not neat circles. For example, a building's damage from an earthquake depends on its structural resilience and the intensity of earthquake shaking – neither of which is uniformly distributed – so the boundary of the total impact zone can be extremely irregular. Moreover, the infrastructure impacts and social impacts of the fringe impact zone can be equally irregular and extend beyond the boundaries of the resource filter or community aid zones.

A society's subdivisions encompass a wide range of social units arrayed in overlapping social, economic, and political sectors. Thus, individuals are included within households that are in neighborhoods within communities. Businesses are included within industries that are in economic sectors and local jurisdictions are contained within states/provinces that are in nations (see Lindell et al., 2006: Ch. 2). A major challenge to understanding disaster impacts is that social units such as communities are not homogeneous, so subunits such as households and businesses vary in their vulnerability to disaster



**Figure 2.** Disaster impact model.

Source: Adapted from Lindell and Prater (2003).

impacts. This has given rise to an expanding literature on differences in disaster vulnerability associated with demographic characteristics such as gender, ethnicity, and poverty (Fothergill, 1996; Fothergill and Peek, 2004; Fothergill et al., 1999). Similarly, research into disaster impacts on business has examined variations by size and economic sector (Webb et al., 2000; Zhang et al., 2009).

## Disaster impacts model

The basic framework of disaster research can be summarized in Figure 2, which indicates disaster effects are determined by three pre-impact conditions – hazard exposure, physical vulnerability, and social vulnerability – as well as three event-specific conditions – hazard event characteristics, improvised disaster responses, and improvised disaster recovery. Hazard event characteristics and improvised disaster responses combine with pre-impact conditions to produce a disaster’s physical impacts. Physical impacts, in turn, combine with recovery actions to produce a disaster’s social impacts. Communities can engage in three types of emergency management interventions to ameliorate disaster impacts. Physical impacts can be reduced by hazard mitigation practices and emergency preparedness practices, whereas social impacts can be reduced by recovery preparedness practices.

Hazard exposure arises from people’s occupancy of geographical areas where they could be affected by specific types of events that threaten their lives or property. Physical vulnerability includes human vulnerability, agricultural vulnerability, and structural vulnerability. Human vulnerability arises from humans’ susceptibility to environmental extremes of temperature, pressure, and chemical exposures that can cause death, injury,

and illness. Agricultural vulnerability exists because plants and animals are also vulnerable to environmental extremes. Structural vulnerability arises when buildings are constructed using designs and materials that cannot resist extreme stresses (e.g., high wind, seismic shaking) or allow hazardous materials to infiltrate into an occupied building. Social vulnerability (e.g., Wisner et al., 2004) represents an important extension of previous theories of hazard vulnerability (Burton et al., 1978). Whereas people's physical vulnerability refers to susceptibility to biological changes (i.e., impacts on anatomical structures and physiological functioning), social vulnerability refers to limitations in physical assets (buildings, contents) and psychological (knowledge, skills, and abilities), social (community integration), economic (financial savings), and political (public policy influence) resources. Households with higher social vulnerability are more likely to experience a variety of negative outcomes in disasters (Van Zandt, 2012).

Hazard event characteristics can be defined in terms of six attributes – speed of onset; availability of perceptual cues (such as ground movement); the intensity, scope, and duration of impact; and the probability of occurrence (CDRSS, 2006). These characteristics determine people's ability to detect hazard onset, the amount of time they have to respond, the number of affected social units and – thus – the event's casualties, damage, and socioeconomic disruption. The other two event-specific conditions, improvised disaster response and improvised disaster recovery, will be addressed below.

### *Physical impacts*

*Casualties.* According to Lindell (in press, a), the EM-DAT database ([www.emdat.be/database](http://www.emdat.be/database)) reported 25 geophysical, hydrological, or meteorological disasters that produced more than 50,000 deaths between 1900 and 2011. Of these, 12 were earthquakes, seven were tropical cyclones, and six were floods. There is significant variation by region, with Asia experiencing 54% of the earthquakes but 71% of the casualties from these events, 41% of the floods but 98% of the casualties, and 41% of the storms but 92% of the casualties. By contrast, the Americas experienced 22% of the earthquakes but only 17% of the casualties from these events, 24% of the floods but fewer than 2% of the casualties, and 33% of the storms and 8% of the casualties. Berke (1995) reported that developing countries in Asia, Africa, and South America had approximately 3000 deaths/disaster, whereas the corresponding figure for high-income countries was approximately 500 deaths/disaster. Moreover, these disparities appear to be increasing because the average annual death toll in developed countries declined by at least 75% between 1960 and 1990, but the same time period saw increases of over 400% in developing countries.

*Damage.* Losses of structures, animals, and crops also are important measures of physical impacts, and the EM-DAT database shows that these have been rising exponentially throughout the world since 1970. However, the rate of increase is even greater in developing countries (Berke, 1995).

### *Social impacts*

*Psychosocial impacts.* Disasters can cause a wide range of negative psychological responses (Bourque et al., 2006; Gerrity and Flynn, 1997). In many cases, the effects are mild and

transitory and victims can experience positive impacts (e.g., strengthened family relationships) as well as negative ones (e.g., strained family relationships). According to Norris et al. (2002a, 2002b) psychological impacts vary by disaster type (greater in mass violence), victim location (developing countries), and victim type (children and middle age, females, and ethnic minorities with existing psychological problems and poor psychosocial resources). Zahran et al. (2009) found that domestic crimes increased after disasters even though index, property, and violent crimes decreased.

There also are psychological impacts with long-term adaptive consequences, such as changes in risk perception (beliefs in the likelihood of the occurrence of a disaster and its personal consequences for the individual) and increased hazard intrusiveness (frequency of thought and discussion about a hazard). In turn, these beliefs can affect risk area residents' adoption of household hazard adjustments that reduce their vulnerability to future disasters. However, the cognitive impacts of disaster experience do not appear to be large, resulting in modest effects on household hazard adjustment (see Lindell in press, b; Lindell and Perry, 2000).

**Demographic impacts.** The demographic impact of a disaster can be assessed by adapting the *demographic balancing equation*,  $P_a - P_b = B - D + IM - OM$ , where  $P_a$  is the population size after the disaster,  $P_b$  is the population size before the disaster,  $B$  is the number of births,  $D$  is the number of deaths,  $IM$  is the number of immigrants, and  $OM$  is the number of emigrants (Smith et al., 2001). As noted earlier, the number of deaths from disasters can be large in developing countries, but the major demographic impacts of disasters in developed countries are likely to be the (temporary) post-impact immigration of construction workers and emigration of population segments that have lost housing. Housing-related emigration is only temporary for communities that are spared disaster impact (e.g., a hurricane threatens but strikes elsewhere), but can be significant in others. For example, about one-sixth of South Dade County moved out of their homes in the year after Hurricane Andrew, with about half of these moving to North Dade. South Dade regained about half of its population loss in the second year after the hurricane but people were more likely to return if they had not moved far during the interim. Almost three-quarters of those who moved elsewhere in Dade County returned to their original residences, compared to one-tenth of those who left the state altogether (Smith and McCarty, 1996). New Orleans lost thousands of households after Hurricane Katrina and had only returned to 300,000 (66% of its pre-impact population) four years later but was over 360,000 in 2011. Population loss can vary significantly within a community, with strong recovery in some areas and 'ghost towns' in others (Comerio, 1998).

**Economic impacts.** The property damage caused by disaster impact creates losses in asset values that can be measured by the cost of repair or replacement (CACND, 1999). The magnitude of these losses is difficult to determine even in developed countries because no organization tracks all of the relevant data and some data are not recorded at all (CACND, 1999; Charvériat, 2000). Disaster losses are even more difficult to measure in developing countries so Arlikatti et al. (2010) used the Modified Domestic Assets Index (MDAI) – which measures households' facilities for shelter, drinking water, lighting, human waste disposal, food preparation, communication and transportation – to

successfully assess the decline in living standards in Tamil Nadu after the 2004 Indian Ocean earthquake and tsunami.

In addition to direct economic losses, there are indirect losses that arise from the interdependence of community subunits. Business interruption (BI) occurs because its workers are disaster casualties or are forced to move because they have nowhere to live within commuting distance. BI also occurs when a firm loses its infrastructure or its normal customers (Rose and Limb, 2002; Tierney, 2006). In one Southern California earthquake scenario, BI accounted for about 31% of total losses, with about a third of those losses due to delays in restoring water distribution systems and fire damaged properties. Expected BI losses (4.3% of annual gross output) exceeded those of a typical economic recession (Rose et al., 2011).

Disasters can have significant financial impacts on local government. Costs must be incurred for tasks such as debris removal, infrastructure restoration, and re-planning stricken areas. In addition, there are decreased revenues due to loss or deferral of sales, business, property, and personal income taxes. However, most of the research in this area has been conducted by researchers in political science and public administration (e.g., Farazmand, 2001).

*Political impacts.* Disaster impacts can cause social activism resulting in political disruption. The disaster recovery period is a source of many victim grievances and this creates many opportunities for community conflict, both in the US (Bolin, 1982, 1993) and abroad (Albala-Bertrand, 1993). Attempts to change prevailing patterns of civil governance can arise when individuals sharing a grievance about the handling of the recovery process seek to redress that grievance through collective action. In some cases, new groups *emerge* to influence local, state, or federal government agencies and legislators to take actions that they support and to terminate actions that they disapprove. Indeed, such was the case for Latinos in Watsonville, California following the Loma Prieta earthquake (Tierney et al., 2001). Usually, community action groups pressure government to provide additional resources for recovering from disaster impact, but might oppose candidates' re-elections or even seek to recall some politicians from office (Olson and Drury, 1997; Prater and Lindell, 2000).

## **Emergency management interventions**

As Figure 2 indicates, there are three types of emergency management interventions, also known as *hazard adjustments* (Burton et al., 1978), that can reduce disaster impacts. Hazard mitigation and emergency preparedness practices attempt to reduce a disaster's physical impacts (casualties and damage) and indirectly reduce its social impacts, whereas recovery preparedness practices attempt to reduce its social impacts.

