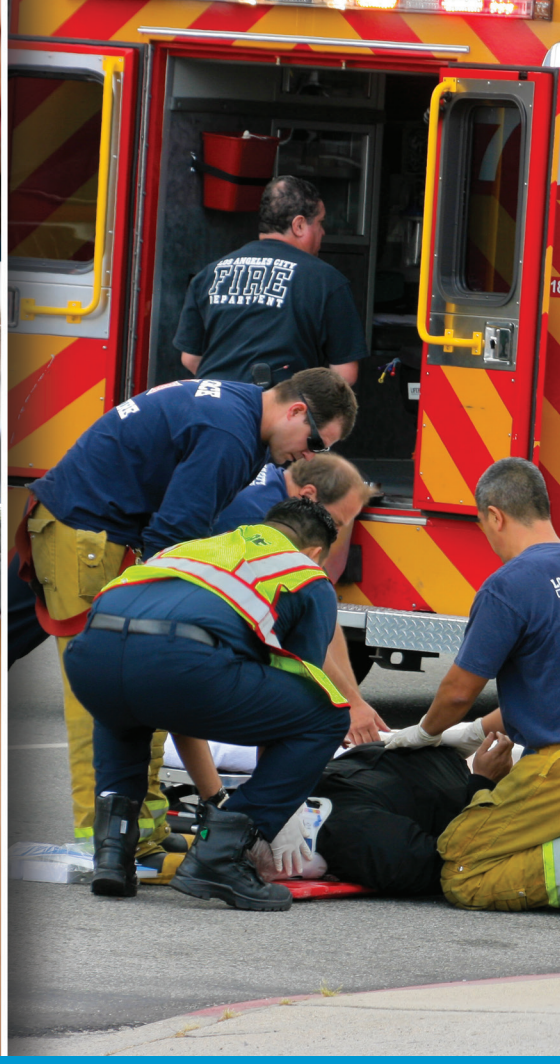

U.S. Fire Administration
Fire is Everyone's Fight®

EMS Safety Practices

April 2022

FEMA

EMS Safety Practices

April 2022

Mission Statement

We support and strengthen fire and emergency medical services and stakeholders to prepare for, prevent, mitigate and respond to all hazards.

U.S. Fire Administration

Fire is Everyone's Fight®

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Section I: Elements of Safety

This section defines safety in the context of emergency medical services (EMS) and discusses risk identification and management. It also focuses on the importance of creating a culture of safety within the EMS department and provides guidance for how this can be achieved. Lastly, this section contains information for developing a safety program and different ways that safety trends are monitored.

Chapter 1: What Is Safety?

Introduction

Merriam-Webster defines safety as "the condition of being safe from undergoing or causing hurt, injury, or loss" (n.d.). Safety is important to all aspects of life to reduce risk of injury and death, but it is especially important for first responders. EMS practitioners work on the frontlines of emergencies and disasters where situations change quickly and an element of danger or uncertainty is already present. As a result, it is crucial that EMS providers think of safety frequently and plan in advance to handle various situations.

Developing and enforcing safety standards

Many organizations and regulatory agencies develop and provide guidelines, standards and protocols for EMS safety. Some of these agencies include the U.S. Fire Administration (USFA), the U.S. Department of Labor Occupational Safety and Health Administration (OSHA), the Canadian Centre for Occupational Health and Safety (CCOHS), the International Association of Fire Fighters (IAFF), the National Fire Protection Association (NFPA), the U.S. Department of Transportation (DOT), the National Highway Traffic Safety Administration (NHTSA), the National Institute for Occupational Safety and Health (NIOSH), the International Association of Fire Chiefs (IAFC), the National Volunteer Fire Council (NVFC), the National Association of Emergency Medical Technicians (NAEMT), as well as many others.

Some of the policies developed by these organizations are guidelines, while others are legally binding. It is important that EMS department leaders follow changes in safety standards and requirements closely. Potential areas for change may include updating protocols, providing newly required equipment or delivering required training for personnel.

