

Addressing emergency response provider fatigue in emergency response preparedness, management, policy making, and research

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ABSTRACT

Fatigue in emergency response providers can compromise the effectiveness of any emergency response operation. Appropriate emergency response preparedness, management, policy making, and research efforts can mitigate the dangers posed by responder fatigue. This article focuses on the need for developing and implementing such efforts nationwide and considers existing resources, opportunities, and challenges for accomplishing this goal.

Key words: fatigue, management, policy making, preparedness, research, responder

INTRODUCTION

Emergency response providers* may be called into service on very short notice and at any time. Once deployed, they may operate in stressful environments (eg, at the scene of an unfolding incident or event or at a more remote command or emergency operations center) requiring extended work shifts and sustained periods of wakefulness and vigilance. They also are counted on to exercise a high level of judgment and decision-making ability for the entire duration of an emergency response, which may last several operational periods.

*In this article, the term “emergency response provider” is used in the same way as defined in the Homeland Security Act of 2002 and as interpreted by the National Institute for Occupational Safety and Health (NIOSH) in its emergency preparedness and response program portfolio: “[E]mergency response providers include Federal, State, and local emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities. These responders might include hazardous materials response teams, urban search and rescue assets, community emergency response teams, antiterrorism units, special weapons and tactics teams, bomb squads, emergency management officials, first receivers, municipal agencies, and private organizations responsible for transportation, communications, medical services, public health, disaster assistance, public works, and construction[.]”¹

These demands for sustained neurocognitive performance over an extended period of time are difficult to meet due to the various physiological factors that:

1. make sleep a biological imperative in humans and
2. impair the ability of people to maintain wakefulness, vigilance, and sound judgment over time if they are not given an adequate opportunity to rest, sleep, and recover.

Emergency response providers participating in long-duration operations are thus at high risk of suffering from decrements in neurocognitive performance related to sleep loss and fatigue.[†] Such performance decrements endanger not only the personal health and safety of these responders but also the health and safety of their fellow responders and the public they serve. Appropriate emergency preparedness, management, policy making, and research activities can reduce these fatigue-related risks and hazards before they pose significant problems during emergency response operations.

This article considers the importance of addressing fatigue in emergency response providers (hereinafter “responder fatigue”) in preincident emergency preparedness efforts, as well as in emergency response

[†]In this article, the term “fatigue” refers to the likelihood of falling asleep. This meaning does not extend to concepts associated with muscular exertion or to chronic fatigue syndrome. The reader should be aware that 1) “fatigue” appears to be the term most often used in the emergency response provider community and 2) in some circumstances, including legislation or other sources of law or policy, other terms are used to describe fatigue (eg, drowsiness, sleepiness, and tiredness), and specific definitions for these terms may be provided that restrict or expand the definition used in this article.

management (during active emergency response operations), policy making, and research. After reviewing some basic findings from the scientific research on the impact of extended duration of duty, sleep loss, and fatigue on human neurocognitive performance, health, and safety, the relevance of such scientific findings to the emergency response provider community will be discussed. Some existing resources on addressing responder fatigue also will be reviewed. The article concludes with a discussion of potential opportunities and challenges for the emergency response provider community (in the United States and elsewhere) to address responder fatigue as part of its emergency response preparedness, management, policy making, and research efforts.

IMPACT OF EXTENDED DURATION OF DUTY, SLEEP LOSS, AND FATIGUE ON HUMAN PERFORMANCE, HEALTH, AND SAFETY

The impact of extended duration of duty, sleep loss, and fatigue on human neurocognitive performance (eg, alertness, reaction time, and executive cognitive functions), health, and safety has been studied and reviewed extensively.²⁻⁶ Moreover, sleep scientists have identified a number of physiological and environmental factors that contribute to fatigue and its associated performance impairments,^{6,7} making it possible to identify occupational groups:

- that are more likely to be affected by fatigue and
- for which fatigue may pose significant risks to personal and public health and safety.