### *Hazard mitigation*

Hazard mitigation can be defined as pre-impact actions that protect passively against casualties and damage at the time of hazard impact (as opposed to an active



emergency response to reduce those casualties and damage). There are a number of different types of hazard mitigation actions that can be implemented at the community level but the ones most commonly addressed are land use practices and building construction practices (see Lindell et al., 2006: Ch. 7, for further discussion). Land use practices reduce hazard vulnerability by avoiding construction in areas that are susceptible to hazard impact, whereas building construction practices make individual structures less vulnerable to natural hazards – for example, using steel reinforced concrete rather than unreinforced masonry to construct apartment buildings. Research on hazard mitigation has mostly been conducted by planners (e.g., Burby, 1998) and political scientists (e.g., Birkland, 1997) although there are exceptions such as Stallings's (1995) study that examined hazard mitigation from the perspective of social construction of risk. Prominent themes have included identifying impediments to mitigation such as lack of information about the hazard and suitable mitigation actions (Sadiq and Weible, 2010), evaluating the quality of local comprehensive plans for mitigating natural hazards (Berke and Godschalk, 2009; Tang et al., 2008, 2011), evaluating the impact of popular urban development strategies such as New Urbanism on community hazard exposure (Song et al., 2009), assessing the quality of state hazard mitigation plans (Berke et al., 2012), and identifying variables that predict which states have submitted plans (Yoon et al., 2012). Other themes include identifying ways to overcome public apathy about hazard mitigation (Godschalk et al., 2003) and ways that individual planners can use their access to the policy process to promote hazard mitigation (Stevens, 2010).

Research has also examined the implementation of hazard mitigation actions by individuals, households, and businesses. This research has examined issues such as influence of hazard proximity, disaster experience, risk perceptions, stakeholder perceptions, and hazard adjustment perceptions on mitigation intentions and actual mitigation actions. With few exceptions (e.g., Paton et al., 2010), studies have been conducted within a single country although similar variables have been used in different countries and across different hazards (Collins, 2008, wildfire; Lin et al., 2008, flood and mudslide; Terpstra and Gutteling, 2008, flood). Paton et al. (2008) found one particularly intriguing result – a 'false experience' effect for volcano preparedness that was previously found after hurricanes. Specifically, people's experience of minor impacts misleads them to believe they are already prepared for the worst (Baker, 1991). This leads to reduction in risk perception and a corresponding reduction in hazard mitigation actions and attention to further hazard-relevant information.

### *Emergency preparedness*

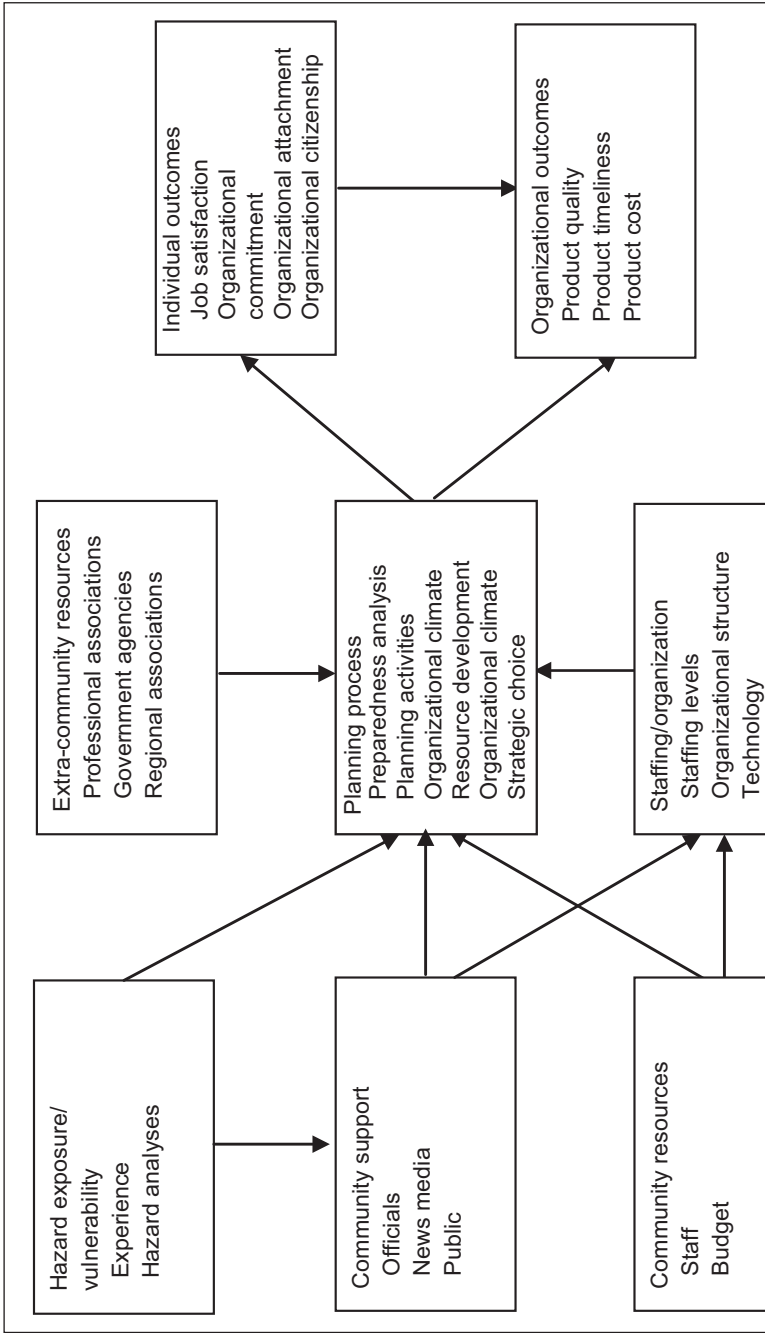
Emergency preparedness practices are pre-impact actions that provide the human and material resources needed to support active responses at the time of hazard impact. An important step in emergency preparedness is to use community hazard/vulnerability analysis (HVA) to identify the geographic areas and population segments at risk (Berke et al., 2010). In addition, communities should develop emergency operations plans, conduct emergency response training, acquire facilities and equipment, and perform emergency drills, exercises, and critiques (Perry and Lindell, 2007).

*Community and organizational disaster preparedness.* Disaster research has identified many conditions influencing the effectiveness of local emergency management agencies (LEMAs) and local emergency management committees (LEMCs) in achieving community disaster preparedness. As Figure 3 indicates, LEMA effectiveness is a direct result of individual outcomes and the planning process. Individual outcomes include job satisfaction, organizational commitment, attachment, and citizenship behaviors (Lindell and Brandt, 2000). The planning process includes preparedness analysis, planning activities, resource development, organizational climate development, and strategic choice. In turn, the planning process is determined by five factors, the first of which is community hazard exposure/vulnerability, as identified by hazard experience and hazard analyses that reveal the likelihood and expected impacts of future disasters. Hazard exposure/vulnerability also has an indirect effect on the planning process via its effects on community support from public officials and the news media, as well as different demographic, economic, and political segments of the local population. This community support draws upon community resources such as staff and budget to yield staffing and organization and technology for the LEMA and the LEMC. In addition, communities draw upon extra-community resources such as professional associations, government agencies, and regional organizations to supplement their own resources (see Lindell and Perry, 2007 for a more complete discussion).

Research since Hurricane Katrina has found that most LEMAs lack provisions for people with disabilities (Uscher-Pines et al., 2009) and don't expect to change because they lack the personnel and funding to accommodate these individuals (Fox et al., 2007). Consequently, new approaches are needed to address vulnerable population segments (Berke et al., 2010), including greater reliance on Community Emergency Response Teams (Flint and Stevenson, 2010).

Research on private sector organizations has articulated models of business vulnerability to disasters and described measures that can be taken by individual firms and community planners to reduce the impacts of environmental disasters (Chang and Falit-Baiamonte, 2002; Zhang et al., 2009). This research has found that size, number of locations, and ownership of its premises are consistently significant predictors of business disaster preparedness (Howe, 2011) across a wide variety of industries ranging from tourism (Bird et al., 2010) to hazardous materials facilities (Cruz and Steinberg, 2005).

*Household disaster preparedness.* Most research on natural hazards has reported significant correlations between hazard adjustment and perceived personal risk, where the latter refers to respondents' judgments of the likelihood that they will be personally affected by specific consequences such as death, injury, property damage, or disruption to daily activities (Lindell, in press, b). There is mixed evidence that personal experience affects responses to hazards – either indirectly (due to its effect on risk perception) or directly (independent of risk perception). There also is conflicting evidence regarding the correlations of hazard proximity with hazard adjustment. Here too, there might be mediating effects of other variables – in this case, the effect of proximity on experience, experience on risk perception, and risk perception on hazard adjustment (Lindell and Hwang, 2008). Finally, there is evidence that people's adoption of hazard adjustments is related to the



**Figure 3.** Protective Action Decision Model. Adapted from Lindell and Perry (2012).

perceived attributes of those adjustments such as efficacy, utility for other purposes, financial cost, knowledge and skill requirements, time and effort requirements, and required social cooperation (Lindell et al., 2009) and that most preparedness actions are motivated by multiple reasons (Bourque et al., 2012).

### Emergency response

As indicated by Figure 2, people try to reduce the physical impacts of a hazard agent by a combination of preparedness and improvisation (Kreps, 1991). People's disaster response actions differ significantly from disaster myths that commonly portray victims as dazed, panicked, or disorganized (Fischer, 2008). Instead, most people respond adaptively albeit somewhat delayed because *normalcy bias* stimulates confirmation (*milling*) before initiating protective action. Contrary to stereotypes of individual selfishness, disaster victims often devote themselves to protecting other people and their property (Drury et al., 2009). There is considerable social and material convergence on the disaster impact area and a decreased incidence of antisocial behaviors such as crime (Tierney et al., 2001). Finally, contrary to the belief that emergency responders abandon their professional duties to protect their families, they are more likely to suffer burnout from working too many consecutive hours without relief (Quarantelli, 1988).

