

Public health practice and disaster resilience: a framework integrating resilience as a worker protection strategy

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Introduction

The disciplines of emergency management and public health share objectives in hazard identification and the application of control or prevention strategies in the advent of disasters. This chapter defines resilience as it pertains to workers converging at a disaster site to perform response, recovery, or clean-up operations. A conceptual framework will be applied to disaster situations to highlight intervention avenues to preserve or enhance the resilience of the workers. Possible interventions include worker training and education, medical and emotional support services, disaster safety management, and alignment of organizational culture, policy, and procedures.

The disciplines of public health and emergency management

Public health is “the science and art of preventing disease, prolonging life and promoting health and efficiency through organized community effort” (Winslow, 1920). Epidemiology is the basic science of public health research, policy, and practice; which provides methods to study factors affecting the health and illness of populations (Institute of Medicine, 2002). Modern public health practice requires alliance among many disciplines and emotionally charged points of view, particularly when health and safety become challenged by disasters. Public health and emergency management share the objectives of identifying hazards and managing risk, particularly before a disaster strikes (Haddow & Bullock, 2006). When looking across these disciplines, risk would be defined as susceptibility to death, injury, and illness to people; damage or destruction of the human-built or natural environment; and disruption or stoppage of services that support people from a population perspective. The

purview of both disciplines has varied over time and in response to events, legislative initiatives, and leadership styles. For the purposes of this chapter, a disaster is defined as a serious disruption in the functioning of a local jurisdiction that poses a significant level of threat to life, health, property, or the environment and requires outside assistance to manage or cope with the event (International Federation of Red Cross and Red Crescent Societies, 2000). In common parlance, disasters are local events and directly impact communities.

Community resilience

The term community resilience is used in multiple, and often vaguely defined, ways. Emergency management uses the term “disaster-resilient community” to describe buildings, bridges, and roadways designed to withstand expected weather and geological hazards. Public policy circles use the term resilience to encourage a degree of self-sufficiency for defined jurisdictions to provide immediate emergency services and adequate food, water, medical help, and law enforcement to preserve social order in the face of disaster. National preparedness planning has applied the concept of resiliency to macro-level systems redundancy, equipment back-up, and alternative sources for raw materials, final goods and services, including information management (US Department of Homeland Security, 2009). However, these approaches focus on hardening the human-built environment and enhancing the systems that sustain people, but they do not address human behavior directly. The disaster literature is full of accounts where poor planning and lack of preparedness for the emotional, social, and behavioral consequences were likely to have delayed or compromised recovery efforts (Flynn, 2003). Disaster events have been associated with health-risk behaviors, exacerbation of chronic medical conditions, incitement of new

psychiatric disturbances, and unexplained physical symptoms associated with decrements in function or quality of life (Katz *et al.*, 2002; Fullerton *et al.*, 2003; Institute of Medicine, 2003; Engel, 2004). However, inadequate planning, personnel, and resources for this arena continue to plague emergency managers (Flynn, 2006).

In 2006, the term community resilience was directly introduced in the Pandemic Influenza and All Hazards Preparedness Act (Public Law number 109-417) and the Homeland Security Presidential Directive 21 (US Department of Homeland Security, 2007). Community resilience was contextualized (paragraph 20) as:

Where local civic leaders, citizens, and families are educated regarding threats and are empowered to mitigate their own risk, where they are practiced in responding to events, where they have social networks to fall back upon, and where they have familiarity with local public health and medical systems, there will be community resilience that will significantly attenuate the requirement for additional assistance.

This led the US Department of Health and Human Services (DHHS) to convene a federal advisory committee (the National Biodefense Science Board) for assistance with strategy and implementation. A special expert subcommittee was initiated to provide guidance to the Secretary of the DHHS about operationalizing community resilience as a health protection strategy (US Department of Homeland Security, 2007).¹ A report capturing the deliberations of this expert advisory body was passed to DHHS in November 2008 (Disaster Mental Health Subcommittee of the National Biodefense Science Board, 2008); it began with the following paragraph:

Disaster mental and behavioral health..., includes the interconnected psychological, emotional, cognitive, developmental, and social influences on behavior and mental health and the impact of those factors on preparedness, response, and recovery from disasters or traumatic events. These factors directly and indirectly influence individual and community risks for health and safety outcomes such as substance use and abuse, aggression and non-adherence to public health recommendations (e.g., medication regimens, infection control, and evacuation or restricted movement), and the success of emergency response strategies and public directives...

Community resilience is sometimes used in multiple, and often vaguely defined ways to imply that the health

and/or safety of community members can be influenced through interventions aimed at defined social networks, local governance, and critical infrastructure pathways supplying products and services needed to sustain a community in the face of disaster (Schoch-Spana, 2008). A recent review of the literature across several disciplines led Norris and colleagues (2008, p. 130) to define community resilience as “a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance” (such as a disaster). Their framework defined adaptation in terms of an ability to function and they went on to comment (p. 132) that post-disaster function is “not necessarily superior in level or character or effectiveness to pre-event functioning; it is simply different.” This is a departure from other conceptualizations of collective resilience, which incorporates the element of learning and growth from the disaster, a transformative process catalyzed by the disaster experience (Brown & Kulig, 1996/97; Tedeschi *et al.*, 1998; Paton & Johnston, 2006; Masten & Obradović, 2008). Norris and colleagues (2008) provided a theoretical model that defines economic development (continuity of business, availability of jobs), social capital (collective value of social networks), information and communication, and community competence (ability to address the challenges) as the dynamic domains of adaptive capacity at the collective community level. Their model utilizes an ecological framework of the interdependencies between people, institutions, and organizations to mobilize resources to adapt to the new reality created by the disaster. It incorporates the process of collective problem solving and a common understanding about respective roles and responsibilities of various private, public, and volunteer entities in advance of a disaster. In a book on disaster resilience, Paton and Johnston (2006, p. 8) define the challenge of adapting to the new reality as “a measure of how well people and societies can adapt to a changed reality and capitalize on the new possibilities offered.”

A framework to guide interventions promoting resilience in disaster workers

The remainder of this chapter will focus on the resilience of workers (affiliated and volunteer) converging at disaster sites to perform response, recovery, and/or clean-up operations. In essence, the concept of community will be targeted to the workers, their organizations,

Table 23.1 The Haddon matrix template.