Examples of these groups include those requiring:

1. extended work hours;
2. shift-work schedules, including night work and rotating shifts;
3. early morning hours; and
4. the performance of safety-critical tasks immediately after waking.^{7,8}

Workers in the fields of emergency response and management, medical services, national defense, and homeland security exhibit these characteristics and therefore are considered to be at high risk of exposure to fatigue and fatigue-related incidents that may pose a threat to personal and public health and safety.⁸

RELEVANCE TO EMERGENCY RESPONSE PROVIDERS

The fatigue research described in the previous section is highly relevant to all sectors of the emergency response provider community, and this relevance has been reviewed in the scientific^{5,9-13} and professional¹⁴⁻²¹ literature. Emergency response providers can be called into service on very short notice and at all hours of the day, as the crises they respond to generally occur unexpectedly and at any time. As a result, emergency response providers may be:

- deployed without sufficient sleep and rest to ensure optimal alertness and performance levels;
- called into service during the circadian trough of alertness and the circadian peak of sleepiness in humans; and
- required to perform safety-critical tasks within minutes of waking up, when the effects of sleep inertia are most potent.

Once deployed, responders may participate in continuous operations requiring extended work shifts and sustained wakefulness during all hours of the day and all circadian phases of the human body. As the National Response Team (NRT, an organization of 16 US federal departments and agencies responsible for coordinating emergency preparedness and response to oil and hazardous substance pollution incidents) succinctly described in its April 2009 technical assistance document on “Guidance for Managing Worker Fatigue During Disaster Operations”:

After a large-scale disaster, workers often work longer shifts and more consecutive

shifts than they would typically work during a traditional 40-hour work week. The fatigue and stress that may arise from strenuous work schedules can be compounded by the physical and environmental conditions in the affected area after a disaster: non-existent, damaged, or limited critical infrastructure (roads/traffic signals, utility lines, transportation/distribution of basic necessities, etc.); vegetative, construction, and hazardous debris; flooding; hazardous material releases; and displaced pets, indigenous wild animals, and snakes or other reptiles.^{22(p6)}

Emergency response providers thus constitute an occupational group that is particularly vulnerable to the effects of fatigue.⁸ Given the nature of the work in which this occupational group engages, such vulnerability poses significant risks to the health and safety of members of this group and the general public. Managing responder fatigue and mitigating its associated health and safety risks are therefore essential to protect responder and public health and safety.²³

EXISTING RESOURCES ON ADDRESSING RESPONDER FATIGUE

Surprisingly, despite the enormous amount of resources dedicated in recent years for researching and developing best practices in various aspects of disaster and public emergency preparedness and response, little attention has been given to the issue of responder fatigue. In its technical assistance document, the NRT found that:

- “available literature does not address the question of how strenuous work schedules combine with the unique hazards and exposures associated with disaster operations to impact worker fatigue[]” and
- “existing literature and work practices generally focus on the effects of shift work [or] extended work hours on employees working normal, non-disaster-related employment and focus on reducing or limiting work hours.”^{22(p8)}

An Australian emergency manager reported similar findings in November 2008, noting that:

- it is “not well known how well [existing fatigue management research] fits into the emergency management context”;
- an assessment of fatigue management policies from Australian emergency agencies and related industries revealed that “the complex interactions between fatigue issues are not well understood and that fatigue management has been developed in other fields and not tested for its appropriateness in the complex emergency management context[]”; and
- the “scarcity of information in the emergency management context highlights the need for future studies in better determining interrelationships and interactions between fatigue factors and testing fatigue management systems in emergencies to evaluate their effectiveness in the emergency management context.”¹⁶

Despite these current shortcomings in research and shortages in best practices, a number of resources have been developed that may be helpful to those interested in addressing responder fatigue.