The actual performance of individuals and organizations in disasters can be characterized by four basic emergency response functions – emergency assessment, hazard operations, population protection, and incident management (Lindell and Perry, 1992). *Emergency assessment* comprises diagnoses of past and present conditions and prognoses of future conditions that guide the emergency response. *Hazard operations* refers to expedient hazard mitigation actions that emergency personnel take to limit the magnitude or duration of disaster impact (e.g., sandbagging a flooding river or patching a leaking railroad tank car). *Population protection* refers to actions – such as sheltering in-place, evacuation, and mass immunization – that protect people from hazard agents. *Incident management* consists of the activities by which the human and physical resources used to respond to the emergency are mobilized and directed to accomplish the goals of the emergency response organization. These emergency response functions provide a useful framework for summarizing and evaluating existing research on disaster preparedness and response.

*Emergency assessment and hazard operations.* Social scientists have conducted little research on topics such as threat detection/emergency classification and damage assessment and virtually none on hazard/environmental monitoring or population monitoring and assessment. What research has been done in these areas has focused on improvisation. Specifically, Wachtendorf (2004; Kendra and Wachtendorf, 2006) proposed that there are different types of improvisation – reproductive, adaptive, and creative – that differ from *organizational continuity* (continuation of normal organizational routines) and *organizational contingency* (implementation of the procedures specified in an emergency operations plan). Mendonça and Wallace (2007) proposed a cognitive theory of improvisation in which procedural and declarative knowledge are used to process information about goals, functions, object groups, objects, and properties to generate novel

solutions to unanticipated problems. In contrast to this problem-solving approach, Kreps and Bosworth (2006) focused on organizational roles. They characterized organizational adaptation to disaster demands in terms of role allocation (consistent or inconsistent), role relationships (continuous or discontinuous), and role behavior (conventional or improvised).

**Population protection.** Much of the research on disaster response has addressed population warning and, especially, evacuation (Lindell, 2012). Warning research has provided a basis for assessing the degree to which 32 different variables are empirically related to warning response (Sorensen, 2000; Sorensen and Sorensen, 2006). This research has been summarized in the Protective Action Decision Model (Lindell and Perry, 2004, 2012), which proposes that sensory cues from the physical environment (especially sights and sounds, see Gruntfest et al., 1978) or socially transmitted information (e.g., disaster warnings) can elicit perceptions of threat that divert a recipient's attention from normal activities (see Figure 4). Disaster warnings are transmitted by social sources using information channels to transmit messages. Warning sources – authorities, news media, and peers – differ in their perceived expertise, trustworthiness, and protection responsibility (Arlkatti et al., 2007). There are many different types of channels that include print media, electronic media, and face-to-face warnings that differ in their dissemination rate and precision, penetration of normal activities, message specificity/distortion, sender and receiver requirements, and feedback/receipt verification (Lindell and Perry, 1987, 1992). Messages have been found to be most effective when they contain information about the threat, especially the hazard agent (type, specific threats, and potential impacts), and affected populations so people can form a perception of certain, severe, and immediate personal risk. These messages should also contain recommended household response actions and describe official response actions such as agency/organizational response actions completed, in progress, and planned. In addition, warning messages should list sources of official assistance and sources of further official information – especially rumor control hotlines (Lindell and Perry, 2004; Scanlon, 2006).

Most warning research has focused on compliance with authorities' evacuation recommendations (Huang et al., 2012; Sorensen and Sorensen, 2006) and, to a lesser extent, *shadow evacuation* – people evacuating from outside officially designated evacuation zones (Zeigler et al., 1981). Transportation analysts have developed models that require data on many other demographic and behavioral variables but social scientists have studied only a few of these variables and transportation analysts have largely ignored the relevant social science data that is available (Lindell and Prater, 2007). Fortunately, however, this is changing (Lindell, in press, c; Murray-Tuite and Wolshon, 2013). Past evacuation research has focused substantially on 'typical' households (two parents and children evacuating in a personal vehicle) and is only now beginning to address transit-dependent populations and special populations that have physical, sensory, or mental disabilities that hinder their evacuation. Although some of these population segments are located in facilities where evacuations can be planned by specialized staff (Vogt, 1991), others are dispersed throughout their communities (Fox et al., 2007). Research is also beginning to examine the problems associated with animals in evacuation (Heath et al., 2001).

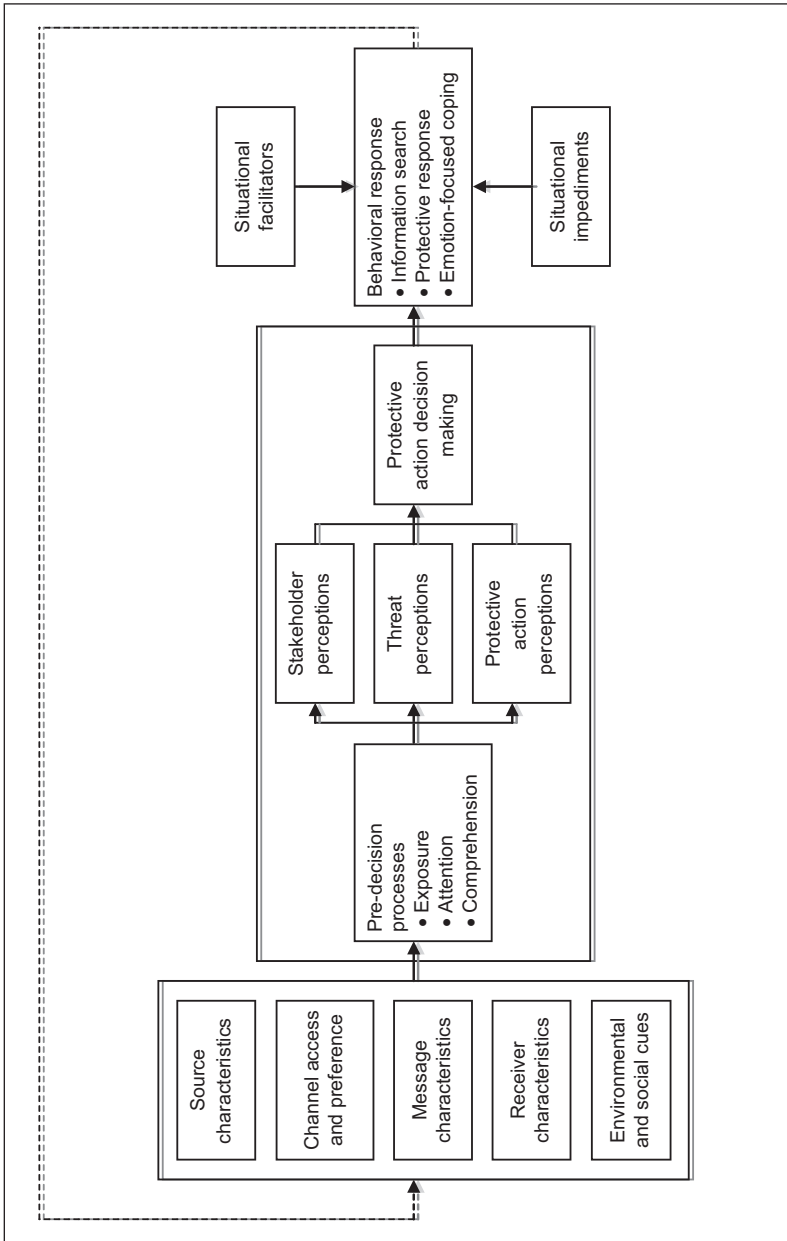


Figure 4. A model of local emergency management effectiveness.

Research on reception and care of evacuees has concluded that, in the US, most stay with friends and relatives while a smaller proportion stay in commercial facilities such as hotels and motels. Very few stay in public shelters – about 5–15% – depending upon the weather, time of day, and evacuees' financial resources (Mileti et al., 1992). Lindell et al. (2011) and Wu et al. (2012) broadened this research by addressing *evacuation logistics* – departure dates, vehicles taken, route information sources, routes, destinations, durations, and costs. Other work has extended Stallings's (1991) research on the anticipated and actual problems of re-entry to evacuation zones (Siebeneck and Cova, 2008; Siebeneck et al., 2013). This research has found that re-entry is complicated enough when evacuees can return to their homes within a few days but the problem is even more complex when evacuees are displaced for months or years (Mitchell et al., 2012).

Search and rescue (SAR; Poteyeva et al., 2006) is an activity that is crucially important in disasters involving building collapses. In such incidents, primarily earthquakes and explosions, *crush syndrome* will kill most of those who are injured within about 24 hours. Consequently, the prompt response of local volunteers – either singly, in emergent groups, or in previously organized and trained SAR teams – is far more significant than the response of heavily equipped urban search and rescue teams because the latter generally take days to arrive even in domestic incidents. The delays are even greater in international incidents, where mobilization delays, long flights, and visa problems can cause even further delays (Prater and Wu, 2002).

It is commonly assumed that authorities transport injured disaster victims in ambulances to the most appropriate hospitals. However, according to Quarantelli (1983), almost as many injured victims arrive at hospitals in their own vehicles or those of peers (46% of casualties) as in ambulances (54% of casualties). Moreover, the vast majority (75%) of victims are transported to the nearest hospital, which is usually overloaded at the same time as other competent facilities receive few or no patients (Auf der Heide, 1994).

*Incident management.* One of the major components of disaster response is emergent behavior, which arises when 'individuals see needs that are not being met and therefore attempt to address them in an informal manner' (McEntire, 2006: 175). According to Dynes (1970), *established organizations* perform their normal tasks within normal organizational structures, *extending organizations* perform novel tasks within normal organizational structures, *expanding organizations* perform their normal tasks within novel organizational structures, and *emergent organizations* perform novel tasks within novel organizational structures. Disaster demands that exceed the abilities of individuals acting independently can generate complex emergency response systems whose functioning is difficult to understand without using social network analysis (Petrescu-Pravova and Butts, 2008; Uhr et al., 2008). Such systems often produce coordinated responses – 'the cooperation of independent units for the purpose of eliminating fragmentation, gaps in service delivery, and unnecessary (as opposed to strategic) duplication of services' (Gillespie, 1991: 57) – through *emergent multiorganizational networks* (EMONs; Drabek et al., 1981). Because of their differences in organizational titles, organizational structures, training, experience, and legal authority, EMONs frequently experience severe difficulties in communicating with each other and coordinating their



responses to disasters, especially when they operate according to strict command and control structures or without emergency operations centers (Drabek and McEntire, 2003). Such coordination problems led to the development of the Incident Command System (ICS). However, there have been challenges to the assumption that ICS can solve the problems that led to its development (Buck et al., 2006; Lutz and Lindell, 2008). Especially problematic is the role of volunteers and emergency-relevant organizations such as social service agencies that have little training in ICS and infrequent experience in emergency response.