Each department should use existing safety standards from external agencies as tools to build their own culture of safety. A culture of safety relies on leadership asking "why" or "how" mishaps or events happen verses "who." This will create an environment that is more open to correcting mistakes and risks to safety, rather than one focused on finding and punishing errors. A culture of safety allows more room for progress and improvement as a department (Bloom, 2015).

Risk identification and management

The CCOHS describes risk as "the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard" (2020). Risk also includes harm to property, equipment or the environment (CCOHS, 2020). A risk assessment is a 3-step process that helps raise awareness of risks and hazards and determine whether changes need to be made to reduce the risk (CCOHS, 2017).

The 3 steps of a risk assessment are:

1. Hazard identification.
2. Risk analysis and evaluation.
3. Risk control.

Hazard identification involves acknowledging and categorizing hazards and risk factors in the EMS workplace. Risk analysis and evaluation examines how likely the identified hazards and risk factors will create harm. Risks can then be ranked, or prioritized, to determine the most effective and efficient mitigation measures. Lastly, risk control involves implementing, or monitoring steps taken, to reduce the hazards or risk factors (CCOHS, 2017).

Risks should be identified by considering the various work environments and incidents EMS practitioners may find themselves responding to (CCOHS, 2017). It is also important to consider past experiences, as well as incident data and records of injuries. This can aid risk analysis, evaluation and mitigation.

Risk avoidance, reduction and transfer

NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* defines risk as "the chance of injury or loss" and stresses the importance of developing a risk management plan to decrease the chances of injury to personnel. This plan should include 2 factors. The first is a risk assessment, which involves identifying and assessing hazards. When assessing a hazard, a level of risk should be assigned based on the likelihood of its occurrence, the potential exposure level and severity of consequences to exposure. The second factor to be considered in risk management is risk control (NFPA, 2012). There are 3 options for risk control in EMS:

1. Risk avoidance.
2. Risk reduction.
3. Risk transfer.

Risk avoidance

Risk avoidance is avoiding the risk entirely (USFA, 2018). This option is usually the least practical; however, in some situations, it can still be useful (USFA, 2018). For example, if there are 2 potential routes to take and 1 is flooded, the ambulance driver can take the route that is not flooded and avoid the risk of hydroplaning.

Risk reduction

Risk reduction can occur in many ways: planning, training, testing, updating safety standards and enforcement of safety policies (USFA, 2018). Although the risk is not totally eliminated, this is often a much more practical solution. Risk reduction is much of what this manual covers: offering strategies and recommendations for best practices.

Risk transfer

In the context of EMS, risk transfer most frequently refers to insurance policies. Having various types of insurance coverage moves the burden of risk from the EMS department to the insurance company.

Additionally, insurance companies may help with risk assessments, as risk reduction and avoidance practices decrease reliance on insurance companies (USFA, 2018). Another example of risk transfer is giving certain tasks to other organizations. For example, some hazardous materials incidents may require intervention from state or federal personnel, which removes the risk from EMS practitioners.

The NFPA strongly recommends establishing a risk management committee that can develop a risk management plan by evaluating the organization's goals, expressing concerns about existing processes and revising them for improved operational safety. The committee should write a formal document outlining the organization's risk management plan to ensure the safety of their personnel (NFPA, 2012).

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Chapter 2: Developing an EMS Workplace Culture of Safety

Introduction

Creating a culture of safety should be a priority for all EMS departments. This ensures that safety is valued by all members and normalizes safe behaviors in the workplace. A strong culture of safety results in a high level of adherence to policies and practices that reduce the risk of harm. As a result, departments with a strong culture of safety are more likely to experience fewer occupational injuries, exposures and fatalities (Gershon et al., 2000).