	Host	Agent or vehicle	Physical environment	Sociocultural environment
Pre-event				
Event				
Post-event				

and the dynamic disaster work environment. The willingness and ability for workers to comply with safe work practices is greatly influenced by each worker's awareness of the hazards, the existence of a safety plan and availability of personal protective equipment, the culture of the responding and affected organizations, and the peculiarities of the incident itself (Jackson *et al.*, 2004; Qureshri *et al.*, 2005; Zohar, 2010). As such, it will be important to integrate resilience within the organizational culture and the activities designed to protect the health and safety of workers (Flynn, 2006; Reissman *et al.*, 2006a; Ursano *et al.*, 2006; Reissman & Howard, 2008). The approach to interventions that preserve or enhance disaster resilience for workers must be tailored to the work organization, the anticipated disaster scenario, and the training and experience of the workers themselves. This requires systematic analysis and evaluation as part of intervention planning. The analysis benefits from combining expertise in a public health practice framework: specifically applying classic models of causation from epidemiology within the fields of occupational health and safety and behavioral and psychological health.

The Haddon matrix: a tool for developing interventions to enhance resilience in the disaster worker community

Designing interventions for public health practice requires the development of a logic model to ascertain reasonable opportunities for intervention and to evaluate the impact of the resources applied. William Haddon, Jr. developed such a model to enable a systematic multidisciplinary analysis of the contributing factors to injury from traffic crashes, which enabled a comprehensive program of highway safety to be developed. This is known as the Haddon matrix (Haddon, 1968, 1970, 1972) and is illustrated in Table 23.1. The columns capture the contributing factors using basic epidemiology as the underpinning: namely identifying who is harmed (host), what is causing the harm (agent),

and how it is transmitted (vehicle), and defining the circumstances or settings that bring the host and agent together resulting in the adverse health or safety outcome (environment). The rows represent time phases (i.e., before, during, and after) in relation to a defined event (e.g., car crash, infectious disease, or disaster).

This systematic approach has broad application for public health practice (Institute of Medicine, 2003; Runyan, 2003; Barnett *et al.*, 2005). The following text outlines how to use the Haddon matrix to define a health or safety outcome under evaluation. The chapter will then give two case studies where the Haddon matrix is applied to two disasters to explore possible interventions to preserve or enhance resilience for workers involved in disaster response, recovery, and clean-up operations.

The disaster literature describes the following potential outcomes: health-risk coping behaviors (smoking, drinking, recklessness), exacerbation of underlying medical conditions (e.g., hypertension, peptic ulcer disease, asthma, chronic anxiety, thought or mood disorders), and the incidence of new anxiety and mood disorders (Katz *et al.*, 2002; Fullerton *et al.*, 2003; Institute of Medicine, 2003; Engel, 2004). For the purpose of this chapter, the rows can be assigned according to the disaster cycle in emergency management: preparedness and mitigation (pre-event), response (during the event), and recovery (post-event). The adverse health and safety outcomes of concern are stipulated as influenced by perceived threats to resilience: the "agent", such as traumatic loss (e.g., sudden death of a co-worker or loved one), harm (e.g., serious injury), or change (e.g., loss of job/income, home/place) resulting from the disaster. As mentioned above, the "environment" is defined collectively as the work site(s) associated with the disaster event. So, in looking more closely at the host, one could define intrapersonal and interpersonal factors for the worker as having a bearing on vulnerability and resilience. The environment is broken into a physical (human-built or natural landscape) and the social and cultural

components. The sociocultural aspects may include the interaction within (co-worker or management support, communication, resources, safety and administrative policies) and between (coordination and control) the work organizations involved in the disaster, the community and workforce behavioral norms and beliefs, and the influence of regulatory aspects (laws and enforcement).

There are several typologies used to classify disasters for the purpose of studying mental and behavioral response. Disasters may be caused by forces of nature or by human action. Examples of natural forces include extreme weather events (hurricanes, tornadoes, cyclones), geological disturbances (earthquakes, volcanic eruptions), or severe infectious epidemics (severe acute respiratory syndrome, pandemic influenza). Technological or industrial disasters may occur from human neglect, error, or by deliberate and harmful actions. People who perceive a loss of control (no warning, unable to avoid, lack of coping skills) or have inadequate social support in relation to the disaster are more likely to have more severe or longer lasting psychopathology (Fullerton *et al.*, 2003; Kaniasty & Norris, 2004). Box 23.1 provides some key observations gleaned from prior disasters, which serve as a context for the case studies to be discussed in the next section.

CASE 1: the World Trade Center terrorist attack on September 11, 2001

At least 40 000 individuals are estimated to have responded to the World Trade Center (WTC) site following the September 11 2001 (9/11) terrorist attacks, encompassing a broad array of traditional first responders, workers as diverse as laborers and morgue staff, and affiliated and unaffiliated volunteers (Herbert *et al.*, 2006). These responders encountered well-characterized physical hazards (including chemical toxins) and emotional traumatogens. It is for this reason and others that their experience provides an ideal lens through which to look at the public health dimensions of resilience amid catastrophe.

Public health observations about the responder population may in fact be particularly generalizable to other catastrophic events because of the vast size of this population and its associated heterogeneity. As responders are members of the broader “disaster community” that grows up around a disaster (Wright *et al.*, 1990), lessons regarding their resilience should be

Box 23.1 Lessons from prior disaster responses

- It is difficult to prepare responders for everything they might encounter
- Even seasoned responders can face situations and issues that cause uneasiness and distress
- It is not unusual for responders to be asked to work outside their areas of expertise
- Concerns about family and friends rank high on responders' lists of priorities
- Timely, accurate, and candid information should be shared to facilitate decision making
- Managers, at every level, need to consider the health, safety, and resiliency of workers on the job as part of situation awareness and for staged planning (implies needs for occupational health and wellness monitoring)
- Resiliency is an integral component of occupational safety and health, which requires pre-planning to maximize worker recovery
- Self-care plans and peer-support activities are essential to mission completion
- Everything possible should be done to safeguard responders' physical and emotional health
- Responders do not need to face response challenges alone; they may share their experiences with buddies, teammates, family members, and colleagues
- It is particularly difficult for responders to maintain emotional distance when they witness the deaths of children
- Organizational differences among groups of responders and cultural differences between victims and responders can impede the timely and efficient provision of emergency services
- Individuals may be thrust into leadership roles for which they have had little to no formal training

relevant to non-responders as well. The 9/11 responders also have had access to a unique long-term medical follow-up program, the information from which has led to much published discussion about issues relevant to the well-being of the responder community in the event of future large-scale catastrophic events.

Although not intended to be exhaustive, Table 23.2 and the following discussion exemplifies the application of the Haddon matrix to the subject of resilience in responders. When the 9/11 rescue and recovery response is overlaid with the Haddon matrix, the

Table 23.2 Haddon matrix of public health measures promoting the resilience of responders to the World Trade Center attacks.

	Host (WTC responders)	Agent	Physical environment	Social environment
Pre-event	Integrate routine mental health services into employee health programming	Emergency response training, including clear role definition	Biohazard training	Promote workplace environment of openness and support around mental health and resilience
Event	Train and deploy providers of psychological first aid; identify high-risk responders	Institute policies for monitoring and limiting exposure to Ground Zero	Promote/require use of personal protective equipment	Promote a disaster response environment that emphasizes responder, workplace, and family well-being
Post-event	Establish a system for long-term mental health follow-up and care	System of financial support and vocational rehabilitation for affected responders	Establish a system for long-term physical health follow-up and care	Involve families in long-term mental health follow-up and care

boxes highlight true accomplishments, missed opportunities, and lessons learned regarding public health measures relevant to resiliency.