Disaster researchers have also examined the dissemination of public information (which is intended for those who *are not* at risk, by contrast to warnings, which are directed to those who *are* at risk). One important goal of public information is to reassure people that they should *avoid* taking protective actions, especially shadow evacuation, that might interfere with the protective actions of those who are at risk. Much of the research on public information has studied specific topics such as news media framing of disaster reports (Kuttischreuter et al., 2011; Vultee, 2009) but Wilkins et al. (2012) provide a broad perspective on disaster news coverage.

There has been little research on topics such as mobilization of emergency facilities/equipment, incident communication/documentation, hazard analysis/planning, finance/administration, and logistics. Such topics might seem to have little theoretical appeal for social and behavioral scientists but they have great practical importance for emergency managers. For example, Sorensen and Rogers (1988) conducted a survey of local agency procedures for notification and mobilization in toxic chemical emergencies. This research provided important background data for legislative and regulatory actions to improve safety around toxic chemical facilities in the aftermath of the Bhopal incident.

### *Disaster recovery*

Disaster recovery begins with stabilization of an incident and ends when the community has re-established normal social, economic, and political routines. It is now generally accepted that disaster recovery encompasses multiple activities, some implemented sequentially and others implemented simultaneously. At any one time, some households or businesses might be engaged in one set of recovery activities while others are engaged in different recovery activities. Thus, attempts to define finely differentiated phases of disaster recovery are inherently limited in their validity so researchers have been less concerned about time phases (e.g., short-term recovery vs. long-term recovery) than about the specific recovery functions that must be performed. The discussion which follows addresses household and business recovery separately but the recovery of these units is interlinked (Xiao and Van Zandt, 2012).

*Household recovery.* There are three basic components to household recovery – housing recovery, economic recovery, and psychological recovery (Bolin and Trainer, 1978). Many studies of housing recovery, such as Bolin and Stanford (1991, 1998) have adopted Quarantelli's (1982) typology of *emergency shelter* (unplanned and spontaneously sought locations), *temporary shelter* (locations that include food preparation and sleeping facilities), *temporary housing* (which allows victims to re-establish household



routines in non-preferred locations or structures), and *permanent housing* (which re-establishes household routines in preferred locations and structures). There is no single pattern of progression through the stages of housing because households vary in the number and sequence of their moves and the duration of their stays in each type of housing (Cole, 2003).

There are significant variations among households in their housing recovery and these are correlated with households' demographic characteristics (Peacock et al., 2006). Because lower income households have fewer resources on which to draw for recovery, they also take longer to return to permanent housing, sometimes remaining for extended periods of time in severely damaged homes (Girard and Peacock, 1997). Indeed, they sometimes are forced to accept as permanent what originally was intended as temporary housing (Peacock et al., 1987). Conversely, the housing that authorities intend to become permanent is likely to be occupied only temporarily if it is incompatible with victims' preferences for location and features (Arlikatti and Andrew, 2012).

Some households' economic recovery takes place quickly, but others' takes much longer. For example, the percentage of households reporting complete economic recovery after the 1987 Whittier earthquake was 50% at the end of the first year but 21% reported little or no recovery even at the end of four years (Bolin, 1993). Economic recovery was positively related to household income and negatively related to structural damage, household size, and the total number of moves (Bolin, 1993). There are also systematic differences in the rate of economic recovery among ethnic groups. For example, Bolin and Bolton (1986) found that Black households (30%) lagged behind Whites (51%) in their return to pre-impact economic conditions eight months after the 1982 Paris, Texas, tornado.

Household recovery is significantly determined by sources of assistance, especially hazard insurance. However, risk area residents tend to forego hazard insurance because they consider premiums to be too high and deductibles too large (Palm et al., 1990), as well as being unable to protect persons and specific to a given hazard (Lindell et al., 2009). Hazard insurance varies significantly in its availability and cost – flood, hurricane, and earthquake insurance being particularly problematic (Kunreuther and Roth, 1998). Moreover, some ethnic groups cannot afford the rates of high quality insurance companies or are denied coverage altogether (Peacock and Girard, 1997).

Kinship networks can also contribute to disaster recovery but the significance of this source depends on the physical proximity of other nuclear families in the kin network, the closeness of the psychological ties within the network, the assets of the other families and, of course, the extent to which those families also suffered losses. Friends, neighbors, and co-workers can assist recovery through financial and in-kind contributions but these tend to be less important.

Institutional sources of recovery assistance include federal, state, and local government as well as non-governmental organizations and community-based organizations (Phillips, 2009). Because the donor-victim relationship is defined by bureaucratic norms, the amount of assistance depends on whether victims meet the qualification standards, usually documented residence in the impact area and proof of loss. Post-disaster loans can be problematic because they involve long-term debt that takes many years to repay (Bolin, 1993).

Because few disaster victims develop major psychological problems, most benefit more from a *crisis counseling* orientation than from a *mental health treatment* orientation, especially if their normal social support networks of friends, relatives, neighbors, and co-workers remain largely intact (Gerrity and Flynn, 1997). However, there are population segments requiring special attention and active outreach. These include children, frail elderly, people with pre-existing mental illness, racial and ethnic minorities, and families of those who have died in the disaster.

*Business recovery.* Many studies have examined the ways in which individual businesses recover from disasters (Zhang et al., 2009). Whereas wholesale and retail businesses generally report experiencing significant sales losses, manufacturing and construction companies often show gains following a disaster (Kroll et al., 1990; Webb et al., 2000). Moreover, businesses that serve a large (e.g., regional or international) market tend to recover more rapidly than those that only serve local markets (Webb et al., 2002). Small businesses, in particular, have been found to experience more obstacles than large firms and chains in their attempts to regain their pre-disaster levels of operations. Compared to their large counterparts, small firms are more likely to depend primarily on neighborhood customers, lack the financial resources needed for recovery, and lack access to governmental recovery programs (Alesch et al., 1993; Kroll et al., 1990).

*Community recovery.* Research on community recovery is beginning to integrate findings on household and business recovery into a coherent theory that is correcting the misconceptions of many researchers and practitioners (Chang and Rose, 2012; Johnson and Hayashi, 2012; Smith and Birkland, 2012; Tierney and Oliver-Smith, 2012). Specifically, recovery should not be defined as physical reconstruction and not all households and businesses recover in the same way (or at all), recovery should not be conceived as either purely market-driven or planning-driven, and the goal of recovery should usually be a 'new normal' that avoids reproducing previous hazard exposure, physical vulnerability, and social vulnerability. As is the case during emergency response, an urgent need for action conflicts with an equally urgent need for analysis and planning, so pre-impact planning is needed to define an organizational structure that can assess the needs and capacities of local households, businesses, and government agencies and develop strategies for achieving recovery (Lindell et al., 2006: Ch. 11).

## **New directions**

### *Theoretical directions*

Disaster studies need to maintain a balance between theoretical and practical significance. That is, researchers should seek to link practical problems that emerge in disasters with broader social science theories and other perspectives on disasters such as organizational crisis response (Boin and 't Hart, 2006; Mitroff, 2005), crisis communications (Seeger and Novak, 2010; Sellnow et al., 2009), and public health (Kohn et al., 2012; Savoia et al., 2009; Yeager et al., 2010). The field will progress if research continues to be done both inductively, beginning with data and working toward theory, *and*

deductively, beginning with theory and making predictions about data. In either case, it will often be necessary to work with researchers from other disciplines, including physical scientists and engineers, to ensure that the field as a whole identifies all of the variables that are needed for better hazard management.

One area that has become particularly active is social vulnerability (e.g., Bolin, 2006; Enarson et al., 2006; Phillips et al., 2010). Most, if not all, disaster researchers would agree with three basic premises of this approach. That is, there are systematic variations in people's hazard exposure attributable to the locations where they live and work. Moreover, there are also systematic variations in people's vulnerability based on the quality of the structures in which they live and work. Finally, there are systematic variations in the social impacts people are likely to experience even controlling for hazard exposure and structural vulnerability. However, disagreements emerge when one tries to examine what is meant by the widely accepted definition of vulnerability as 'the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard' (Wisner et al., 2004: 11). People can be differentiated by many different characteristics, some of which *define* vulnerability and others of which are merely *correlated with* vulnerability. Are demographic characteristics such as gender, age or race/ethnicity defining characteristics of vulnerability or are they correlated with other variables (e.g., human, social, physical, financial, and natural capital) that are the defining characteristics? A comprehensive theory of hazard vulnerability will need to identify which variables are *measures* of vulnerability, which are *proximal causes* of vulnerability, which are *distal causes* of vulnerability, and which are merely *correlated with* these causes. To date, our ability to disentangle these theoretical issues has been hindered by the limited amount and uneven quality of the available research. In some cases there is a relatively strong research literature on which to base conclusions (Peek, 2010) whereas in others there is little more than anecdotes and highly aggregated statistics to work with (Clive et al., 2010).

Finally, there are many topics – such as popular culture of disaster (Webb, 2006) and community commemoration (Eyre, 2006) – that could not be addressed here. Though less likely to produce direct reductions in casualties, damage, and disruption, research in these areas is needed to generate a comprehensive understanding of disasters.

### *Methodological directions*

As Stallings (2006) noted, disaster research has been characterized by inductive field studies in which researchers travel to the site of a reported disaster to observe behavior and conduct personal interviews (see *The American Behavioral Scientist*, Jan./Feb. 1970; Vol. 13, No. 3). This type of research collects important documents and interviews key informants who are identified by organizational position or by snowball sampling. In recent decades, there has been an increasing reliance on survey research (Bourque et al., 1997) to study households' warning response (Mileti and Beck, 1975; Perry et al., 1981) or perception and response to natural hazards (Turner et al., 1986; White, 1974).