NRT technical assistance document

The previously mentioned NRT technical assistance document represents an attempt to:

1. establish a fatigue management approach that accounts for the unique needs of disaster workers and
2. guide organizations through the process of developing organization-wide fatigue management programs from which incident-specific fatigue management plans may be created.^{22(p6)}

The NRT identifies the following four essential components for the development of such fatigue management programs and plans:

1. an assessment of the types of activities that an organization expects to perform during a disaster;
2. an assessment of fatigue risk factors that may be present at a disaster site;
3. the development of controls that target identified fatigue risk factors; and
4. the establishment of evaluation schedules to assess the effectiveness of these controls.^{22(p10-16)}

Several useful resources are provided as appendices to the technical assistance document, including:

- a template for a “Fatigue Management Risk Assessment Tool” that can be used to assist an organization in developing plans and procedures and in identifying resources that should be in place in preparation for emergency response operations;
- a list of “Potential Controls for Mitigating Fatigue Risk Factors”; and
- a “Sample Incident-Specific Fatigue Management Plan.”^{22(pA-1-C-2)}

Although these recommendations can be applied throughout a disaster operation, the NRT acknowledges that they are targeted primarily at operations occurring once rescue efforts have been concluded.

International Association of Fire Chiefs report

The International Association of Fire Chiefs (IAFC) has developed an online “Operations Resource” on sleep deprivation in firefighters and emergency medical services (EMS) personnel.²⁴ Consisting of a written

research report (hereinafter “IAFC report”)⁵ and educational videos, this online resource reviews potential countermeasures against sleep deprivation and measures to effectively manage work hours, including:

- means to identify individuals who are particularly vulnerable to the risks of sleep deprivation;
- individual mitigating strategies (eg, sleep habits and lifestyles; strategic use of caffeine, stimulants, and napping);
- issues related to work place environment and physical activity; and
- the structuring of work hours based on behavior based and prescriptive work hour management efforts.^{5(p59-70)}

The information disseminated through this online resource is intended to foster a “culture of awareness and support” that is:

1. focused on occupational health and safety among firefighters and EMS personnel and
2. built on continuous education activities and efforts to translate knowledge “into attitudes and behaviors that promote appropriate work hour management.”^{5(p73)}

Moreover, the authors of the IAFC report endorse the use of this “Operations Resource” to facilitate a multistakeholder approach to building such a health and safety culture in the fire and EMS community:

As fire fighters and EMS responders continue to address the issue of sleep deprivation, it is important that they, their families, administrators and others with whom they work become educated about the performance and health effects of fatigue and assess their individual actions,

job demands and work culture and structure. Involving all stakeholders (personnel and their families, management, representatives from labor organizations and national administrative bodies, and sometimes outside consultants) is critical to the success of any fatigue management program.^{5(piv)}

Lessons Learned Information Sharing resources

The Lessons Learned Information Sharing (LLIS) Web site²⁵ administered by the US Federal Emergency Management Agency includes a number of “lessons learned” documents highlighting responder fatigue issues that arose during exercises or actual emergency response operations.²⁶⁻³¹ These documents offer some general principles and concepts to be considered while addressing responder fatigue through emergency preparedness, management, and policy making activities. They do not, however, provide detailed guidance or suggestions on how to go about developing and implementing such activities.

Responder fatigue guidance from US federal agencies

Some US federal agencies with occupational health and safety missions have developed resources relevant to addressing responder fatigue. In 2004, NIOSH (part of the Centers for Disease Control and Prevention), and the RAND Corporation released a joint report on safety management practices and issues related to the protection of emergency workers who respond to large-scale disasters and terrorist attacks.³² The NIOSH-RAND report addressed a number of issues related to responder fatigue, including:

- information on the need for safety and logistical measures to support long-duration disaster response operations;
- advice relating to “work/rest ratios” for emergency response providers;
- the need for near real-time mechanisms to monitor the amount of time individual

responders have been working at a disaster site; and

- the importance of leadership by example in the area of responder fatigue management.