Pre-event

Host

Planning in the pre-disaster period affords the opportunity to deploy a robust cohort of responders in the event of disaster. A responder base that begins from a healthy position is best positioned to manage itself and the response in a healthy and effective manner (Bills *et al.*, 2008). In a sample of the first 1138 participants in a medical/mental health screening and treatment program for 9/11 responders, ultimately known as the WTC Medical Monitoring Program, only 3% reported ever having previously seen a mental health professional (Smith *et al.*, 2004).

Ensuring better access to mental health services to responders pre-disaster should enhance resiliency when disaster strikes. To achieve this requires a system of capable and available mental health providers who can be reimbursed for their services. This may be easier for disaster response agencies that rely on employees rather than volunteers, but voluntary agencies could also mandate receiving proof of a “mental health check up” for all potential volunteers.

Agent

Adequate training in disaster response is essential for ensuring not only an effective response but also the well-being of responders themselves. An analysis of 28 962 registrants in the WTC Health Registry who identified themselves as having been rescue or recovery workers at the WTC site found that rates of post-traumatic stress disorder (PTSD) were lowest in police and highest in unaffiliated volunteers (Perrin *et al.*, 2007). This seems to underscore the importance of training and experience in bolstering mental health and coping during disaster. Indeed, the study also found that risk of PTSD was heightened if responders reported having performed tasks at “Ground Zero” atypical for their occupation.

Public health-oriented management of future disaster responses would, therefore, include better gate-keeping around unaffiliated volunteers ill prepared to handle what awaits them. In addition, emergency management agencies can work to ensure that partner agencies provide fully trained and credentialed responders and that these responders adhere to their roles as best as circumstances permit.

Physical environment

The attacks on the WTC generated exposure to physical contaminants, which has been the subject of much

subsequent discussion (Herbert *et al.*, 2006). The toxins derived from the thousands of liters of exploded jet fuel and the tons of coarse and fine particular matter generated by the collapse of the towers themselves, airborne exposure to which was perpetuated by days to weeks of smoldering fires. Emergency response training must include consideration of the potential biohazards to which responders may be exposed. Although it may be impossible to anticipate, or at least meaningfully educate about, all possible physical exposures, anyone who trains to participate in disaster response should at least be trained to ask two general questions: what are the potential physical exposures and who is monitoring occupational safety? This will be particularly important in the event of a nuclear, chemical, or biological terrorist attack, although it may be those very cases where the issue is most salient. Emergency response agencies can mandate basic “all-hazards” training to be an element of the training programs of their partner agencies.

Social environment

Even if employers provide for capable, available, and affordable pre-event mental health services for disaster responders, another hurdle remains – stigma. The challenge therein lies to create a workplace environment that promotes mental well-being and characterizes the action of seeking out mental health professionals as not only acceptable but also desirable. This challenge likely extends beyond the purview or capacity of any one employer to that of a community as a whole, including its departments of health or mental health. A discussion of de-stigmatization is beyond the scope of this paper, but, for example, models for addressing workplace depression have been developed (Bilsker *et al.*, 2007).

Event

Host

The evidence base for mental health interventions in the acute aftermath of disaster is limited, leading to reliance on general principles for intervention, including promoting a sense of safety, calm, hope, self-efficacy, and connectedness (Hobfoll *et al.*, 2007). Consensus exists around a set of basic interventions known as “psychological first aid” for addressing the psychological equivalent of the bumps and scrapes of trauma (Brymer *et al.*, 2006). However, little is known about the nature and extent of mental health services provided to responders in the course of their rescue and

recovery work at the WTC, despite anecdotal reports of the availability of these services. One organization, Disaster Psychiatry Outreach, did “staff” Ground Zero after the 9/11 attacks with volunteer psychiatrists, although minimal documentation is available regarding the interventions (McQuiston & Katz, 2001).

The experience of 9/11 responders has suggested the need for a comprehensive mental health program that spans the immediate and long-term aftermath of disaster and that includes real-time surveillance, treatment, and study of service utilization and impact (Bills *et al.*, 2008). This program should smoothly link immediate and long-term mental health services (Garakani *et al.*, 2004). Psychological first aid was widely promulgated in the aftermath of 9/11, providing a standard for basic mental health intervention that public health authorities may implement in future disasters. In keeping with a key aspect of psychological first aid, and in the setting of scarce resources, future peri-event mental health interventions can be targeted at higher-risk groups within the responder and general population. A host of well-documented risk factors for developing post-disaster psychopathology have been established in the general psychiatric literature (Garakani *et al.*, 2004) and in the 9/11 responder literature (Katz *et al.*, 2009). These span prior psychiatric history, extent of exposure to a disaster such as 9/11, and availability of post-disaster social supports; this suggests a picture of who among a disaster-affected population may be less resilient and need more assistance.

Agent

The disaster literature is replete with evidence that “dose of exposure” to a disaster or other trauma correlates with likelihood of suffering psychiatrically in its aftermath (Katz *et al.*, 2002). This association has also been shown in 9/11 responders, where exposure was reflected in such dimensions as having directly witnessed the attacks, been exposed to the dust cloud, lost someone, or spent more time at Ground Zero (Bills *et al.*, 2008). Regarding the last, among the WTC Health Registry’s 28 962 responders, arriving at the WTC site soon after 9/11 and total duration of time spent working at the site (from 1 to 200 days) were each an exposure variable that correlated with likelihood of having PTSD in all responders except police (Perrin *et al.*, 2007).

Emotional exposure represents a multifaceted construct that includes at least one major modifiable factor – duration of exposure. Communities need their

responders to rush in quickly. However, the scientific literature suggests that limiting responders' subsequent duration of exposure at places like the WTC site should promote the resilience of the responders and, therefore, be in the interest of the community that has a stake in their well-being. Responders' time of exposure to a disaster could be monitored according to at least two parameters: total time spent on-site and how much time off occurs within that time period. While further study will be required to calibrate the former threshold, common sense should be of more use in guiding public health decision making on the latter.

Physical environment

One of the major exposures suffered by WTC responders, toxins, has already been alluded to. In a study of the first 9442 WTC responders who participated in a medical and mental health screening program, the WTC Worker and Volunteer Screening Program, 69% reported new or worsened respiratory symptoms at the time of working at the WTC site and 59% reported persistent complaints at the time of their examination up to two and a half years later (Herbert *et al.*, 2006). As with emotional exposure, earlier time of arrival correlated with respiratory symptoms and findings. Likewise, in the WTC Health Registry's cohort, time of arrival as well as duration of exposure at the WTC site correlated with the likelihood of newly diagnosed asthma (Wheeler *et al.*, 2007).