Future research needs to continue to use a variety of research methods involving a mix of qualitative and quantitative studies (see Stallings, 2002, 2006). Qualitative

studies need to continue the practice of systematically sampling situations and informants, as well as conducting observations and interviews. Extending the four-decades-long tradition of Disaster Research Center teams, such data collection efforts can be followed by systematic analysis of interview archives (e.g., Kreps and Bosworth, 2006). Following such data collection, researchers should make more extensive use of qualitative analysis programs to systematically code and analyze the data that are collected.

Disaster researchers can also take advantage of emergency response organizations' increased reliance on computer software to enter, distribute, and store messages transmitted from one emergency responder to another. The accessibility of software systems such as eTeam and WebEOC should make it easier for disaster researchers to retrieve the data needed to conduct sophisticated network analyses (e.g., Butts, 2009).

Disaster researchers should also increase the use of experiments such as Drabek's (1970) simulation of a police dispatch center and Rosoff et al.'s (2011) eight-stage scenario to assess participants' expectations about their emotional reactions and immediate behavioral responses to shaking from a major earthquake. Such simulations, which have become increasingly feasible because of the availability of inexpensive networked microcomputers, can be useful in disentangling causal mechanisms producing observed correlations in survey studies. Moreover, the advent of the Internet provides researchers with opportunities to conduct web experiments in which representative population samples are contacted to log in to websites where they can be randomly assigned to different information conditions (Joinson et al., 2007). In addition to randomization, such web experiments can provide graphical materials (not available in telephone surveys) and control over the order of question completion (not available in mail surveys) at a cost that is far lower than personal interviews. Moreover, experiments allow researchers to test hypotheses about stages of information processing that cannot be tested rigorously in survey designs.

Field experiments and quasi-experiments have the potential for providing important complements to laboratory experiments and surveys. Mileti and colleagues (Mileti and Darlington 1995, 1997; Mileti and Fitzpatrick, 1993) conducted evaluations of earthquake hazard awareness programs and Perry (1990) conducted an evaluation of a volcano hazard awareness program. Systematic comparisons of communities that vary in their receipt of hazard information can provide valuable insights into the degree to which households have received, attended to, comprehended, and processed information from authorities.

One recommended future direction for survey researchers is to increase the frequency with which they use the same measures as previous researchers so systematic comparisons can be made across studies. As Baker (1991) noted, disaster experience is routinely invoked as an explanation for why people do or do not evacuate but this variable has been measured in many different ways. Finally, survey researchers need to increase the number of studies that test multivariate, multi-equation models. It is becoming increasingly obvious that theoretical progress will depend on researchers' ability to identify the mediating mechanisms through which the ultimate exogenous variables (independent variables that are not presumed to be caused by any other variables) exert their effects on the endogenous variables of interest (the ultimate dependent variables).

It is only through the use of such models that it is possible to determine if hazard proximity, hazard experience, risk perception, and hazard adjustment form a causal chain in which each variable completely determines the next variable in the chain (e.g., Lindell and Hwang, 2008).

### Funding

This article is based upon work supported by the National Science Foundation under Grants SES-0838654 and IMEE-113861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

### Annotated further reading

This section lists eight books that provide significant insights into disaster research. For summaries of a wider variety of hazards-related publications, see [www.colorado.edu/hazards/library](http://www.colorado.edu/hazards/library).

Committee on Disaster Research in the Social Sciences. (2006) *Facing Hazards and Disasters: Understanding Human Dimensions*. Washington, DC: National Academy of Sciences. This volume reports the results of a US National Research Council evaluation of social science research on disasters. In addition to discussing research in the areas of hazard/vulnerability analysis, hazard mitigation, disaster preparedness, and response and disaster recovery, the report also addresses trends that will affect future disaster losses and the infrastructure needed to analyze these losses. The latter topics include interdisciplinary and international research, issues in data collection and management, knowledge dissemination to practitioners, and future staffing of the disaster research enterprise. The report includes recommendations for research areas that deserve funding by the US federal government and, especially, the National Science Foundation.

Lindell MK, Prater CS and Perry RW (2006) *Fundamentals of Emergency Management*. Emmitsburg, MD: Federal Emergency Management Agency Emergency Management Institute. Available at: [training.fema.gov/EMISWeb/edu/fem.asp](http://training.fema.gov/EMISWeb/edu/fem.asp) and [hrrc.arch.tamu.edu/publications/books](http://hrrc.arch.tamu.edu/publications/books). This is a graduate-level text that addresses all aspects of emergency management ranging from its history in the US to international, professional, and legal issues. This is the source document for the authors' undergraduate textbook, *Introduction to Emergency Management*, published by Wiley in English and Chinese. *Fundamentals* has been translated into Korean.

Mileti DS (1999) *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Washington, DC: Joseph Henry Press. This book is the capstone volume for the US National Science Foundation-funded Second Assessment of Research on Natural Hazards. Mileti summarizes the reports of the topical committees, some of which were published as separate volumes, and casts their findings in the framework of sustainable development. Although written primarily for national policy makers, *Disasters by Design* provides a useful conceptual framework for non-specialists who are interested in hazards policy. It also is useful for researchers from other research areas who are interested in seeing their work inform governmental policy.

Peacock WG, Morrow BH and Gladwin H (eds) (1997) *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disasters*. New York: Routledge. This edited volume provides an in-depth examination of Hurricane Andrew's impacts and the Miami area's response to those impacts. The book is notable for its foundation in sociopolitical ecology. This framework guides a thorough examination of the conditions affecting vulnerable populations – racial/ethnic minorities, women, and the poor.

- Rodríguez H, Quarantelli EL and Dynes RR (eds) (2006) *Handbook of Disaster Research*, New York: Springer. This edited volume contains 32 chapters that address a wide range of topics addressed by sociologists and other social scientists who conduct research on rapid onset disasters involving natural and technological hazards. Many of the chapters (e.g., the chapter on warning and evacuation) emphasize the practical implications of disaster research for reducing casualties, damage, and social disruption. However, others (e.g., the chapter on popular culture) are guided primarily by sociological theory. Overall, the volume provides a comprehensive overview of the entire field of disaster research.
- Tierney KJ, Lindell MK and Perry RW (2001) *Facing the Unexpected: Disaster Preparedness and Response in the United States*. Washington, DC: Joseph Henry Press. This volume is one of a series of books published as part of the US National Science Foundation-funded Second Assessment of Research on Natural Hazards. The authors summarize the findings of research on emergency preparedness and response at the individual, household and community levels.
- Tierney KJ and Waugh WF Jr (eds) (2007) *Emergency Management: Principles and Practice for Local Government*, 2nd edn. Washington, DC: International City/County Management Association. This edited volume addresses the range of disaster-related topics most relevant to local public administrators. The contents of this book overlap with those of the Handbook of Disaster Research (see above) - especially in the areas of disaster preparedness, response and recovery. However, there are some significant differences between the two books. For example, Emergency Management includes material on hazard/vulnerability analysis and hazard mitigation. These are topics that, to date, have been largely neglected by sociologists. However, given the book's intended audience, the chapters tend to focus on reporting established findings rather than identifying new research questions. Although the chapters generally provide excellent summaries of their topics, the reference lists are rather limited.
- Wisner B, Blaikie P, Cannon T and Davis I (2004) *At Risk: Natural Hazards, People's Vulnerability and Disasters*, 2nd edn. London: Routledge. This book extends the argument, articulated in its first edition, that people's vulnerability to environmental hazards is frequently produced by the limited choices that they over the locations and structures in which they live and work. The authors identify root causes of these constraints, among which are conditions created by conventional conceptions of economic development. Frequently, such development is dominated by projects whose short-term gains are offset by the expansion of geographic areas at risk and the creation of impediments to people's ability to cope effectively with those expanding hazards.

## References

- Albala-Bertrand JM (1993) *The Political Economy of Large Natural Disasters*. Oxford: Clarendon Press.
- Alesch DJ, Taylor C, Ghanty S and Nagy RA (1993) Earthquake risk reduction and small business. In: Committee on Socioeconomic Impacts (eds) *1993 National Earthquake Conference Monograph 5: Socioeconomic Impacts*. Memphis, TN: Central United States Earthquake Consortium, 133–160.
- Arlikatti S and Andrew SA (2012) Housing design and long-term recovery processes in the aftermath of the 2004 Indian Ocean tsunami. *Natural Hazards Review* 13(1): 34–44.
- Arlikatti S, Lindell MK and Prater CS (2007) Perceived stakeholder role relationships and adoption of seismic hazard adjustments. *International Journal of Mass Emergencies and Disasters* 25(3): 218–256. Available at: [www.ijmed.org](http://www.ijmed.org)
- Arlikatti S, Peacock WG, Prater CS et al. (2010) Assessing the impact of the Indian Ocean tsunami on households: A modified domestic assets index approach. *Disasters* 34(3): 705–731.
- Auf der Heide E (1994) *Disaster Response: Principles of Preparation and Coordination*. St Louis, MO: Mosby. Available at: [orgmail2.coe-dmha.org/dr/flash.htm](http://orgmail2.coe-dmha.org/dr/flash.htm)