Elements of a culture of safety

An understanding of culture can be used as the foundation to establish safe practices and policies, thus reducing the number of EMS practitioners injured or killed each year. The USFA and IAFC National Safety Culture Change Initiative defines culture as "a process that occurs in the individual, based upon learned behaviors that are influenced by a group and the group's history" (USFA, 2015). The USFA suggests that the first priority of any organization should be to convince agencies, their personnel and society as a whole that the death and injury rates of the nation's EMS practitioners are unacceptable, and that improving the culture of safety within an organization will not compromise its mission or service delivery (USFA, 2015). To improve the safety of culture, Gershon et al. identify 6 elements of a culture of safety in a health care setting (2000). These elements are:

1. Support from senior management.
2. Absence of barriers to performing safety behaviors.
3. Cleanliness and orderliness of worksite.
4. Minimal conflict.
5. Frequent safety-related feedback and training.
6. Availability of personal protective equipment (PPE) and engineering controls.

Support from senior management

Support from senior management includes taking steps to put policies in place and reduce the risk of injury or exposure in the workplace from the top down. It also involves actively encouraging employees to follow safety precautions and policies. Safety should be a core value within any organization, and a commitment to safety should be included in the mission statement of each agency.

Absence of barriers to performing safety behaviors

Absence of barriers refers to whether or not any physical, departmental or job-related limitations exist which prevent employees from following safety-related policies or protocols. Some examples of barriersinclude time and workload. Agencies should identify ways to eliminate any barriers that may discouragereporting of safety issues, as well as any barriers that may impede implementation of safety practices.

Cleanliness and orderliness of worksite

Cleanliness and orderliness of the worksite is important in a culture of safety because it allows employees to find appropriate equipment, decreases the risk of injury and reduces provider stress.

Minimal conflict

Minimal conflict involves both the employee's relationship with supervisors and other members of their crew. A culture of safety fosters support between all employees and allows for bidirectional communication. Frequent safety-related feedback and training is key, as this is the element that aims to improve behaviors and raises awareness of safety practices in daily work routines (Eliseo et al., 2012). Finally, effective followership (discussed further in the next section) promotes respect and safety by remaining flexible, showing respect for authority, keeping leaders and other followers safe, demanding clear assignments, and publicly acknowledging mistakes (Cline, 2017).

Frequent safety-related feedback and training

Feedback can be formal or informal and can come from anyone in the department. Feedback can be corrective but should not be primarily punitive in nature. One of Phoenix Fire Chief Alan Brunacini's beliefs was to share stories of failure, without pointing fingers or assigning blame, so that others would not have to experience it. Training should continue throughout the year to reinforce safety behaviors.

Availability of personal protective equipment and engineering controls

Finally, the availability of PPE and engineering controls ensures that employees have quick, easy and reliable access to equipment, such as gloves, masks and sharps containers, to protect themselves from exposure and injury. This will result in higher compliance rates with PPE use. In addition to providing PPE, it is equally important to ensure that proper disposal is available to reduce exposure to contaminated materials. Some examples include biohazard bags and appropriate sharps containers.

Each element plays an important role in shaping a culture of safety. However, research has shown that management support, cleanliness of the work site, and frequent feedback and training make the largest impact on compliance to safe work practices and policies (Eliseo et al., 2012; Gershon et al., 2000). Each agency should further implement training that reinforces concepts to improve the culture of safety and highlights examples of inappropriate risk behaviors (USFA, 2015).

Leadership and followership

Leadership and followership complement one another in creating, implementing and sustaining a culture of safety. While leadership implies a certain level of authority and responsibility, followership implies the ability to respond appropriately to leadership and directives. However, these 2 aspects are not entirely exclusive of each other. Effective leadership requires some elements of followership, such as the need to listen and to respect authority. Similarly, followership should be an active process where followers are encouraged to practice advocacy and ask for clarification.

The National EMS Advisory Council (NEMSAC) describes the role of leadership in an EMS culture of safety as the following (2011):

- Determining and frequently promoting an expectation of safety.
- Explaining what a safe workplace looks like, creating a process to achieve that vision and providing the resources to do so.
- Integrating safety as a central workplace value instead of a priority to ensure sustainability.