Furthermore, the Occupational Safety and Health Administration (OSHA, part of the US Department of Labor) has developed a safety and health guide on “Extended/Unusual Work Shifts” to inform employers and workers in the field of emergency preparedness and response about the health and safety hazards associated with such work shifts.³³ However, it should be noted that OSHA has not established specific federal standards for extended or unusual work shifts (defined as shifts requiring work during the evening or that deviate from a “normal” work period of “no more than eight consecutive hours during the day, five days a week with at least an eight-hour rest[]”).

Fatigue management policies and standard operating procedures for emergency response providers

Emergency management agencies in some jurisdictions have developed and adopted formal policies or standard operating procedures (SOPs) related to the management of responder fatigue and its associated health and safety risks. In Australia, for example, the New South Wales Department of Primary Industries adopted a policy in 2009 that requires:

- emergency response providers (including contractors) to use a risk management approach to manage fatigue during emergency response operations;
- responder fatigue to be “factored in to the [jurisdiction’s] emergency management occupational health and safety management system and linked into other emergency management risk management strategies[]”;
- the development of a fatigue management plan to implement fatigue management into the jurisdiction’s emergency management

occupational health and safety system;
and

- emergency managers to improve fatigue management in specific emergency responses by following a staged assessment process that includes “identifying potential hazards, assessing the severity, consequences and likelihood of those hazards, and selecting and implementing risk control measures.”³⁴

It should be noted that existing occupational health and safety laws and regulations in New South Wales enhance the authoritativeness of this responder fatigue management policy.[‡]

US national research agenda

In addition to providing practical guidance for emergency response providers, the US government has taken steps toward establishing a national research agenda related to the health and safety of emergency response providers. For example, NIOSH has established an emergency preparedness and response program portfolio “to advance research and collaborations to protect the health and safety of emergency response providers and recovery workers by preventing diseases, injuries, and fatalities in anticipation of and during responses to natural and man-made disasters and novel emergent [*sic*] events.”³⁵

In April 2009, the National Occupational Research Agenda (NORA) Public Safety Sub Council released its “National Public Safety Agenda” to address occupational safety and health issues in public safety workers (ie, personnel in fire services, law enforcement, corrections, and EMS).³⁶ The “Agenda” includes several fatigue-related goals that appear to be geared toward the identification and development of best practices, including the:

- creation and utilization of data collection systems for evaluating “sleep deprivation

and fatigue as factors in law enforcement officer injuries and fatalities through the collaborative efforts of law enforcement agencies and related organizations[]” (Intermediate Goal 6.3);

- development and dissemination of “evidence-based recommendations to reduce the incidence of sleep deprivation and fatigue among law enforcement officers” (Translation Goal 6.3.6);
- development of “effective guidelines to reduce worker fatigue and occupational stress [in EMS personnel] through collaboration with groups representing EMS labor, management, and professional interests” (Intermediate Goal 15.1); and
- creation of “an integrated occupational health and safety surveillance data system for [EMS] personnel” (Strategic Goal 16).

The authors of the IAFC report (refer to the “International Association of Fire Chiefs report” section) also propose some areas for further research related to fatigue in firefighters and EMS personnel:

- the monitoring of vehicle crashes while commuting;
- the utility of strategic napping;
- the prevalence of sleep disorders among these responders;
- cardiovascular risks and other lifestyle issues and their relationship to work hours;
- the use of available technologies to “index whether performance is affected by the prolonged but discontinuous work that can characterize the work of” these responders; and

[‡]Occupational Health and Safety Act 2000, N.S.W. ACTS 40, pt. 2 (Duties Relating to Health, Safety and Welfare at Work); Occupational Health and Safety Regulation 2001, N.S.W.R. Regs. & B. 648, c. 2 to 4.