- Baker EJ (1991) Hurricane evacuation behavior. *International Journal of Mass Emergencies and Disasters* 9: 287–310. Available at: [www.ijmed.org](http://www.ijmed.org)
- Berke PR (1995) Natural-hazard reduction and sustainable development: A global assessment. *Journal of Planning Literature* 9(4): 370–382.
- Berke P and Godschalk D (2009) Searching for the good plan: A meta-analysis of plan quality studies. *Journal of Planning Literature* 23(3): 227–240
- Berke P, Cooper J, Salvesen D et al. (2010) Disaster plans: Challenges and choices to build the resiliency of vulnerable populations. *International Journal of Mass Emergencies and Disasters* 28(3): 368–394. Available at: [www.ijmed.org](http://www.ijmed.org)
- Berke P, Smith G and Lyles W (2012) Planning for resiliency: Evaluation of state hazard mitigation plans under the Disaster Mitigation Act. *Natural Hazards Review* 13(2): 139–149.
- Bird DK, Gisladottir G and Dominey-Howes D (2010) Volcanic risk and tourism in southern Iceland: Implications for hazard, risk and emergency response education and training. *Journal of Volcanology and Geothermal Research* 189(1): 33–48.
- Birkland TA (1997) *After Disaster: Agenda Setting, Public Policy and Focusing Events*. Washington, DC: Georgetown University Press.
- Boin A and 't Hart P (2006) The crisis approach. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 42–54.
- Bolin RC (1982) *Long-term Family Recovery From Disaster*. Boulder: University of Colorado Institute of Behavioral Science.
- Bolin RC (1993) *Household and Community Recovery After Earthquakes*. Boulder: University of Colorado Institute of Behavioral Science.
- Bolin B (2006) Race, class, ethnicity, and disaster vulnerability. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 113–129.
- Bolin RC and Bolton P (1986) *Race, Religion, and Ethnicity in Disaster Recovery*. Boulder: University of Colorado Institute of Behavioral Science.
- Bolin RC and Stanford L (1991) Shelters, housing and recovery: A comparison of U.S. disasters. *Disasters* 15(1): 25–34.
- Bolin RC and Stanford L (1998) Community-based approaches to unmet recovery needs. *Disasters* 22(1): 21–38.
- Bolin RC and Trainer PA (1978) Modes of family recovery following disaster: A cross-national study. In: Quarantelli EL (ed.) *Disasters: Theory and Research*. Beverly Hills, CA: Sage, 233–247.
- Bourque LB, Mileti DS, Kano M and Wood MM (2012) Who prepares for terrorism? *Environment and Behavior* 44(2): 374–409.
- Bourque LB, Shoaf KI and Nguyen LH (1997) Survey research. *International Journal of Mass Emergencies and Disasters* 15(1): 71–101. Available at: [www.ijmed.org](http://www.ijmed.org)
- Bourque LB, Siegel JM, Kano M and Wood MM (2006) Morbidity and mortality associated with disasters. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 97–112.
- Buck DA, Trainor JE and Aguirre BE (2006) A critical evaluation of the Incident Command System and NIMS. *Journal of Homeland Security and Emergency Management* 3(1): 1–27.
- Burby RJ (1998) *Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities*. Washington, DC: Joseph Henry Press.
- Burton I, Kates RW and White GF (1978) *The Environment as Hazard*. New York: Oxford University Press.
- Butts CT (2009) Revisiting the foundations of network analysis. *Science* 325: 414–416.
- CACND (Committee on Assessing the Costs of Natural Disasters) (1999) *The Impacts of Natural Disasters: A Framework for Loss Estimation*. Washington, DC: National Academy Press.

- CDRSS (Committee on Disaster Research in the Social Sciences) (2006) *Facing Hazards and Disasters: Understanding Human Dimensions*. Washington, DC: National Academy of Sciences.
- Chang SE and Falit-Baiamonte A (2002) Disaster vulnerability of businesses in the 2001 Nisqually earthquake. *Environmental Hazards* 4(1): 59–71
- Chang SE and Rose AZ (2012) Towards a theory of economic recovery from disasters. *International Journal of Mass Emergencies and Disasters* 30(2): 171–181. Available at: [www.ijmed.org](http://www.ijmed.org)
- Charvériat C (2000) *Natural Disasters in Latin America and the Caribbean: An Overview of Risk*. Working paper #434. Washington, DC: Inter-American Development Bank.
- Clive A, Davis EA, Hansen R and Mincin J (2010) Disability. In: Phillips BD, Thomas DSK, Fothergill A and Blinn-Pike L (eds) *Social Vulnerability to Disasters*. Boca Raton, FL: CRC Press, 187–216.
- Cole PM (2003) *An Empirical Examination of the Housing Recovery Process Following Disaster*. College Station: Texas A&M University.
- Collins TW (2008) What influences hazard mitigation? Household decision making about wildfire risks in Arizona's White Mountains. *The Professional Geographer* 60(4): 508–526.
- Comerio MC (1998) *Disaster Hits Home: New Policy for Urban Housing Recovery*. Berkeley: University of California Press.
- Cruz AM and Steinberg LJ (2005) Industry preparedness for earthquakes and earthquake-triggered hazmat accidents in the 1999 Kocaeli earthquake. *Earthquake Spectra* 21(2): 285–303.
- Drabek TE (1970) *Laboratory Simulation of a Police Communication System Under Stress*. Columbus: Ohio State University Disaster Research Center.
- Drabek TE and McEntire DA (2003) Emergent phenomena and multiorganizational coordination in disasters: Lessons from the research literature. *International Journal of Mass Emergencies and Disasters* 20(2): 197–224. Available at: [www.ijmed.org](http://www.ijmed.org)
- Drabek TE, Tamminga HL, Kilijaneck TS and Adams CR (1981) *Managing Multiorganizational Emergency Responses*. Boulder: University of Colorado Institute of Behavioral Science.
- Drury J, Cocking C and Reicher S (2009) The nature of collective resilience: Survivor reactions to the 2005 London bombings. *International Journal of Mass Emergencies and Disasters* 27(1): 66–95. Available at: [www.ijmed.org](http://www.ijmed.org)
- Dynes R (1970) *Organized Behavior in Disaster*. Lexington, MA: Heath-Lexington Books.
- Enarson E, Fothergill A and Peek L (2006) Gender and disaster: Foundations and directions. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 130–146.
- Eyre A (2006) Remembering: Community commemoration after disaster. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 441–455.
- Farazmand A (2001) *Handbook of Crisis and Emergency Management*. New York: Marcel Dekker.
- Fischer HW III (2008) *Response to Disaster: Fact versus Fiction and Its Perpetuation*, 3rd edn. Lanham, MD: University Press of America.
- Flint CG and Stevenson J (2010) Building community disaster preparedness with volunteers: Community Emergency Response Teams in Illinois. *Natural Hazards Review* 11(3): 118–124.
- Fothergill A (1996) Gender, risk, and disaster. *International Journal of Mass Emergencies and Disasters* 14(1): 33–56. Available at: [www.ijmed.org](http://www.ijmed.org)
- Fothergill A and Peek L (2004) Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards* 32(1): 89–110.
- Fothergill A, Maestes EGM and Darlington JD (1999) Race, ethnicity and disasters in the United States: A review of the literature. *Disasters* 23(2): 156–173.



- Fox MH, White GW, Rooney C and Rowland JL (2007) Disaster preparedness and response for persons with mobility impairments: Results from the University of Kansas nobody left behind study. *Journal of Disability Policy Studies* 17(4): 196–205.
- Fritz CE (1961) Disaster. In: Merton RK and Nisbet RA (eds) *Contemporary Social Problems*. New York: Harcourt, Brace and World, 651–694.
- Gerrity ET and Flynn BW (1997) Mental health consequences of disasters. In: Noji EK (ed.) *The Public Health Consequences of Disasters*. New York: Oxford University Press, 101–121.
- Gillespie D (1991) Coordinating community resources. In: Drabek TS and Hoetmer GJ (eds) *Emergency Management: Principles and Practice for Local Government*. Washington, DC: International City/County Management Association, 55–78.
- Girard C and Peacock WG (1997) Ethnicity and segregation: Post-hurricane relocation. In: Peacock WG, Morrow BH and Gladwin H (eds) *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disasters*. New York: Routledge, 191–205.
- Godschalk DR, Brody S and Burby R (2003) Public participation in natural hazard mitigation policy formation: Challenges for comprehensive planning. *Journal of Environmental Planning and Management* 46(5): 733–754.
- Gruntfest E, Downing T and White GF (1978) Big Thompson flood exposes need for better flood reaction system. *Civil Engineering* 78(1): 72–73.
- Heath S, Kass P, Beck A and Glickman L (2001) Risk factors for pet evacuation failure after a slow-onset disaster. *Journal of the American Veterinary Association* 218(12): 1905–1910.
- Howe PD (2011) Hurricane preparedness as anticipatory adaptation: A case study of community businesses. *Global Environmental Change* 21(2): 711–720.
- Huang SK, Lindell MK, Prater CS et al. (2012) Household evacuation decision making in response to Hurricane Ike. *Natural Hazards Review* 13(4): 283–296.
- Johnson L and Hayashi H (2012) Synthesis efforts in disaster recovery research. *International Journal of Mass Emergencies and Disasters* 30(2): 212–238. Available at: [www.ijmed.org](http://www.ijmed.org)
- Joinson AN, McKenna, KYA, Postmes T and Reips U-D (2007) *The Oxford Handbook of Internet Psychology*. New York: Oxford University Press.
- Kendra JM and Wachtendorf T (2006) Community innovation and disasters. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 316–334.
- Kohn S, Eaton JL, Feroz S et al. (2012) Personal disaster preparedness: An integrative review of the literature. *Disaster Medicine and Public Health Preparedness* 6(3): 217–231.
- Kreps GA (1984) Sociological inquiry and disaster research. *Annual Review of Sociology* 10: 309–330.
- Kreps GA (1991) Organizing for emergency management. In: Drabek TS and Hoetmer GJ (eds) *Emergency Management: Principles and Practice for Local Government*. Washington, DC: International City/County Management Association, 30–54.
- Kreps GA and Bosworth SL (2006) Organizational adaptation to disaster. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 297–315.
- Kroll CA, Landis JD, Shen Q and Stryker S (1990) The economic impacts of the Loma Prieta earthquake: A focus on small business. *Berkeley Planning Journal* 5(1): 39–58.
- Kunreuther H and Roth RJ Sr (1998) *Paying the Price: The Status and Role of Insurance Against Natural Disasters in the United States*. Washington, DC: Joseph Henry Press.
- Kuttschreuter M, Gutteling JM and de Hond M (2011) Framing and tone-of-voice of disaster media coverage: The aftermath of the Enschede fireworks disaster in the Netherlands. *Health, Risk and Society* 13(3): 201–220.

