The Safety and Health of Emergency Workers

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Emergency personnel, like all workers, carry out their duties within an environment composed of a set of discrete elements. First, there is the emergency itself. Whether a forest fire in France, a tornado in the American Midwest, or a mining disaster in Russia, the emergency imposes certain exigencies upon the responders. Second, a social structure exists with specific social units, rules, and forms of association. An emergency response, therefore, takes place within a context of prescribed behaviors, expectations, and value judgments that are sometimes in conflict with each other. Third, there is a technology that must be understood in order to accomplish group goals. If the technology itself is implicated in the emergency, the entire emergency environment may be impacted. Clearly, a breakdown in any of these elements could result in worker injury and might heighten responder stress. This paper discusses how emergency workers not only get injured but may come to experience burn-out, post-traumatic stress syndrome, or impaired work and family relationships, even though their normal work setting (the emergency) is expected to be 'abnormal'. The authors suggest areas in each of the three environmental elements that deserve further inquiry.

Introduction

A successful emergency management effort involves many components. Consequently, a holistic, multi-dimensional model is needed to identify and inter-relate the various components of pre-disaster, disaster, and post-disaster response. The emergency manager and worker play strategic roles and hold key positions. They are also exposed to potential injury and loss of life. Equally important, they are sometimes required to perform arduous physical tasks and face emotional situations such as rescue work or body recovery. The nature of these challenges prompted the authors to examine some emergency worker safety and health issues within the context of emergency work environments.

The authors first offer a discussion of these *environments*. Secondly, the human/environment interface is presented in a brief synopsis of the *human response under stress*, which precedes a brief review of the latest research in this area. The goal of this paper is to promote thought and discussion about emergency workers, their environments, and their safety and health. The Critical Incident Stress Management (CISM) model will be presented as an example of a multi-dimensional *intervention* focused on the safety and health of emergency workers. Finally, the authors will suggest areas in each of the three environments that warrant further study.

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The Disaster Work Environment

A disaster scene, such as the scene of an underground mine fire, is a dynamic work setting. As such, it presents workers with a need to constantly adapt to their physical environment. Meanwhile, they must adhere to the formal and informal expectations of their organization. Their organization, in turn, is an open system that must be responsive to its organizational environment.

Emery and Trist (1978) suggest that circumstances such as those described above can lead to a gross increase in an organization's area of relevant uncertainty. In response, values are instilled and rules promulgated to shore up this uncertainty. These rule 'enactments' to use Weick's (1995) term, are likely to be oriented toward organizational cohesion rather than toward individual affect. This condition gets translated into cultural attitudes that emerge in the form of policy letters, directives, memos, and other organizational manifestations. From this chain of events, two primary implications arise for the safety and health of emergency workers.

First, official directives may be instrumental in squelching public concern, but potentially dangerous to workers when put into practice. Hart (1995), in referring to the South Canyon fire near Glenwood Springs, Colorado, noted that the Grand Junction District Management

Team directive stated that all fires should be 'initially attacked and suppressed as soon as possible'. This directive reflects a highly functional cultural attitude. The firefighters' roles are unambiguous, and other organizations in the environment (such as town councils or timber companies) automatically see that approach as in their best interests. Further, from the workers' perspective, such a cultural attitude reinforces the sense of ideal solidarity that characterizes groups in dangerous work settings (Vaught and Smith, 1980). In other words, the need to enhance interpersonal predictability can be achieved through a like-minded sharing of group core values.

Unfortunately, the attitude described above can also have deleterious consequences. Organizations can easily lose sight of individual needs in pursuit of the organizational mission. Weick (1995), in referring to the general wild land firefighters' guidelines called 'Watch Outs', suggested there should be a separate guideline compiled for administrators. First on this list would be 'Watch Out when the governor is in town'. In other words, when high-ranking officials are present, the organizational mission is likely to be pursued zealously, possibly at the expense of individual needs.

A second problem with the response of emergency organizations is that they, like other formal organizations in society, are designed to be instrumental. Because of their basic mission-oriented structure, there is little provision for affect. Thus, even when it becomes apparent that the human factor should be included to achieve organizational effectiveness, change is not easy to foster. Perhaps the most basic barrier to change is that those who inhabit an organization have internalized the very principles that undergird contemporary organizational forms. These principles, taken from the industrial era, and mechanical in nature, evoke such criteria as speed, reliability, and efficiency of operation. Scant allowance is made for people in this milieu.