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- a systematic data collection effort on department schedules, work and job structures, and performance and health characteristics (including sleeping habits and fatigue-related indices) of individual workers in the fire and EMS communities.^{5(p73)}

Some researchers also have proposed a more general national research agenda for the safety and health implications of long work hours.³⁷

DISCUSSION: OPPORTUNITIES AND CHALLENGES

Despite the availability of the resources described in the “Existing Resources on Addressing Responder Fatigue” section, fatigue management and the maintenance of adequate performance levels in emergency response providers remain under-studied and under-developed areas of public emergency preparedness, management, policy making, and research. A number of potential opportunities to address these knowledge and capability gaps are discussed in this section, as are potential challenges to converting these opportunities into realities. It should be noted that the resources discussed in the “Existing Resources on Addressing Responder Fatigue” section may serve as conceptual guide posts for addressing these opportunities and challenges.

Opportunities in emergency preparedness

The continuous process of developing, evaluating, and improving emergency response plans offers several opportunities to incorporate fatigue management and risk mitigation principles into general emergency preparedness activities and thereby to address responder fatigue as a part of these activities.

1. *Fatigue risk assessments.* One of the initial actions emergency planners can take to address responder fatigue is to conduct fatigue risk assessments for a variety of scenarios to which their respective organizations might be expected to respond. The Fatigue Management Risk Assessment Tool included in the NRT technical assistance document, as well as existing policies

or laws in the relevant jurisdiction, may be referenced to assist with this process. Once completed, the fatigue risk assessments should serve as the basis for subsequent preparedness activities.

2. *Incident action plans.* Incident action plans (IAPs) are prepared in advance of every operational period of an ongoing emergency response to an incident or event (including the first operational period; such initial IAPs should be prepared as part of preincident planning activities). In general, an IAP:

- formally sets forth and documents the general objectives reflecting the overall strategy for managing an incident or event (as defined by incident command during response planning), including general tactics to achieve the goals and objectives within the overall strategy and
- provides important information on incident (or event) and response parameters.^{38,39}

An IAP should include a health and safety plan for workers participating in the incident response (the Incident Command System [ICS] 215a form⁴⁰ provides a useful template for the development of such plans). These worker health and safety plans are ideal for reinforcing messages and announcing strategies to manage responder fatigue and mitigate associated health and safety risks during ongoing emergency response operations.

3. *Preparing safety officers.* The safety officer position within an ICS established during a response to an incident or event (pursuant to National Incident Management System [NIMS] protocols) plays a key role in ensuring that participating emergency response providers do not endanger themselves or others as a result

of fatigue-related performance impairments. Emergency planners should take steps to ensure that safety officers monitor and address fatigue-related safety risks and hazards as a regular part of their ICS responsibilities during emergency response operations. For example, emergency planners can:

- provide training on the recognition and management of fatigue to persons who potentially may be called on to serve as safety officers during emergency response operations or
- include reminder messages in IAPs, job action sheets, or task lists for safety officers to be looking out for signs of fatigue in emergency response providers and to monitor and mitigate fatigue-related health and safety risks and hazards.

4. Preparing incident commanders and operations chiefs. Incident commanders and operations chiefs within an ICS also have important roles to play in mitigating the risks that fatigued emergency response providers under their command pose to responder and public health and safety. As with safety officers, emergency planners can provide training opportunities and develop tools (eg, job action sheets) in advance of an incident or event to prepare potential incident commanders and operations chiefs for these roles.

5. Trainings and exercises. Trainings and exercises provide additional opportunities to address responder fatigue in emergency preparedness activities. Examples of such trainings and exercises might include:

- seminars to educate emergency response providers about the impact of fatigue on responder performance, health, and safety;

- workshops or tabletop exercises for emergency planners and managers to identify and adopt practices intended to address responder fatigue and to develop fatigue management plans for incorporation into existing emergency response plans and IAPs; or
- drills or full-scale exercises based on scenarios in which responder fatigue must be addressed by the players.

