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TECHNICAL
REPORT

Emergency Responder Injuries and Fatalities

An Analysis of Surveillance Data

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Executive Summary

The emergency response community represents a significant population of workers exposed to a particularly intense and variable hazard environment in the course of their work activities. This study focuses on firefighting, law enforcement, and emergency medical services personnel. In the United States, approximately 1,100,000 firefighters, 600,000 patrol and investigative law enforcement officers, and 500,000 emergency medical service responders answer calls for assistance and service that result in significant numbers of occupational injuries and fatalities.

In addition to the tragic events of September 11, in which over 400 emergency responders were killed, an average of 97 firefighters and 155 police officers died each year between 1990 and 2001, and an average of at least 11 nonfirefighter EMS personnel died in the line of duty each year between 1998 and 2001. The injury and fatality rates here and in the rest of this document do not include the events of September 11 because the magnitude of those tragic events obscures other trends in the data. The fatality rate for both police and career (paid) firefighters is approximately three times as great as the average for all occupations, placing them in the top fifteen occupations for the risk of fatal occupational injury; the fatality rate for emergency medical services responders is about two and one-half times the rate for all occupations. The rate of occupational injury and illness for employees of local fire and police agencies is similarly elevated. Approximately 88,000 firefighters are injured each year; about 2,000 of their injuries are potentially life-threatening. Approximately 100,000 police were injured in 2000.

This report is designed to collect and synthesize available data on casualties experienced by the emergency responder population for the purpose of estimating the frequency, causes, and characterization of those casualties.

The available data sources provide information about the occupational injuries and fatalities experienced by a significant portion of the emergency response community. Although there are some gaps in the data, many of these gaps are in the process of being addressed, and currently available data sources—in combination with community interviews and other sources of information—are adequate to provide an overview of emergency responder protection needs. In addition, extensive data are available to describe the injuries and fatalities

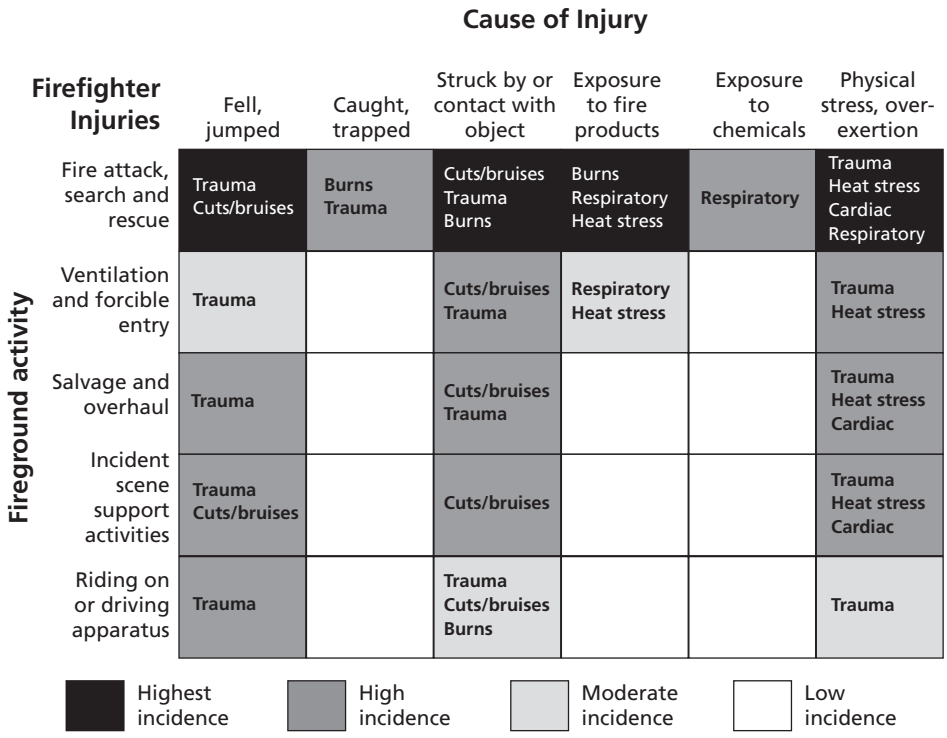
suffered by firefighters. From these sources, counts and incidence rates are available for both fatalities and injuries, and both can be broken down by nature, cause, activity, and type of duty. The detailed National Fire Incident Reporting System (NFIRS) database, maintained by the U.S. Fire Administration, can be used to investigate specific questions about the risks faced by firefighters at fire scenes.