A third barrier, in relation to worker safety and health is organizations' interlocking networks of divisions and functions. Because of the way they are structured, non-instrumental activities (or those seen as non-instrumental) can be shunted into 'staff' status. Those who work outside the line functions have a different command structure, are valued differently from an organizational perspective, and have a differential ability to impact the organization. Thus, many of the affective innovations that could enhance organizational functioning are grafted on rather than integrated into the organization's structure. An example of this is the role and status given mental health professionals during a disaster. These professionals are given less status and involvement in the structure than traditional medical personnel. Although, clearly, sequence of function must be triaged in an emergency i.e. stop the bleeding before addressing the emotional trauma, both functions are key to long-term adjustment and overall health of the victim.

Applying the Social Sciences to Emergency Situations

The stress response, sometimes referred to as 'fight or flight', is a normal, primitive human reaction to a stressor. Thus, this response may be thought of as a survival mechanism. The stressor may be bio-organic (physical) or psycho social (emotional). Psychosocial stressors are described as environmental events, such as the type of exposure emergency workers face, in which an individual's interpretation plays a key role in triggering the stress response. Regardless of its source, there is a physiological response that brings about such symptoms as dry mouth, sweaty palms, and the cessation of digestion. Additionally, symptoms may include increases in heart rate, temperature, respiration, and visual acuity. Finally, blood moves to the skeletal muscles. The body prepares to fight or to run.

A typical scenario would include the decision to fight or run, execution of that decision, resolution, and return to a normal baseline until the next stressor arises. Unfortunately, in today's world the stressors often continue, overlap, and do not provide for a 'down time' or return to a baseline. This is particularly relevant in an emergency response situation where the stress is ongoing, even chronic. In fact, the high level of stress has become a part of the socio-technical system. This impacts emergency managers, workers, and victims, not only during the present disaster but cumulatively.

As the authors suggested in their treatise presented at the 1995 TIEMES Conference in France (Kowalski and Vaught, 1995), the behavioral science disciplines are important to emergency management planning and engineering. Knowledge in the social sciences can provide empirical information, not only on general human response patterns, but also about individual and group behavior during emergencies. This information might mitigate safety and health factors for emergency workers, resulting in fewer injuries and fatalities. Such knowledge could also lessen longer-term consequences such as burnout or post-traumatic stress symptoms that can lead to Post Traumatic Stress Disorder (PTSD).

Recent Research on Stress and Emergency

An international conference was held during March, 1999, in Baltimore, Maryland, U.S. Entitled 'Work, Stress and Health 99: Organization of Work in a Global Economy' (WSH, 1999). This conference presented the latest global research dealing with exposure to stressful situations. Thus, we are provided a current picture of thinking about human response.

Overall, work stress may increase an individual's risk of injury, cardiovascular disease, psychological disorders, and other health problems. Stressful working conditions are also associated with increased disability claims, absenteeism and tardiness. An overload of stress can result in burnout, which may manifest itself in emotional and physical exhaustion, emotional withdrawal, depersonalization, and aggressive tendencies. The Japanese even have a term for brain and heart disease caused by overwork: *karoshi*. Overload, fatigue, and varying work schedules (all relevant to the worker in an emergency) can lead to unrealistic expectations and a constant demand for high performance. Couple this with a lack of resources (not uncommon in an emergency situation, particularly in the first hours and days of a disaster) and the risk to the emergency manager and worker safety increases.

During the Work, Stress and Health Conference 1999 it was noted that studies showed 90% of disaster victims exhibit some of the symptoms of PTSD, most commonly defined as intense psychological distress upon exposure to events that symbolize or resemble some aspect of a traumatic event. These symptoms include: difficulty in concentrating, headaches, nervousness, nightmares, difficulty falling or staying asleep, loss of appetite, anxiety, depressions, helplessness/hopelessness, irritability or outburst of anger, and a feeling of detachment from others. Studies on emergency workers indicate these symptoms, but the percentage of the population of workers suffering has not been extrapolated.