Importantly, the WTC Health Registry study found that delays in use of respiratory masks, and to a lesser degree total days without using masks, correlated with the likelihood of developing asthma (Wheeler *et al.*, 2007). The authors of the study concluded that timely and appropriate use of respiratory masks, along with programs that enforce this usage, should reduce future respiratory exposures in the event of disasters that involve airborne contaminants. This reflects a hard-learned lesson from 9/11 that can inform future public health planning around disasters.

Social environment

In the necessary rush to respond and help after a disaster such as 9/11, there is great potential for neglect of life beyond the disaster site. Self, family, and workplace may all be neglected in the course of becoming immersed in rescue and recovery efforts. When the length of a disaster response spans months, as it did at the WTC site, this neglect may have significant ill consequences in any or all of these domains. For example,

family tensions may become exacerbated (Katz *et al.* 2006a). In addition, it must be considered whether the immersion in disaster response represents, at least in part, an unhealthy flight from personal problems (Katz & Nathaniel, 2002).

It should be possible for response agencies to "preach" balance to their responders in the course of training and emergency response planning, thereby making it easier to "practice" balance during the inherently unbalanced state of eventual disaster. Attempts can be made to foster disaster response environments that accentuate the need for decisive action without siphoning excessively from the responder's self, home, or workplace. Specific approaches to this include inviting responders to examine their motivations, devising "buddy systems" for responders to look after one another in the course of a disaster, and prioritizing literal lines of communication between responders and their home environments.

Post-event

Host and physical environment

The WTC Worker and Volunteer Medical Screening Program and the associated WTC Worker and Volunteer Mental Health Screening Program were established in July 2002 through a combination of federal and philanthropic funding in order to screen WTC responders for physical and mental health conditions associated with the disaster (Herbert *et al.*, 2006; Katz *et al.*, 2006a). Originally funded as a one-year program, what is now called the WTC Medical Monitoring and Treatment Program (MMTP) has evolved into an ongoing multiyear program that includes physical and mental health screenings, follow-up examinations, on-site treatment services, and case management services (Katz *et al.*, 2006b). A similar but separate program exists for firefighters from the Fire Department of New York. As of May 2008, over 24 000 WTC responders had undergone initial screenings across the consortium of non-fire department clinical sites in the metropolitan New York City area, funded by the National Institutes of Occupational Safety and Health. Details of the clinical programming are described elsewhere (Smith *et al.*, 2004; Herbert *et al.*, 2006; Katz *et al.*, 2006a).

To the best of our knowledge, the MMTP and its forerunner, the WTC Worker and Volunteer Medical Screening Program, represent programs of unprecedented scope and magnitude in addressing the medical and mental health needs of disaster responders.

Congress appropriated \$323 million to support both responder and non-responder WTC medical surveillance and treatment programs between 2003 and 2008 (Gerberding, 2008), reflecting the magnitude and the cost of these programs. The MMTP represents a post-event public health safety net to capture 9/11-associated health and mental health problems arising despite whatever pre-event and event-related health measures were undertaken, and because of those measures that perhaps were overlooked. Although future research will be needed to determine the full impact of these WTC programs, the MMTP serves as the best available working model for addressing post-event resiliency through public medical and mental healthcare.

Agent

We are not aware of any peer-reviewed publications on the issue of disability related to working or volunteering as a 9/11 responder. However, clinical observations from the MMTP by one of the authors (CLK) suggest that it is a major issue for many patients, with workers' compensation claims constituting a frequent dimension of both physical and mental healthcare. The inability to work as a result of their exposure at the WTC site deprives 9/11 responders of both income and fulfillment.

As of 2006, Congress had awarded \$105 million to New York State in support of 9/11-related worker compensation claims (Gerberding, 2008). A portion of this funding has also gone toward planning for future disasters. The public health impact of providing workers' compensation on the resilience of 9/11 responders remains to be investigated but can be predicted to be a significant ingredient in post-event recovery. Clinical observations suggest that, whatever the magnitude of this impact it could be increased by better pairing of compensation with vocational rehabilitation programming.

Social environment

The need for better connections between responders and their families during a catastrophic event has already been discussed. In a similar fashion, families should be involved in post-event mental health treatment programming for responders. The rationale is twofold: the mental health problems of responders after 9/11 may affect their partners and children, while mental health issues in the family may exacerbate the 9/11-related mental health issues of the responders. Experts have generally agreed that a multifaceted approach to

problems such as PTSD is necessary, particularly given the modest effect and evidence base for most pharmacological and psychotherapeutic treatment modalities (Shalev *et al.*, 1996).

One clinical center within the MMTP has created a family intervention program based on a recent New York State Office of Mental Health initiative for involving families in the treatment of patients with chronic mental illness (Salerno *et al.*, 2008; McKay, personal communication, 2009). Having such a specialized unit within a broader medical/mental health program may serve as a model for broad-based public health planning around future disasters.

CASE 2: the Sago Mine disaster on January 2, 2006

Background

It is useful for the reader to have some understanding of the mine environment in order to appreciate the inherent danger of the workplace and relate to the case study. A mine is broadly defined as an opening or excavation in the earth created for the purpose of extracting minerals (Thrush *et al.*, 1968). Coal is mined either on the surface of the earth or underground. To extract coal from an underground mine, the coalbed (or seam) must be accessed from the surface. The term "portal" is generally given to any entrance that provides access to a coal mine. In hilly terrain, such as is found in the Appalachian coalfields in the eastern USA, the coal may form an outcrop on a hillside, which allows direct entry to the coal seam via a horizontal tunnel or "drift" opening. At other locations, it may be possible to open a "slope" tunnel that angles down from the surface and intersects with the coal seam. If the coal seam is too deep for a slope to be feasible, a "shaft" must be constructed. The shaft, which may be 20 feet (12.5 m) or more in diameter, extends vertically from the surface to the seam and is accessed via a large elevator. Once inside the underground mine, miners are transported to various worksites underground, sometimes miles away. The transportation system is installed for moving workers, supplies, equipment, and the extracted coal.

In an underground coal mine, workers must contend with poorly illuminated work areas that can be dusty, uneven, and wet and muddy depending upon the amount of water present. Work areas can be extremely confined, particularly in mines with a low seam coal height (i.e., less than 5 feet [1.5 m] high). In low seams,

coal miners work on their knees or backs during their entire shift. To extract the coal, miners must operate large, noisy, technically sophisticated equipment in these confined work areas. The only lighting available comes from the miner's battery-operated cap lamp and from localized sources on various mining machines. In addition, the coal mining process releases dangerous gases, including methane, which is highly explosive and needs to be monitored. Miners may also have to deal with carbon monoxide should there be a fire or explosion underground and be aware of oxygen deficiency in locations that may not be adequately ventilated. As per federal regulation, miners are required to carry emergency respirators – self-contained self-rescuers (SCSRs) – whenever they are inside the mine. The SCSRs are closed system breathing devices designed to provide the miner with a protected oxygen supply that lasts one hour. Miners are mandated to receive appropriate training on when and how to properly use the SCSRs. The SCSR is for emergency escape from the mine when the air is thought to be contaminated with toxic gas (i.e., carbon monoxide).