- Lin S, Shaw D and Ho M-C (2008) Why are flood and landslide victims less willing to take mitigation measures than the public? *Natural Hazards* 44(2): 305–314.
- Lindell MK (2012) Response to environmental disasters. In: Clayton S (ed.) *Handbook of Environmental and Conservation Psychology*. New York: Oxford University Press, 391–413.
- Lindell MK (in press, a) Recovery and reconstruction after disaster. In: Bobrowsky P (ed.) *Encyclopedia of Natural Hazards*. Heidelberg: Springer.
- Lindell MK (in press, b) North American cities at risk: Household responses to environmental hazards. In: Rossetto T, Joffe H and Adams J (eds) *Cities at Risk: Living with Perils in the 21st Century*. Dordrecht: Springer.
- Lindell MK (in press, c) Evacuation planning, analysis, and management. In: Bariru AB and Racz L (eds) *Handbook of Emergency Response: A Human Factors and Systems Engineering Approach*. Boca Raton, FL: CRC Press.
- Lindell MK and Brandt CJ (2000) Climate quality and climate consensus as mediators of the relationship between organizational antecedents and outcomes. *Journal of Applied Psychology* 85(3): 331–348
- Lindell MK and Hwang SN (2008) Households' perceived personal risk and responses in a multi-hazard environment. *Risk Analysis* 28(2): 539–556.
- Lindell MK and Perry RW (1987) Warning mechanisms in emergency response systems. *International Journal of Mass Emergencies and Disasters* 5(2): 137–153. Available at: [www.ijmed.org](http://www.ijmed.org)
- Lindell MK and Perry RW (1992) *Behavioral Foundations of Community Emergency Planning*. Washington, DC: Hemisphere.
- Lindell MK and Perry RW (2000) Household adjustment to earthquake hazard: A review of research. *Environment and Behavior* 32(4): 590–630.
- Lindell MK and Perry RW (2004) *Communicating Environmental Risk in Multiethnic Communities*. Thousand Oaks, CA: Sage.
- Lindell MK and Perry RW (2007) Planning and preparedness. In: Tierney KJ and Waugh WF Jr (eds) *Emergency Management: Principles and Practice for Local Government*, 2nd edn. Washington, DC: International City/County Management Association, 113–141.
- Lindell MK and Perry RW (2012) The Protective Action Decision Model: Theoretical modifications and additional evidence. *Risk Analysis* 32(4): 616–632.
- Lindell MK and Prater CS (2007) Critical behavioral assumptions in evacuation analysis for private vehicles: Examples from hurricane research and planning. *Journal of Urban Planning and Development* 133(1): 18–29.
- Lindell MK, Arlikatti S and Prater CS (2009) Why people do what they do to protect against earthquake risk: Perceptions of hazard adjustment attributes. *Risk Analysis* 29(8): 1072–1088.
- Lindell MK, Kang JE and Prater CS (2011) The logistics of household evacuation in Hurricane Lili. *Natural Hazards* 58: 1093–1109.
- Lindell MK, Prater CS and Perry RW (2006) *Fundamentals of Emergency Management*. Emmitsburg, MD: Federal Emergency Management Agency Emergency Management Institute. Available at: [hrrc.arch.tamu.edu/publications/books](http://hrrc.arch.tamu.edu/publications/books)
- Lutz LD and Lindell MK (2008) The Incident Command System as a response model within emergency operation centers during Hurricane Rita. *Journal of Contingencies and Crisis Management* 16(3): 122–134.
- McEntire DA (2006) Local emergency management organizations. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 168–182.
- Mendonça DJ and Wallace WA (2007) A cognitive model of improvisation in emergency management. *IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans* 37: 547–561.

- Mileti DS and Beck E (1975) Communication in crisis. *Communication Research* 2(1): 24–49.
- Mileti DS and Darlington JD (1995) Societal response to revised earthquake probabilities in the San Francisco Bay Area. *International Journal of Mass Emergencies and Disasters* 13(2): 119–145. Available at: [www.ijmed.org](http://www.ijmed.org)
- Mileti DS and Darlington JD (1997) The role of searching in shaping reactions to earthquake risk information. *Social Problems* 44(1): 89–103.
- Mileti DS and Fitzpatrick C (1993) *The Great Earthquake Experiment*. Boulder, CO: Westview Press.
- Mileti DS, Sorensen JH and O'Brien PW (1992) Toward an explanation of mass care shelter use in evacuations. *International Journal of Mass Emergencies and Disasters* 10(1): 25–42. Available at: [www.ijmed.org](http://www.ijmed.org)
- Mitchell CM, Esnard A-M and Sapat A (2012) Hurricane events, population displacement, and sheltering provision in the United States. *Natural Hazards Review* 13(2): 150–161.
- Mitroff I (2005) *Why Some Companies Emerge Stronger and Better from a Crisis: 7 Essential Lessons for Surviving Disaster*. New York: AMACOM.
- Murray-Tuite P and Wolshon B (2013) Evacuation transportation modeling: An overview of research, development, and practice. *Transportation Research Part C* 27: 25–45.
- NGA (National Governors Association) (1978) *Comprehensive Emergency Management*. Washington, DC: NGA.
- Norris FH, Friedman MJ, Watson PJ et al. (2002a) 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry* 65(3): 207–239.
- Norris FH, Friedman MJ, Watson PJ (2002b) 60,000 disaster victims speak: Part II. Summary and implications of the disaster mental health research. *Psychiatry* 65(3): 240–260.
- NSC (National Safety Council) (2011) *Injury Facts*. Itasca, IL: NSC.
- Olson RS and Drury AC (1997) Untherapeutic communities: A cross-national analysis of post-disaster political unrest. *International Journal of Mass Emergencies and Disasters* 15(2): 221–238. Available at: [www.ijmed.org](http://www.ijmed.org)
- Palm R, Hodgson M, Blanchard RD and Lyons D (1990) *Earthquake Insurance in California*. Boulder, CO: Westview Press.
- Paton D, Sagala S, Okada N et al. (2010) Making sense of natural hazard mitigation: Personal, social and cultural influences. *Environmental Hazards* 9(2): 183–196.
- Paton D, Smith L, Daly M and Johnston DM (2008) Risk perception and volcanic hazard mitigation: Individual and social perspectives. *Journal of Volcanology and Geothermal Research* 172(3–4): 179–188.
- Peacock WG and Girard C (1997) Ethnic and racial inequalities in disaster damage and insurance settlements. In: Peacock WG, Morrow BH and Gladwin H (eds) *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disaster*. London: Routledge, 171–190.
- Peacock WG, Dash N and Zhang Y (2006) Sheltering and housing recovery following disaster. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 258–274.
- Peacock WG, Killian LM and Bates FL (1987) The effects of disaster damage and housing on household recovery following the 1976 Guatemala earthquake. *International Journal of Mass Emergencies and Disasters* 5(1): 63–88. Available at: [www.ijmed.org](http://www.ijmed.org)
- Peek L (2010) Age. In: Phillips BD, Thomas DSK, Fothergill A and Blinn-Pike L (eds) *Social Vulnerability to Disasters*. Boca Raton, FL: CRC Press, 155–185.
- Perry RW (1990) Volcanic hazard perceptions at Mt. Shasta. *Environmental Professional* 12: 312–318.
- Perry RW (2006) What is a disaster? In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 1–15.
- Perry RW and Lindell MK (2007) *Emergency Planning*. Hoboken, NJ: John Wiley.

- Perry RW, Lindell MK and Greene MR (1981) *Evacuation Planning in Emergency Management*. Lexington, MA: Heath Lexington Books.
- Petrescu-Prahova M and Butts CT (2008) Emergent coordinators in the World Trade Center disaster. *International Journal of Mass Emergencies and Disasters* 26(3): 133–168. Available at: [www.ijmed.org](http://www.ijmed.org)
- Phillips BD (2009) *Disaster Recovery*. Boca Raton, FL: CRC Press.
- Phillips BD, Thomas DSK, Fothergill A and Blinn-Pike L (2010) *Social Vulnerability to Disasters*. Boca Raton, FL: CRC Press.
- Poteyeva M, Denver M, Barsky LE and Aguirre BE (2006) Search and rescue activities in disasters. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 200–216.
- Prater CS and Lindell MK (2000) Politics of hazard mitigation. *Natural Hazards Review* 1(1): 73–82.
- Prater CS and Wu J-Y (2002) The politics of emergency response and recovery: Preliminary observations on Taiwan's 921 earthquake. *The Australian Journal of Emergency Management* 17(1): 48–59.
- Quarantelli EL (1982) *Sheltering and Housing After Major Community Disasters*. Columbus: Ohio State University Disaster Research Center.
- Quarantelli EL (1983) *Delivery of Emergency Medical Services in Disasters: Assumptions and Realities*. New York: Irvington.
- Quarantelli EL (1988) Disaster crisis management: A summary of research findings. *Journal of Management Studies* 25(4): 373–385.
- Rose A and Limb D. (2002) Business interruption losses from natural hazards: Conceptual and methodological issues in the case of the Northridge earthquake. *Environmental Hazards* 4(1): 1–14.
- Rose A, Wei D and Wein A (2011) Economic impacts of the ShakeOut scenario. *Earthquake Spectra* 27(2): 539–557.
- Rosoff H, John R, Burns WJ and Mayad I (2011) Scenario simulation group reactions to the aftermath of the Great ShakeOut Magnitude 7.8 earthquake. *Earthquake Spectra* 27(2): 597–614.
- Sadiq A-A and Weible CM (2010) Obstacles and disaster risk reduction: Survey of Memphis organizations. *Natural Hazards Review* 11(3): 110–117.
- Savoia E, Massin-Short SB, Rodday AM et al. (2009) Public health systems research in emergency preparedness: A review of the literature. *American Journal of Preventive Medicine* 37(2): 150–156.
- Scanlon J (2006) Unwelcome irritant or useful ally: The mass media in emergencies. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 413–429.
- Seeger MW and Novak JM (2010) Modeling the recall and warning process in the foodborne contamination event: Perspectives from disaster warnings and crisis communication. *International Journal of Mass Emergencies and Disasters* 28(1): 115–144. Available at: [www.ijmed.org](http://www.ijmed.org)
- Sellnow TL, Ulmer RR, Seeger MW and Littlefield RS (2009) *Effective Risk Communication: A Message-Centered Approach*. New York: Springer.
- Siebeneck LK and Cova TJ (2008) An assessment of the return-entry process for Hurricane Rita 2005. *International Journal of Mass Emergencies and Disasters* 26(2): 91–111. Available at: [www.ijmed.org](http://www.ijmed.org)
- Siebeneck LK, Lindell MK, Prater CS et al. (2013) Evacuees' reentry concerns and experiences in the aftermath of Hurricane Ike. *Natural Hazards* 65(3): 2267–2286.
- Smith G and Birkland T (2012) Building a theory of recovery: Institutional dimensions. *International Journal of Mass Emergencies and Disasters* 30(2): 147–170. Available at: [www.ijmed.org](http://www.ijmed.org)