A lesser, but still useful, amount of information is available for police casualties. Significant data exist describing police fatalities, but less information is available on injuries. Detailed breakdowns of injuries from the Survey of Occupational Injuries and Illnesses (SOII), maintained by the Bureau of Labor Statistics, can be used to investigate specific questions about the risks faced by police officers. Information regarding officer activity at the time of injury is not available and represents the most significant gap in police data. Emergency medical services data sources are scarce, and few conclusions can be drawn from the existing data. However, some data are available describing fatalities, nature and body part of injury, and potential exposures to infectious diseases.

Improvements to the occupation coding used by the federal government that are currently underway will allow emergency medical responders to be broken out of government public health databases. In addition, the new categories for law enforcement responders will make understanding the hazards faced by officers involved in emergency response more straightforward. The SOII will become a particularly useful data source when these changes are implemented beginning in the 2003 data year.

The injuries most frequently experienced by firefighters are traumatic injuries, cuts and bruises, burns, asphyxiation and other respiratory injuries, and thermal stress. Physical stress and overexertion, falls, being struck by or making contact with objects, and exposure to fire products are the primary causes of injury at the fire scene. Physical stress, becoming lost or trapped in a fire situation, and vehicle accidents are the primary causes of death. Physical stress is responsible for nearly half of all on-duty deaths.

Approximately half of all firefighter injuries occur at the scene of fire emergencies, or “on the fireground.” Firefighters experience a much higher risk of injury on the fireground than at other emergency incidents or during nonemergency duty. The injury incidence matrix shown in Figure S.1 shows graphically during which combinations of fireground activities and hazards firefighters are most often seriously injured, as well as the injuries that are most likely to result from each combination. Black cells correspond to combinations of



SOURCE: Based on data from the NFIRS 1998 Firefighter Casualty Module.

NOTES: Black cells indicate at least 150 reported injuries (10 percent of the total); dark-gray cells 36 to 66 injuries (2 to 4 percent); and light-gray cells 15 to 28 injuries (1 to 2 percent). Injuries with cause or activity unreported or reported as "other" are not included. Because of sample size, differences between some dark-gray and light-gray and some light-gray and white cells may not be statistically significant. Incident scene support activities include water supply operations and picking up and moving tools.

RAND *TR100-S.1*

Figure S.1—Injury Incidence Matrix for Moderate and Severe Firefighter Fireground Injuries by Cause and Activity

activities and hazards with the highest incidence of injuries, dark gray to high incidence, light gray to moderate incidence, and white to low incidence. Within each cell, the most common injuries are listed, with the most frequent injuries listed first.

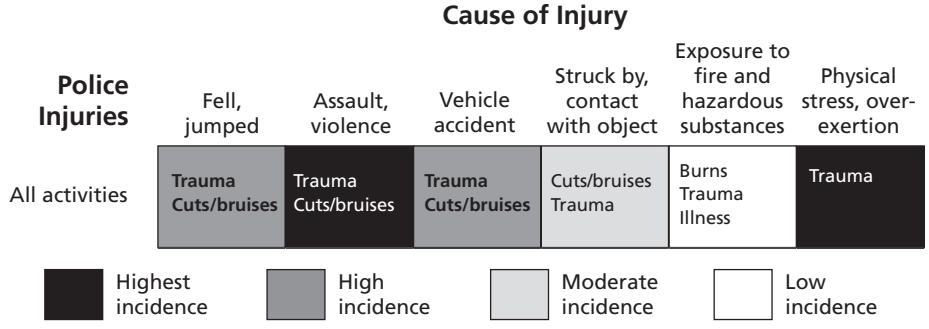
The highest number of injuries from all causes occurs during fire attack and search and rescue. Fire attack is not only one of the most dangerous fireground activities but also one of the most common. In activities other than fire attack, firefighters are injured most frequently from falls during salvage and overhaul, incident scene support activities, or from apparatus; and from physical stress and overexertion or being struck by or making contact with an object during ventilation, forcible entry, salvage and overhaul, and incident scene support activities.

Cuts and bruises and traumatic injuries such as sprains, strains, and fractures are the most commonly encountered. Burns, respiratory trouble, and heat stress are also common injuries in "forward" activities such as fire attack and search and rescue.