In summary, the mining environment is dangerous and the hazards are dynamic in nature – constantly changing as the mining process creates new space (Kowalski-Trakofler & Barrett, 2003). Our example, the Sago Mine disaster in West Virginia, is a drift mine opening into the Middle Kittanning coal seam through five drift openings. Battery-powered track-mounted personnel carriers (mantrips) and locomotives were used to move the men and materials throughout the mine. Coal was transported to the surface by a series of conveyor belts.

Historical trends

The safety of miners is dependent upon many inter-related factors including knowledge of the dynamic, ever-changing environment, the ability to recognize and respond to hazards, training, experience, and communication. In the USA, mine operators, federal and state mine safety agencies, and researchers have looked at numerous aspects of miner injuries and fatalities with regard to mitigating future incidents and increasing resilience amongst the population. The most intense efforts in this area have occurred following major mine emergencies. Mining has a history of disasters. From 1900 to 2007, some 11 612 underground coal mine workers died in 514 different mining disasters, with most disasters resulting from explosions or fires (DeMarchi, 1997; Mine Safety

and Health Administration 1998a, 1998b; Kowalski-Trakofler *et al.*, 2009).

During a five-month period in 2006, three underground coal mining incidents in the USA resulted in the deaths of 19 miners. All three incidents received nationwide attention, particularly the Sago Mine disaster in West Virginia. These incidents represented a departure from the recent trends in underground coal mining safety (Figure 23.1). Before 2006, the number of mining disasters had decreased from a high of 20 in 1909 to an average of one every four years during 1985–2005.

The events of the Sago Mine disaster

On Monday, January 2, 2006, at approximately 6:30 a.m., an explosion occurred at Wolf Run Mining Company's Sago Mine in West Virginia, leading to the death of 12 miners. Thirteen miners were working in the vicinity of the explosion. One miner was working alone about 1500 feet (450 m) from the others and was killed instantly by the forces from the explosion. The other 12 were members of a coal production crew: of this group, 11 perished from carbon monoxide poisoning. The sole survivor from the production crew was able to give testimony in the ensuing investigations conducted by the Mine Safety and Health Administration (Gates *et al.*, 2007) and the West Virginia Office of Miners' Health, Safety, and Training (2006). These official reports conflicted in some aspects in the description of events.

What is understood is that following the explosion the crew attempted to escape by their transport vehicle (mantrip) but soon encountered debris that made their route impassable. The crew then entered their primary escapeway on foot, a tunnel that would lead them to a portal and out of the mine. They walked approximately 1000 feet (305 m) through a potentially deadly atmosphere before donning their SCSRs. They returned to their original location at the coal face and erected a barricade of plastic sheeting – which is part of standard training when escape is not possible. Reportedly, the miners took off their SCSRs while they were building the barricade.

After the barricade was finished, all 12 men went behind it to wait for rescue teams to arrive. The only survivor reported that there were not enough SCSRs to go around since after a time four miners were not able to make their's work, so individuals shared with each other, trading off SCSRs between them. Besides removing and replacing mouthpieces while sharing the apparatus, members of the crew also removed their

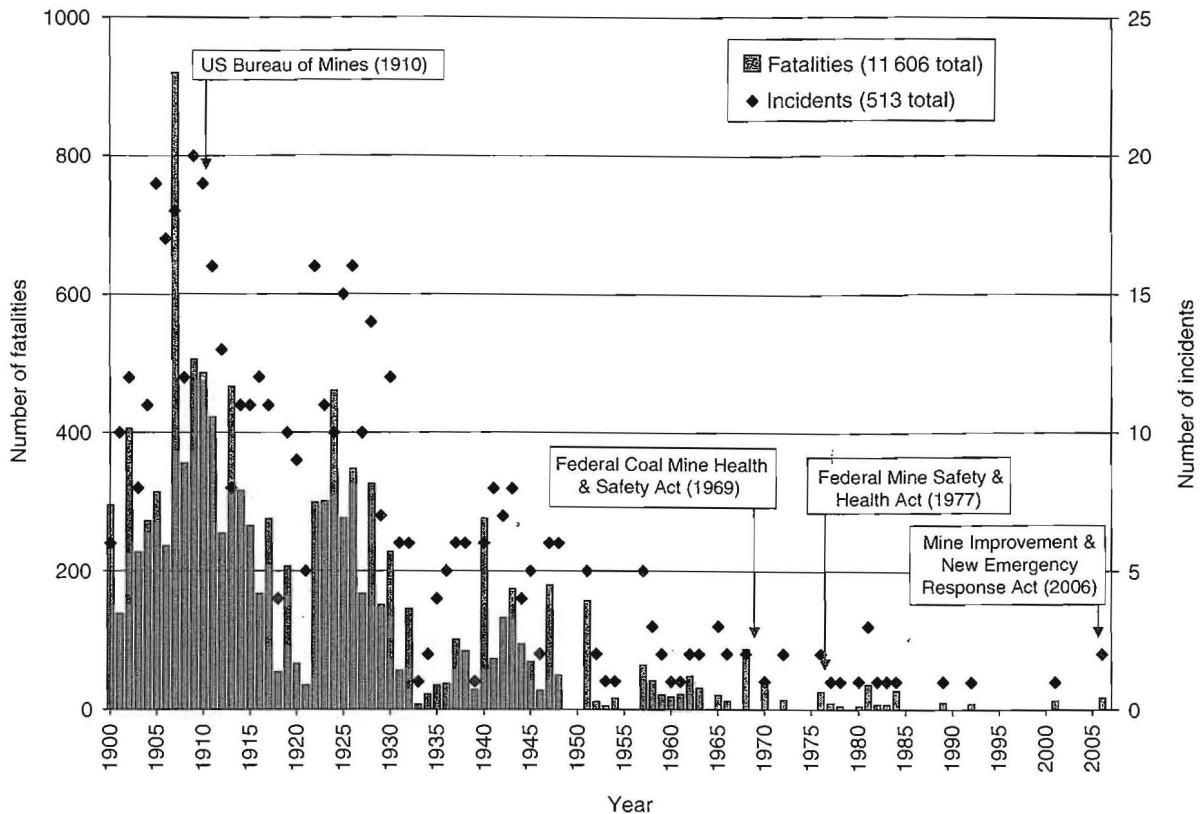


Figure 23.1 Underground coal mining disaster incidents and fatalities from 1900 to 2006. A mining disaster is an incident with five or more fatalities. (Data from <http://www.cdc.gov/niosh/mining/statistics/disasters.htm> MSHA, accessed February 22, 2011.)

mouthpieces to talk. The West Virginia Office of Miners' Health, Safety, and Training Report of Investigation concluded that the 11 miners succumbed to carbon monoxide poisoning.