A study of firefighters in Germany (Preuss and Schaecke, 1998) suggested that specific activities resulting in maximum stress included, first of all, the rescue of children. Other studies of emergency workers (police, hospital emergency personnel) suggest that the number one stressor is disasters in which children have been injured or killed. In addition, age is a factor in determining the measurement of stress for firefighters. Von Hallmeyer found that as firefighters became older and more experienced, they perceived the risks differently and more negatively (Von Hallmayer, A., Klingbeil, M., Kohn-Seyer G., 1981). Preuss and Schaecke found no significant correlation between age, experience, and level of perceived strain, but did find that the highest stress for the firefighters in their study was related to rescue operations. In other words, emergency operations involving fatalities or injured people were viewed as most stressful.

The authors suggest that stress could be present in two of the three environments in which emergency workers must function: the circumstances of the emergency itself, and their social environment.

Another dimension of stress concerns intentional and unintentional technological disaster. Intentionally caused disasters have increased in the past several years, and emergency managers and workers have had to respond to this trend. Intentional disasters include terrorism, which is on the rise globally. The subway chemical release in Japan is an example, as is the Oklahoma City bombing in the United States. In fact, the Associated Press recently noted that the 1995 bombing sparked a wave of right-wing terror in the United States that has led to an alarming growth in the anti-government movement. The Southern Poverty Law Center's Intelligence Project (SPLC) reported that the FBI was investigating about 100 domestic terrorism cases prior to the April 19, 1995 bombing of the Alfred P. Murrah Federal Building. According to the SPLC, three years later the FBI was working on more than 900 such cases. If intentional disasters continue to escalate, there should be increased evaluation of different environments with respect to the safety and health of emergency workers.

Crisis Interventions

Given the complexity of emergency management, a comprehensive, multi-component, multi-discipline intervention is appropriate. The world's most widely used crisis intervention system is the Critical Incident Stress Management (CISM) model (Mitchell and Everly, 1998). This model effectively addresses the many facets that must be included in an intervention aimed at ensuring the safety and health of disaster workers. The US Occupational Safety and Health Administration recommends that multi-component crisis intervention programs be established in healthcare institutions, social service agencies, and even in convenience stores (OSHA, 1996; OSHA, 1998).

CISM has been adopted by diverse organizations in a wide variety of workplace settings. These include the Federal Aviation Administration, the U.S. Secret Service, the FBI, the Airline Pilots Association, the U.S. Air Force,

the Swedish National Police, the Association of Icelandic Rescue Teams, and the Australian Navy.

CISM is a multi-factor, integrated crisis intervention system that spans the entire temporal spectrum of a crisis. CISM interventions range from the pre-crisis phase through the acute phase, and into the post-crisis phase. CISM interventions may be applied to individuals, small functional groups, large groups, families, organizations, and communities. The seven core components of this program are presented in Table 1 and can be applied to the environments in which emergency workers function. Everly and Mitchell (1996) note that these interventions are not typical mental health counseling methods and caution that these interventions are not to be viewed within the typical mental health model. Specialized training is needed to administer the CISM program.

Future Directions

In conclusion, the authors suggest some research that might be conducted within each of the defined environments:

The Emergency Environment Itself

Most research on disasters has been conducted on a specific disaster or a specific emergency

Table 1: Critical Incident Stress Management (CISM): the seven core components (adapted from Everly and Mitchell, 1999)

INTERVENTION	TIMING	ACTIVATION	GOALS	FORMAT
1. Pre-crisis preparation	Pre-crisis phase	Anticipation of crisis	Set expectations; Improve coping; Stress management	Groups; Organizations
Large Groups:				
2a. Demobilizations and Staff Consult. (rescuers); 2b. Group Info. Briefing for schools, businesses and large civilian groups	Shift disengagement; or Anytime post-crisis	Event-driven	To inform and consult; To allow for psychological decompression; Stress management	Large groups; Organizations
3. Defusing	Post-crisis (within 12 hrs)	Usually symptom-driven	Symptom mitigation; Possible closure; Triage	Small groups
4. Critical Incident Stress Debriefing (CISD)	Post-crisis (1 to 10 days); At least 3–4 weeks for mass disasters	Usually symptom-driven. Can be event driven	Facilitate psychological closure; Stress mitigation Triage	Small groups
5. Individual crisis intervention (1:1)	Anytime; Anywhere	Symptom-driven	Symptom mitigation; Return to function, if possible; Referral, if needed	Individuals
Systems:				
6a. Family CISM; 6b. Organizational Consultation	Anytime	Either symptom-driven or event- driven	Foster support, communications; Symptom mitigation; Closure, if possible; Referral, if needed	Families; Organizations
7. Follow up; referral	Anytime	Usually symptom-driven	Assess mental status; Access higher level of care	Individual; Family