Opportunities in emergency management

Emergency managers can demonstrate leadership by taking the initiative to address responder fatigue and mitigate its associated risks as a matter of policy and practice within their respective jurisdictions. They also can take leading roles in incorporating or advocating for the incorporation of fatigue management and risk mitigation principles into emergency preparedness activities. For both cases, one emergency manager who has studied fatigue management in the emergency management context recommends “a flexible risk management approach, rather than a prescriptive management approach” when tackling this issue.¹⁶

Opportunities in emergency response policy making

Emergency preparedness and response policy in the United States is largely set forth in:

- the National Response Framework (NRF), which provides “the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies[,]” and establishes a “comprehensive, national, all-hazards approach to domestic incident response”^{41,42} and
- NIMS, which provides a “systematic, proactive approach to guide departments and agencies at all levels of government, non-governmental organizations, and the private sector to work seamlessly to prevent, protect against, respond to, recover from,

and mitigate the effects of incidents . . . in order to reduce the loss of life and property and harm to the environment.”^{43,44}

Responder fatigue is not discussed explicitly in these national policy documents (nor in the NRF’s support annex on worker safety and health⁴⁵). In the absence of nationwide policy guidance on recognizing and managing responder fatigue (and mitigating its associated risks), it is up to emergency managers at the state and local levels to develop policies and SOPs that address these issues in their respective jurisdictions. Emergency managers also could consider working with policy makers in their jurisdictions to pass legislation or to promulgate regulations to enhance the authoritativeness of these policies. The New South Wales example discussed in the “Fatigue management policies and standard operating procedures for emergency response providers” section may serve as a blueprint for such policy making efforts.

Challenges and research opportunities

The realization of the opportunities described in this section face several challenges. Chief among these is the lack of research and dearth of verifiable best practices in fatigue management and risk mitigation for emergency response providers mentioned in the “Existing Resources on Addressing Responder Fatigue” section. Further complicating the issue are the varying needs of the different sectors of the emergency response provider community (eg, firefighters vs staff at nonmedical points of dispensing). Fortunately, the responder-focused national research agenda discussed in the “US national research agenda” section encourages the creation of multidisciplinary collaborations and partnerships to address these challenges directly. Potential examples for such cooperative efforts may include:

1. *Interdisciplinary partnerships.* Partnerships between the emergency response provider community (including representatives from management, planning, and operations) and subject matter experts in sleep science, human performance research,

and occupational and public health and safety could be formed to identify and develop effective, scientifically informed, and evidence-based fatigue management programs, plans, and policies for emergency management agencies (or other entities that manage, respond to, or prepare for emergencies) to consider adopting and implementing.

2. *Evaluations of effectiveness.* Once a fatigue management program, plan, or policy has been adopted by an emergency management agency, the previously described interdisciplinary partnership could evaluate the implementation of such efforts (either in exercise or in actual emergency scenarios) to objectively assess:

- the effectiveness of the program, plan, or policy in reducing fatigue among emergency response providers and its associated health and safety risks and
- the impact of such programs, plans, or policies on emergency response operations.

The findings from these evaluations could be used subsequently to update and improve the evaluated program, plan, or policy. They also may be submitted for publication or presentation in appropriate fora.

3. *Comparative studies.* Assuming that a variety of fatigue management programs, plans, and policies are developed, implemented, and evaluated over time as described in (1) and (2), the findings from these evaluations of alternative programs, plans, and policies eventually could be compared with one another to identify best practices for fatigue management in the emergency response and preparedness context. Such a comparative analysis may be submitted subsequently for publication or presentation in appropriate fora.

CONCLUSIONS

The public expects emergency response providers to be alert and ready when a disaster or crisis strikes while everyone else sleeps. Taking reasonable steps to ensure that such expectations are met without causing harm to the health and safety of responders and the public can be justified on practical and moral grounds. Efforts to address responder fatigue clearly exemplify such reasonable steps.

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