- Creating systems and procedures to evaluate workplace safety and sharing findings with all team members.
- Encouraging all employees to acknowledge the need for innovations such as technology, engineering controls or new procedures that improve workplace safety.
- Aiding the implementation of policies and interventions to promote employee safety at work and at home.

The term "followership" is relatively new for emergency services workers. Effective followership should not hinder authority in making decisions or following through with tasks. Instead, effective followership should include respecting authority, keeping leaders and other followers safe, demanding clear assignments, publicly acknowledging mistakes, and remaining flexible (Cline, 2017). This does not mean that followers cannot help make decisions or share in leadership responsibilities. Rather, followership promotes respect and safety.

Just culture

The term "just culture" refers to a framework of shared accountability within a health care organization. This means that an organization's leadership fosters an environment where employees are encouraged to report medical errors for the purpose of learning from their mistakes rather than being punished for them. Data collected on medical errors can be used to inform safer practices in patient care (Boysen, 2013).

In a just culture system, employers react to employees' actions justly, and both parties are responsible for the quality of their choices and behaviors (NAEMT, 2020). The NAEMT issued a position statement advocating for adoption of a just culture in EMS as it benefits EMS practitioners, EMS agencies, patients and the public in the following ways:

1. **EMS practitioners:** While it still holds individuals accountable for their actions, a just culture assures providers that they can report errors without fear of punishment. It also ensures they will receive guidance on how to improve the quality of the care they deliver to patients.
2. **EMS agencies:** A culture of transparency encourages regular communication about risk factors in the field and discussion about risk management tactics to increase the safety of the agency members. The agency develops a framework for fair responses to employee behaviors and errors as they occur.
3. **Patients:** Patient outcomes and safety will improve when receiving care from providers who work in a just culture environment and continuously learn from their mistakes to increase the standard of patient care they deliver.
4. **Public:** As EMS agencies improve their safety standards with regard to patient safety, provider safety and operational safety through systemic changes, the public at large will also reap the benefits (NAEMT, 2020).

Crew resource management components

Based on review of numerous NIOSH firefighter line of duty death reports, the IAFC found the root cause of most of these failed incidents was due to a breakdown in communications, poor decision-making, lack of appropriate task allocation, poor

situational awareness and failures at the leadership level (Griffith et al., 2015). As a result, the concept of crew resource management (CRM) was adopted by many of the fire and emergency services.

CRM involves using all available methods and resources to reduce the risk of incidents and ensure the safety of crew members. It uses a combination of technology, engineering and fellow crew members to achieve its goals (IAFC, 2007). It should be strongly reinforced that the focus of CRM is about the mission, not the individual personalities. The crew is assembled to achieve a successful conclusion or outcome of the mission. CRM is driven by the following 5 key principles (IAFC, 2002):

1. Communication.
2. Situational awareness.
3. Decision-making.
4. Teamwork.
5. Barriers.

Communication

Communication is key to the success of any decision-making process. Misunderstandings lead to errors and mistakes, while effective communication can improve efficiency and precision of a task. CRM teaches providers to communicate clearly, directly, respectfully and assertively. Communication consists of at least 2 parties: the sender and the receiver. For effective communication, both parties must remain alert and pay attention to verbal cues, such as tone and word choice, and nonverbal cues, such as body language (IAFC, 2002).

Communication typically occurs through a multistep process. First, the sender thinks of an idea. Then, the idea is formed into words. The words are then sent through a medium such as a verbal exchange or written message. The receiver obtains the message and must interpret it. Finally, the receiver may ask for clarification or provide feedback to the sender (Lunenburg, 2010). An error in communication can occur in any of these steps. It is important to remain open during communication and correct or clarify a message if needed.