Given the way that the SCSRs were utilized during the building of the barricade, it seems apparent that they were not used correctly, at least not in that instance. Evaluation of SCSRs removed from the mine revealed all were working. Lack of expectations and training in how the devices work may have had something to do with their misuse, which, in turn, led to the miners' inability to utilize the equipment fully. In addition, carbon monoxide poisoning may have affected the miners' reasoning and decision-making abilities and may have contributed to how they utilized the SCSRs during the building of the barricade.

The first mine rescue teams arrived about four and a half hours after the explosion, but they did not reach the barricaded miners until 40 hours after the explosion. This proved to be a critical issue. In mining, the miners themselves are actually the "first responders" as

the logistics of escape and rescue in an underground coal mine are complex, involving time and distance to the portal. All miners are trained in emergency response. It takes time to assemble a mine rescue team, who sometimes must travel a distance, assemble, be briefed, and don their equipment. There is a basic mine rescue protocol that has developed over the years based on rescue efforts made during previous mine disasters, with a focus on the safety of the rescuers, monitoring of the environment such as toxic gases, and constructing roof support as needed; consequently forward progress can be slow. However, each mine disaster is unique and presents its own challenges.

To complicate matters, and create a second tragedy, families and the media were told that "all are okay behind barricade – 12 men" (West Virginia Office of Miners' Health, Safety, and Training, 2006). The devastating news came to the families and media over an hour later, that there was only one survivor and that he was in serious condition. Communications were problematic because of the need to pass information

Table 23.3 Application of the Haddon matrix to the Sago Mine disaster, 2006.

	Host (underground coal miners; mine emergency response personnel including mine rescue, mine incident command)	Agent/vehicle (death, injury, loss of income, penalty fines, psychological consequences)	Physical environment (underground coal mine)	Social environment (safety culture at mine/in the industry; mine policies; legal environment; community norms)
Pre-event	Promote mental health and resilience behaviors; travel escape routes; teach proper behavior and use of personal protective equipment in mine emergency response	Develop site emergency plans (mandated); emergency response training, know the law; clearly marked escapeways; assigned roles; teach decision-making points to escapees; security and media plan	Prevention through engineering; monitor gases; design emergency communication and protocols; provide equipment at mandated intervals (i.e., SCSRs, refuge shelters, etc.)	Promote workplace support around mental health and resilience; provide community with ways to support each other; provide specific disaster mental health resources. Develop cooperation with local emergency rescue teams, state and federal personnel
Event	On-site response immediate; trapped miners follow escape procedures; mine rescue protocol and incident monitoring take leadership; psychological first aid	Mandates and policies provide structure for response	Monitor mine conditions; build barricade; utilize refuge chamber	Provide information (shift/fatigue) and support to incident command; provide protection and support for families and community
Post-event	Long-term mental health follow-up and care; SCSR training;	Official report; cause; lessons learned; rescue policy evaluation; develop interventions	Evaluate cause; make appropriate engineering interventions to make the mine safe; close mine;	Involve miners, families, mine rescue, and community in long-term mental health follow-up; facilitate evaluation of policies; cooperation; positive support; MINER Act passed

SCSR, self-contained self-rescue.

through multiple individuals. On the surface, there were two pager phones in the mine office, one in the dispatcher's building and one just inside the mine portal, in addition to one near the mine rescue truck. There were over 100 people on the surface, many with cell phones. Although the site was being secured by police, the national media had set up observation positions for their camera crews; what was not known at the time was that some of these media crews had directional listening devices pointed at the mine portal and could hear the pager phone, further complicating official communication from the command center to the affected families.

Analysis of the disaster using the Haddon matrix

To determine mine emergency prevention and intervention strategies, the Haddon matrix is helpful in organizing and examining the various aspects of pre-event, event, and post-event activities (Table 23.3). There are more pre-event activities than in most other emergency situations, mainly because of legal mandates and constraints, both state and federal, concerning types of hazard, enforcement of safety regulations, allowable technology, and particularly mandated training in the mining industry. While the discussion

of the WTC disaster was covered by considering events before, during, and after the attack, the mine disaster here is better illustrated by considerations based on the matrix column heads – host, agent, physical environment, and social environment – at various stages within the disaster pathway.

Host

The population or host for the Sago disaster is defined as the actors involved. All played a part in the event response from the moment the event was identified. The actors are highly dependent upon each other. Underground coal miners are actually their own first responders, as they may be miles from the surface. It may take hours to assemble a mine rescue team, command center, and support personnel. Therefore, the host or responder is defined broadly to include the escaping miners, the mine office initial response personnel (dispatcher), the eventual incident command (mine management, federal, state, union personnel) and the mine rescue teams, plus of course the miners' families and the community. Pre-event for the host is focused on training for emergencies, including understanding escapeways, practicing with equipment, and reviewing emergency plans and procedures. The Sago miners completed mandated training, yet *during the event* they struggled with the use and operation of their SCSRs. Mine rescuers, who are highly trained, took 40 hours to reach the miners because of the environment and the established protocols for advancement in toxic air.

Agent

The loss or harm (or agent) that results from an incident such as Sago is substantial. At Sago, there were 12 deaths; one injured miner; closure of the mine, resulting in loss of livelihood for many in the community; legal and financial penalties for the mine company; and long- and short-term mental health consequences. Pre-event development of site-specific emergency plans is mandated. All miners must complete emergency response training annually. Mine operators are expected to know the law. Teaching miners decision-making points in escape should be an important component in the training. During the event, escapeways should be clearly identified and emergency roles assigned. Sago Mine provided the lesson that extensive security and media plans need to be in place. Mines have plans in the event of an emergency to cordon-off the mine property. Mine personnel provide this function until local

or state police arrive on scene. In addition, mines designate an area for families to gather and provide space for media at a separate location. The essential goals are to protect incident command in order to focus on the emergency, provide for the families, and maintain official communications. Sago showed the industry that with the advent of sophisticated technology, revisiting security of both property and information communication is important.

Post-event, the matrix can put into perspective the need for SCSR training and the development of a switch-over procedure from one SCSR unit to another, as the units are designed to last one hour. There is also need for expectations training for miners so that they understand what they can anticipate when wearing a working unit. There were two ex-Sago miners who committed suicide eight months after the disaster. The company had provided "grief counseling" after the disaster and renewed the offer after the two suicides. There is no formal ongoing disaster mental health counseling after a mine disaster. The Sago disaster emphasized the need for such a service and the Mine Safety and Health Administration has recognized this need.