situation. Consequently, the data reflects the targeted emergency, the fire, the hurricane, the mine explosion, the flood, the earthquake, etc. Many emergency workers are exposed to a number of emergencies over time. Follow-up research is needed on these individuals and groups of workers who have been exposed to a number of emergencies within a specific timeframe. In fall, 1999, the eastern United States experienced a series of hurricanes, which included loss of life and extensive pre and post preparation activities and cleanup. In addition, in the late summer and fall of that year, earthquakes followed by after-quakes in Turkey and Taiwan created devastating loss of life and injury. Research with these workers, exposed to the reality of numerous hurricanes and earthquakes could provide information about cumulative effects on the emergency worker.

Is there a difference in the emergency worker response to an unintentional (natural) disaster as opposed to an intentional disaster (terrorism)? We have developed specific tools for specific disasters, for example hurricanes. With sophisticated technology, we can predict the path of a hurricane, not perfectly, but well enough to alert potential target areas. There are preventative activities we can engage in with hurricanes, such as boarding up windows, preparing food and shelters for the population, and developing plans for evacuating the population. We have some control of the outcome.

There are more limited tools in the prediction of earthquakes. With both earthquakes and hurricanes, the major activity is clean up and in some cases rescue. We have studied fire behavior and developed innovative equipment that can assist the fireman in planning strategies to help control the blaze. Fire protective clothing and special tools help the emergency worker access victims and save lives. We have developed certain technologies and strategies that, though incomplete, help control the emergency environment and provide the worker with tools.

But, what of emergency environments that are intentional, terrorist caused emergencies? Do we have any control in these situations? Do emergency workers approach a terrorist situation differently than an earthquake? We presently have limited tools to support the emergency worker in these situations. This is an area of need in exploring issues in the safety and health of emergency workers.

Finally, the future must provide a forum for the sharing of information. As emergency environments, both natural and intentional, appear to be increasing worldwide as the new millennium begins, a multi-disciplinary, international, problem solving, information-sharing approach is warranted.

The Social Environment

The social environment is becoming more and more intertwined with technology. While much technology is directed toward production, a significant portion has been developed to meet increased health and safety demands. The performance of these technologies will be hardly tested in the real world, and their impact on human/machine and human/human interaction will probably not be assessed at all.

As emergency technology and personal protective equipment become more sophisticated, real-world assessment becomes critical. That is because each innovation, as it is introduced, gets placed in a social system that has developed a comprehensive set of formal and informal rules about how to behave in certain situations. The adoption of new technology may allow behavior that has heretofore been prohibited, for good reason. For instance, members of a mine rescue team are tethered to a line. During explorations of smoke-filled entryways, they follow a rigid search protocol. Recently, however, imaging technology that can allow at least one member (the captain) to see through smoke has become available. It is now possible for a member of the team to release from the line and, ignoring protocol, go directly to a victim. As might be assumed, rules for the proper use of an imaging device are currently under debate.

In order to provide guidance in debates like the one above, scientists will need to employ a socio-technical systems perspective to focus upon variables that are relevant to the design of emergency work systems. This implies the application of a systematic methodology to organization/machine interactions before and after the technology is introduced. This approach would concentrate not only on how things function under normal circumstances, but should also recognize and address dysfunctional elements in a system.

The Technological Environment

Many accidents attributed to 'human error' may be due to design features that did not adequately account for how humans respond. In other words, a given technology can function perfectly within its design parameters and still kill people. Automobile air bags are an example. In the future, more attention should be paid to how design parameters are set. The place to start with this investigation is with the design engineer.

Design engineers usually occupy a position in a departmentalized organization, and may operate on less than complete knowledge of how a thing is to be used. Essentially the product interface is decided outside the design engineer's

domain. Production people do not talk to design people, and neither spend much time with marketing. In order to produce better designs, therefore, it seems advisable to develop a social organization in which all aspects of product development are interrelated. Thus, a design engineer would work with ergonomists and others to develop a product that would not only meet its predetermined design parameters, but that would have human-friendly design parameters to begin with.

In sum, the future is likely to bring increasing numbers of 'accidents by design' unless scientists develop a greater understanding of the social organizations from which our technological environments arise. It is only by restructuring the design environment that humankind will experience more human-friendly machinery in the technological environment.

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