Most injuries to police are traumatic injuries and cuts and bruises resulting from vehicle accidents, falls, assaults, or physical stress. Nine out of ten line-of-duty deaths are due to vehicle accidents or assaults. Figure S.2 compares the incidence of lost-time injuries to patrol and investigative officers from several types of hazards. As with the firefighter injury incidence matrix, black cells correspond to hazards resulting in the most injuries, dark gray to high incidence, light gray to moderate incidence, and white to low incidence.

Police are most often injured in falls, assaults, vehicle-related accidents, and through stress or overexertion. The most common injuries from all causes are traumatic injuries, such as sprains and strains, and cuts and bruises. Police are also at risk of burns and symptoms of illness as a result of exposure to fire and hazardous substances (in the figure, "illness" indicates injuries in which disease or illness symptoms are present but a definite diagnosis is lacking or is unclassifiable). These exposure-related injuries represent less than 1 percent of all law enforcement injuries.

Information about EMS injuries and hazards is scarce and far less definitive. EMS personnel are most at risk of sprains and strains, and back injuries represent a higher proportion of injuries for EMS personnel than they do for other



SOURCE: Based on data from the Survey of Occupational Injuries and Illnesses, Bureau of Labor Statistics (2003b).

NOTES: Data are for police and detectives, State of New York, at the local government level, for the years 1998–2000. Black cells represent at least 5,000 injuries; dark-gray cells at least 4,000 injuries; and the light-gray cell about 2,400 injuries. SOII estimates a total of 25,000 injuries for 1998–2000; the estimate in the figure is based on a smaller number of recorded cases.

RAND *TR100-S.2*

Figure S.2—Injury Incidence Matrix for Police Lost Work Time Injuries, by Cause

responders. EMS personnel also have a high risk of infectious disease exposure, mostly through percutaneous injuries such as needle sticks. Nearly all on-duty deaths for which data are available are due to aircraft and vehicle accidents.

The surveillance data clearly show that some hazards are common to all responders, including the risk of vehicle-related deaths, traumatic injuries such as sprains and strains, and cuts and bruises. The data also demonstrate the clear differences in hazard exposure and, consequently, the protection needs of segments of the emergency response community. The available data can provide a route for identifying those combinations of kinds and causes of injury, body parts involved, and types of responder activity where injury reduction efforts might be most effectively applied. Such detailed analyses are most accessible for firefighters because of the comparative richness of the available data sources.

However, injury counts alone are not sufficient to fully define the protection needs of emergency responders. By definition, they measure the negative consequences of exposure to particular risks over particular time periods. As a result, surveillance data give a preferential focus to routine activities because those tasks occupy the vast majority of responders' time. Therefore, the levels of injury should not be interpreted as direct measures of the level of risk faced by responders for *all* activities. Activities performed by responders for short periods of time, or events that occur infrequently, may involve a level of risk much higher than more common tasks. Natural disasters, major hazardous materials emergencies, structural collapse, civil disturbance, bomb disposal, hostage situations, and terrorism response all involve intense hazards not normally encountered in routine activities. The consequences of other potential hazards that have not yet been realized, such as large-scale terrorist attacks involving biological or chemical weapons, cannot be effectively captured. To fully assess responders' personal protection needs, all high-risk nonroutine activities must be considered separately from routine activities.

Similarly, while direct counts of injuries and the severity measures discussed in this report are excellent indicators of the scope of a health and safety problem, they cannot completely capture all the issues associated with the problem. For instance, although sprains and strains are the most common injuries experienced by responders in all three services, responders typically do not view these injuries as a primary concern. Thus, merely using injury frequencies when setting priorities for protective technology will not adequately address the concerns of the community. To address the limitations of a purely data-based approach, RAND has also gathered information directly from the emergency response community through an extensive structured-interview process. The

results of that effort, included in a separate report (LaTourrette et al., 2003), are a critical complement to the surveillance data analyzed here.

Beyond simply demonstrating the utility of the currently available data and data sources, this analysis also suggests a range of potential future efforts that could contribute to a better understanding of this technology area. The diversity of data sources on emergency responders suggests that efforts to interconnect information from different databases could be valuable. An area of particular potential is fatality data—where the comparatively small number of cases and the availability of rich narrative information could enable many types of analysis. Such interconnection, combined with improved occupational coding efforts, would make it possible to ask detailed questions about protective technology design and performance in specific response situations.