The physical environment

Much is known about the *pre-event* physical environment in most mine disasters. Specific mine hazards such as fires and explosions or inundations of gas or water are well known and continuously studied. Underground coal mines are inspected by both federal and state inspectors regularly. Maintaining a safe mining environment is a key component to a safe and resilient workforce. At Sago, the explosion was most likely caused by a lightning strike on the surface. It is believed that energy from the lightning propagated through the earth to a sealed, abandoned working area, igniting methane gas that had accumulated in the old workings, blasting out the walls between the abandoned and active mine areas. *During the event*, the mine rescue team monitors the air in addition to drilling surface bore holes to lower sensors. The major focus of *post-event* interventions in the mining industry are engineering controls. The first line of defense is to engineer out the hazard in the environment.

The social environment

Less is known about the *pre-event* social environment: the safety climate at the mine. Most miners work within a crew and buddy system and are taught to stay together in the event an escape is necessary. The Sago

crew exemplified their training. As the Haddon matrix defines social environment, policies and the legal environment are included, which are well defined in the mining industry. Therefore, the social environment pre-event at Sago Mine can be defined and understood more than in many other types of disaster. Mines are in rural locations and most members of the mining community live in rural or small communities. This provides a support system during and after an event – one which is already in place through community interaction.

Lessons from the Sago Mine disaster

Examination of the Sago Mine disaster utilizing the Haddon matrix helps to define the response strengths and to focus on key issues to target for intervention with the goal of developing a more resilient host, including miners, mine operators, mine emergency response and command personnel, and the overall mining community itself. Clearly as the model illuminates, further training on SCSR use is warranted. In addition, since SCSRs last approximately one hour, switching SCSRs in a toxic environment became an issue after Sago. Why some miners thought their SCSRs did not function when testing after the incident showed that the units were not empty remains a concern.

Within six months of the Sago disaster, the US Congress enacted the 2006 Mine Improvement and New Emergency Response Act (MINER Act, 2006). This legislation contained provisions to improve safety, health, preparedness, and emergency response in US mines. The MINER Act requires mine operators to develop and maintain an emergency response plan. Prior to the Sago incident, mines were only required to provide miners with a single self-contained breathing apparatus affording the wearer one hour of protection. Regulators felt miners needed to be provided with sufficient quantities of breathing apparatus to give them at least two hours of protection in the event of a prolonged escape. The legislation requires mines to store extra emergency breathing apparatus along escapeways in sufficient quantities that miners will have oxygen breathing apparatus available to them the entire length of their escapeways. The Mine Safety and Health Administration developed SCSR switchover training along with expectations training, based on a study by researchers at the National Institutes of Occupational Safety and Health (Kowalski-Trakofler *et al.*, 2008)

The inability of trapped miners to communicate with rescuers during the Sago Mine disaster led to another

feature in the MINER Act, which called for installation and maintenance of flame-resistant directional lifelines in escapeways. Mine operators must install wireless two-way communication and tracking systems between underground and surface workers. Congress subsequently passed an emergency supplemental appropriation to accelerate implementation of (1) emergency oxygen supplies, (2) underground refuge chambers, and (3) communications and tracking systems.

Communication quality surfaced as a major issue in the Sago disaster, in the mine, mine to surface, and personal communication with families and media. Since Sago, resources have been applied to the development of wireless communications, and procedures have been put in place to communicate with families and secure the media. Evaluations of mine rescue policies are ongoing. Of major interest in terms of developing a resilient workforce is the need for training on psychological aspects of human response and behaviors in disaster, in addition to a program such as psychological first aid during the event and afterwards (Brymer *et al.*, 2006).

Conclusions

The tools for impacting resilience at the workforce (population) level share strategies with those used for occupational health and safety and public health practice, such as leadership training, public education, worker training, legislation, engineering design codes and standards, land use management, and research regarding human behavior and intervention effectiveness. During the pre-event period, workers must acquire and maintain appropriate education, training, and certification (credentials) specific to their potential deployment roles. Medical, emotional, and cognitive readiness are important dimensions of workforce health protection planning. This may be enhanced by improving coping skills through training and by building social support networks before the disaster strikes. Leadership training is a critical element of force protection as team cohesion, buddy relations, and operations are all leadership dependent.

In addition, the employers can implement organizational changes to preserve and maintain worker resilience by encouraging and supporting safe work practices and adopting policies that better enable workers to balance competing work and life demands. Boxes 23.2 and 23.3 are organizational tools for use pre-event to improve leadership and resilience in workers,

Box 23.2 Organizational Leadership Self-Assessment Tool: adapting existing worker support services to provide enhanced workforce support during public health emergencies

The Organizational Leadership Self-Assessment Tool is designed to help state and local health departments, healthcare facilities, and first-responder organizations to develop plans for ensuring the availability of workforce support services during an influenza pandemic. These plans may be developed by existing employee assistance programs, occupational health services, or human resource departments and can be used as the basis for other disaster scenarios. The tool consists of a series of questions.

- What are the most essential or mission critical functions performed by your organization? How might they be impacted by pandemic influenza? What is your organization's plan for protecting workers and maintaining essential functions? What is your organization's role in the response to pandemic influenza?
- What psychosocial issues might arise within your organization and workforce because of pandemic influenza (i.e., consider increases in workload [absenteeism], alternative work strategies such as telework, just-in-time training, currency of information, exchange of ideas, grief leadership to help with death of co-workers or others in personal life, management flexibility, increased challenge of disseminating current, accurate, timely information, etc.)?
- What significant aspects of your organization's structure, business practices, workforce demographics, and culture should be considered in planning for pandemic influenza?
- What hurdles might your organization encounter in attempting to provide services to your workforce during different phases of pandemic influenza? What strategies might be employed to overcome those hurdles (e.g., alternative service delivery methods)?
- How might your organization assist your covered workforce in preparing for and dealing with these psychosocial issues?
- How might your organization assist its executive leaders in preparing for and dealing with these psychosocial issues?
- What might your organization be doing now to promote the resiliency of your workforce and coping ability in the event of a pandemic emergency (prepare and mitigate)?

Source: Reissman *et al.*, 2006b.