- Smith SK and McCarty C (1996) Demographic effects of natural disasters: A case study of Hurricane Andrew. *Demography* 33(2): 265–275.
- Smith SK, Tayman J and Swanson DA (2001) *State and Local Population Projections: Methodology and Analysis*. New York: Kluwer.
- Song Y, Berke P and Stevens M (2009) Smart developments in dangerous locations: A reality check of existing New Urbanist developments. *International Journal of Mass Emergencies and Disasters* 27(1): 1–24. Available at: [www.ijmed.org](http://www.ijmed.org)
- Sorensen JH (2000) Hazard warning systems: Review of 20 years of progress. *Natural Hazards Review* 1(2): 119–125.
- Sorensen JH and Rogers GO (1988) Local preparedness for chemical accidents: A survey of U.S. communities. *Industrial Crisis Quarterly* 2(2): 89–108.
- Sorensen JH and Sorensen BV (2006) Community processes: Warning and evacuation. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 183–199.
- Stallings RA (1991) Ending evacuations. *International Journal of Mass Emergencies and Disasters* 9(2): 183–200. Available at: [www.ijmed.org](http://www.ijmed.org)
- Stallings RA (1995) *Promoting Risk: Constructing the Earthquake Threat*. New York: Aldine de Gruyter.
- Stallings RA (2002) *Methods of Disaster Research*. Bloomington, IN: Xlibris.
- Stallings RA (2006) Methodological issues. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 55–82.
- Stevens M (2010) Implementing natural hazard mitigation provisions: Exploring the role that individual land use planners can play. *Journal of Planning Literature* 24(4): 362–371.
- Tang Z, Lindell MK, Prater CS and Brody SD (2008) Measuring tsunami planning capacity on the U.S. Pacific coast. *Natural Hazards Review* 9(2): 91–100.
- Tang Z, Lindell MK, Prater CS et al. (2011) Examining local coastal zone management capacity in U.S. Pacific coastal counties. *Coastal Management* 39(2): 105–132.
- Terpstra T and Gutteling JM (2008) Households' perceived responsibilities in flood risk management in the Netherlands. *International Journal of Water Resource Development* 24(4): 555–565.
- Tierney KJ (2006) Businesses and disasters: Vulnerability, impact, and recovery. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 275–296.
- Tierney K and Oliver-Smith A (2012) Social dimensions of disaster recovery. *International Journal of Mass Emergencies and Disasters* 30(2): 123–146. Available at: [www.ijmed.org](http://www.ijmed.org)
- Tierney K, Lindell MK and Perry RW (2001) *Facing the Unexpected: Disaster Preparedness and Response in the United States*. Washington, DC: Joseph Henry Press.
- Turner R, Nigg J and Heller Paz D (1986) *Waiting for Disaster*. Los Angeles: University of California Press.
- Uhr C, Johansson H and Fredholm L (2008) Analysing emergency response systems. *Journal of Contingencies and Crisis Management* 16(2): 80–90.
- Uscher-Pines L, Hausman AJ, Powell S et al. (2009) Disaster preparedness of households with special needs in Southeastern Pennsylvania. *American Journal of Preventive Medicine* 37(3): 227–230.
- Van Zandt S, Peacock W, Henry DW et al. (2012) Mapping social vulnerability to enhance housing and neighborhood resilience. *Housing Policy Debate* 22(1): 29–55.
- Vogt BM (1991) Issues in nursing home evacuations. *International Journal of Mass Emergencies and Disasters* 9(2): 247–265. Available at: [www.ijmed.org](http://www.ijmed.org)
- Vultee F (2009) News frames of mitigation and responsibility after Hurricane Katrina. *International Journal of Mass Emergencies and Disasters* 27(2): 103–126. Available at: [www.ijmed.org](http://www.ijmed.org)



- Wachtendorf T (2004) *Improvising 9/11: Organizational Improvisation Following the World Trade Center Disaster*. Newark: University of Delaware Disaster Research Center.
- Wallace AFC (1956) *Tornado in Worcester: An Exploratory Study of Individual and Community Behavior in an Extreme Situation*. Washington, DC: National Academy of Sciences – National Research Council
- Webb GR (2006) The popular culture of disasters: Exploring a new dimension of disaster research. In: Rodríguez H, Quarantelli EL and Dynes RR (eds) *Handbook of Disaster Research*. New York: Springer, 430–440.
- Webb GR, Tierney KJ and Dahlhamer JM (2000) Business and disasters: Empirical patterns and unanswered questions. *Natural Hazards Review* 1(2): 83–90.
- Webb GR, Tierney KJ and Dahlhamer JM (2002) Predicting long-term business recovery from disasters: A comparison of the Loma Prieta earthquake and Hurricane Andrew. *Environmental Hazards* 4(1): 45–58.
- White GF (1974) *Natural Hazards: Local, National, Global*. New York: Oxford University Press.
- Wilkins L, Steffens M, Thorson E et al. (2012) *Reporting Disaster on Deadline: A Handbook for Students and Professionals*. New York: Routledge.
- Wisner B, Blaikie P, Cannon T and Davis I (2004) *At Risk: Natural Hazards, People's Vulnerability and Disasters*, 2nd edn. London: Routledge.
- Wu HC, Lindell MK and Prater CS (2012) Logistics of hurricane evacuation in Hurricanes Katrina and Rita. *Transportation Research Part F: Traffic Psychology and Behaviour* 15(4): 445–461.
- Xiao Y and Van Zandt S (2012) Building community resiliency: Spatial links between household and business post-disaster return. *Urban Studies* 49(11): 2523–2542.
- Yeager VA, Menachemi N, McCormick LC and Ginter PM (2010) The nature of the public health emergency preparedness literature 2000–2008: A quantitative analysis. *Journal of Public Health Management and Practice* 16(5): 441–449.
- Yoon DK, Youngs GA and Jr Abe D (2012) Examining factors contributing to the development of FEMA-approved hazard mitigation plans. *Journal of Homeland Security and Emergency Management* 9(2): Article 14. DOI: 10.1515/1547–7355.201.
- Zahran S, Shelley TO, Peek L and Brody S (2009) Natural disasters and social order: Modeling crime outcomes in Florida. *International Journal of Mass Emergencies and Disasters* 27(1): 26–52. Available at: [www.ijmed.org](http://www.ijmed.org)
- Zeigler DJ, Brunn SD and Johnson JH Jr (1981) Evacuation from a nuclear technological disaster. *Geographical Review* 71(1): 1–16.
- Zhang Y, Lindell MK and Prater CS (2009) Vulnerability of community businesses to environmental disasters. *Disasters* 33(1): 38–57.

### Author biography

Michael K Lindell is a social psychologist with appointments at Texas A&M University as Professor of Landscape Architecture and Urban Planning, Water Management and Hydrological Science, and Psychology (adjunct) – as well as Senior Scholar in the Hazard Reduction and Recovery Center. He has over 40 years of experience in the field of emergency management, during which time he has conducted a program of research on the processes by which individuals and organizations respond to natural and technological hazards. He has written extensively on emergency management and is the author of over 80 technical reports; 120 journal articles, book chapters, and encyclopedia entries; and 12 books. Professor Lindell is currently the co-editor of the *International Journal of Mass Emergencies and Disasters* and a member of the US National Earthquake Hazard Reduction Program's Advisory Committee on Earthquake Hazard Reduction.

**Résumé**

L'étude des catastrophes aborde les aspects sociaux et comportementaux lors de situations soudaines de stress collectif, communément appelées situations d'urgence ou catastrophes. Ces situations peuvent être créées par des désastres naturels, des accidents technologiques, de violents conflits intergroupes, des pénuries de ressources vitales et d'autres risques majeurs pour la vie, la santé, les biens, le bien-être et les routines quotidiennes. L'étude des catastrophes traite des répercussions de ces événements sur l'ensemble des unités sociales, des individus et des ménages dans les États-nations. Les histoires de vie de ces événements, à la fois réels et menaçants, sont examinées en détail, tant du point de vue des populations exposées au risque que de leur vulnérabilité et de leurs efforts pour planifier et mener des actions d'atténuation, préparation, intervention et rétablissement.

**Mots-clés**

Atténuation, crise, convergence, désastre, improvisation préparation, réponse, récupération, urgence, vulnérabilité

**Resumen**

Los estudios sobre catástrofes abordan los aspectos sociales y de comportamiento de las situaciones de repentina tensión colectiva típicamente conocidos como emergencias masivas o catástrofes. Estas situaciones pueden ser creadas por desastres naturales, accidentes tecnológicos, conflictos violentos entre grupos, desabastecimiento de recursos vitales y otros grandes riesgos a la salud, la propiedad, el bienestar y las rutinas cotidianas. Los estudios sobre catástrofes abordan los impactos de estos eventos en todas las unidades sociales, desde los individuos, pasando por el espacio doméstico, hasta los estados nacionales. Todos los aspectos de la historia vital de dichos eventos, tanto reales como su amenaza, son evaluados en términos de las maneras en que las poblaciones en riesgo conducen los análisis de peligro y vulnerabilidad, en los planes como la puesta en práctica de acciones de reducción, preparación, respuesta y restablecimiento.

**Palabras clave**

Catástrofe, crisis, convergencia, emergencia, improvisación, preparación, reducción, respuesta, restablecimiento, vulnerabilidad