Box 23.3 Organizational actions supporting resiliency for essential service workers

Actions supporting worker resiliency at the organizational level require dedicated resources and an alignment of management practices and administrative policies. The following list provides guidance about how to achieve this level of support for both workforce and organizational resiliency:

- monitoring workforce needs for stress management and healthcare
- planning for continuity of medical care (specialists, medicines) for workers with chronic illnesses (physical and psychological)
- monitoring for emerging needs (e.g., stress-related, depression, grief, idiopathic medical conditions)
- providing education about stress-related conditions and anticipated health and safety concerns
- providing family assistance programs (most coping will come from family/friends/faith and programs within workplaces and schools)
- providing/receiving leadership, management, and supervisory training
- anticipating needs and work pace over time (think of the metaphor of a marathon not a sprint)
- providing/receiving grief leadership, ceremony, support (fatality management)
- improving perceptions of collective efficacy (i.e., ability to handle problems as a team) through education, training, and drills
- promoting integrated health, safety, and security culture/climate (hardiness, resiliency)
- using role modeling by leadership
- enabling workers to balance work and home demands through flexible work schedules and other administrative policies
- reinforcing organizational commitment to worker safety and health through appropriate supervision, training, and access to services
- implementing continuity of information and communication systems (FEMA Emergency Management Guide for Business and Industry, <http://www.fema.gov/business/guide/index.shtml>; Continuity of Operations, <http://www.fema.gov/government/coop/index.shtml#0>)
- ensuring continuity of essential operations (organizational resiliency)
- ensuring redundancy and cross-training of critical tasks/roles providing alternative worksites and innovative use of technology to maintain operations.

Sources: Reissman *et al.*, 2006a; Ursano *et al.*, 2006.

Box 23.4 The Worker Resiliency Program

The Worker Resiliency Program was created by the US Centers for Disease Control and Prevention (CDC) as an internal workforce strategy in 2004, during the humanitarian response to the Indian Ocean earthquake and tsunami, to safeguard the health, safety, and resiliency of staff members deployed to dangerous locations. It was further expanded during the 2005 responses to Hurricane Katrina along the Gulf Coast in the USA and to a large outbreak of Marburg hemorrhagic fever in Angola. The program, which continues to evolve, currently performs the following activities:

- identifies and anticipates stressors that responders are likely to encounter
- develops field resources and conducts pre-deployment briefings on how to use self-care strategies to minimize anticipated stressors
- ensures access to healthcare and counseling services during and after deployment
- recommends organizational strategies to assist responders deployed to harsh settings, such as administrative leave, just-in-time training, tactical logistical assistance, clarifying mission assignments
- provides support materials for families of those deployed using Internet technology and a peer-support (family buddy) system
- assists in interim and after-action reporting
- supports development of routine training courses for team leaders and deployment personnel
- facilitates external expert consultation with senior leadership and employee assistance professionals on strategic and operational policies, training, and behavioral healthcare practices
- institutes an integrated health, safety, and resiliency function as part of command staffing within the CDC incident management system
- supports a pilot field-support program, ranging from field support by peers (buddy) and tactical deployment, safety and resiliency team members, with linkage to CDC emergency operations for technical support and situation awareness
- provides field training involving the basics of safety, peer support, and psychological first aid.

respectively. Box 23.4 outlines the Worker Resiliency Program developed by the US Centers for Disease Control and Prevention to support its workers during a disaster and in its aftermath. This program is being

presented to demonstrate how the principles presented in this chapter have been applied to a particular workplace setting and organizational culture. Organizational changes may include flexible schedules, portable communication devices (and air time), leadership and team building, regulating the operational tempo or staff rhythm, monitoring worker health, fatigue and safety practices, and providing services to meet work-related physical and emotional healthcare needs. Supervisors should be aware that fatigue and sleep deprivation can have serious negative consequences in the workplace and lead to recklessness or unsafe work practices during an emergency, particularly if shift length and duration of mandated service are long and rest periods are inadequate (Caruso *et al.*, 2006). Fatigue management becomes increasingly important when workers face multiple or hazardous work demands, threats to personal safety, and/or traumatic and psychologically challenging experiences, such as witnessing mass fatalities or handling affected persons who are angry or emotionally distraught.

It is helpful to anticipate needs for psychological interventions within the workplace and do the homework required to ensure that potential techniques are based on empirically defensible and evidence-based practices – and are conducted by qualified individuals. It is also important to tailor any intervention strategy to the ecology of the workplace and workforce (e.g., when and how the intervention unfolds) (Hobfoll *et al.*, 2007). These are all essential elements for organizational continuity. The cost of not doing this can be quite high, including loss of specialized workers, with a need to recruit and train new staff; interim loss of productivity; worker compensation costs for job-related injury, illness, or disability; and other potentially cascading organizational effects (e.g., loss of morale). Effective disaster safety management requires appropriate infrastructure and interagency planning and coordination before the emergency arises. Pre-deployment and preparedness activities shape and influence the overall success of the emergency response efforts, and, in turn, the disaster recovery process. As seen in the WTC disaster, workers who assume roles to which they are not accustomed, or for which they are psychologically unprepared, may experience significant interpersonal and organizational stresses (Perrin *et al.*, 2007). The same may be true for workers who shoulder extra responsibilities to ensure the continuity of businesses, governmental offices, or critical community services (e.g., energy,

food, and water supply; waste management; telecommunications; and transportation).

Finally, expert consultation (advisor) to the incident or crisis leadership regarding the resilience, health, and safety of the affected workers would greatly benefit the efficiency of the combined operations. Behavioral expertise in a command staff advisory role may also serve to minimize decision-making errors stemming from the impact of the traumatic events on the leaders themselves.² Psychologically and behaviorally informed advice is likely to improve information analyzed about when and why leadership should implement major decisions: such as when to transition from *response* (rescue and life safety activities) to *recovery* (managing the losses) operations. There are cascading and enduring consequences that can occur when such a transition is delayed (Jackson *et al.*, 2004).

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Endnotes

1. The National Biodefense Science Board was established by the Secretary of the US Department of Health and Human Services (DHHS) pursuant to section 319M of the Public Health Services Act (42 USC. 247d-7f) as added by section 402 of the Pandemic and All Hazards Preparedness Act (PAHPA) (Pub. L. 107–417), effective December 19, 2006. The Board provides expert advice and guidance to the Secretary on scientific, technical, and other matters of special interest to HHS regarding current and future chemical, biological, nuclear, and radiological agents, whether naturally occurring, accidental, or deliberate. The Board may also provide advice and guidance to the Secretary on other matters related to public health emergency preparedness and response. It is an established Federal Advisory Committee with both legal and discretionary authorities.
2. Under the Homeland Security Presidential Directive 21, paragraph 31 (US Department of Homeland Security, 2007), the Secretary of Health and Human Services, in coordination with the Secretaries of Defense, Veterans Affairs, and Homeland Security, was directed to establish a Federal Advisory Committee for Disaster Mental Health. The directive stated that the committee shall consist of appropriate subject matter experts and, within 180 days after its

establishment, shall submit to the Secretary of Health and Human Services recommendations for protecting, preserving, and restoring individual and community mental health in catastrophic health event settings, including pre-, intra-, and post-event education, messaging, and interventions. To execute this directive,

the Disaster Mental Health Subcommittee was established under the National Biodefense Science Board, an established Federal Advisory Committee with both legal and discretionary authorities providing advice and guidance to the Secretary of Health and Human Services.