Assertive statements. While communicating, providers should advocate for their position using assertive statements. Using assertive statements ensures that communication is neither aggressive nor passive and improves mutual understanding. There are 5 parts to an assertive statement (IAFC, 2002):

1. A direct address (e.g., person's name or position).
2. Showing concern or personal reaction (e.g., "I feel this is an unsafe situation.").
3. Communicating the problem (e.g., "There appears to be an aggressive dog.").
4. A potential solution (e.g., "I suggest we back away and relocate.").
5. Asking for agreement (e.g., "What do you think?").

Active listening. Active listening is another essential component of clear communication and improves the receiver's understanding of the message. It involves the entire body and requires the receiver to pay attention to what the sender is saying. Some components of active listening include open body language, eye contact, and some form of physical or verbal feedback, such as nodding along, repeating what the sender said or asking follow-up questions (Lunenburg, 2010). Utilizing a closed feedback loop, where the receiver repeats the sender's message and the sender confirms the message was understood, can reduce the risk of potential mistakes or misunderstandings. An example of this is when

an EMS provider calls out the 5 R's (i.e., the right patient, right drug, right dose, right route and right time) prior to any medication administration and then hands the medication to another EMS provider for confirmation. Practicing these active listening techniques can improve understanding, decision-making and safety.

All of these communication techniques are central aspects of CRM and help to build an overall culture of safety. By improving communication within the department and encouraging all providers to advocate for their positions, all providers are given a role to play in ensuring the safety of their crew.

Situational awareness

Situational awareness is the ongoing process of continuously assessing the scene and surroundings and identifying any dangers or risk factors. Situational awareness is essential to every phase of emergency response. It is conducted independently by each provider and consists of 3 parts: awareness, reality and perception (IAFC, 2002). CRM emphasizes how situational awareness not only protects the individual, but actually protects the entire crew. For example, if one provider notices a potential danger, they can communicate this to other crew members and make a decision as a group how to proceed. Situational awareness requires remaining alert and vigilant at all times, as circumstances can change drastically with only a moment's notice (IAFC, 2002).

> Situational awareness is a mental state of alertness that involves perceiving, processing and predicting the event to prevent an unexpected incident from happening.
>
> USFA, 2020

Decision-making

Leaders make decisions based on available risk and benefit analysis, using information seen, heard, learned or otherwise experienced. In other words, making decisions can be broken down into 4 factors: information, knowledge, experience and urgency (IAFC, 2002). Decision-making plays a large role in emergency response situations, and, typically, decisions must be made very quickly.

CRM builds a framework where all crew members are part of the decision-making process. It recognizes the importance of input from multiple sources to make the best decision for the group. One common decision-making model is the DECIDE model (IAFC, 2002). This model walks through the steps of decision-making, from identifying the problem to reflecting on the decision made. The acronym is broken down as follows (IAFC, 2002):

Determine the problem.
Evaluate the scope of the problem.
Consider options to solve the problem.
Identify the best solution.
Do the most appropriate action.
Evaluate the effectiveness of actions.

Teamwork

CRM emphasizes the importance of teamwork for peak team performance. It emphasizes the leadership-followership model to improve teamwork dynamics. This model requires a leader to determine goals and a group of followers to take steps to accomplish those goals (IAFC, 2007). This makes completing tasks more efficient and reduces the risk of EMS practitioner harm. The leadership-followership model ensures all team members understand their individual team role and reinforces mutual respect among crew members.

Barriers

CRM recognizes the presence of barriers and how they can inhibit communications, situational awareness, decision-making and teamwork. Barriers can be physical and either external or internal, such as unconscious biases, prejudices, opinions, attitudes and stress (IAFC, 2002). An example of this would be forgoing a full assessment of a familiar patient based on the assumption that the underlying cause is the same as prior incidents involving the patient (e.g., assuming an altered mental status is the result of intoxication). Using a CRM approach helps to address the existence of these barriers and offers solutions to counter their negative effects. During calls, barriers can create distractions for an EMS crew and may increase the level of risk during an incident. Effective training and department cohesion can help providers overcome barriers. As crew members become more comfortable with one another, they may be more willing to remain open with each other and work together to overcome barriers.

CRM is beneficial for use on EMS calls as it fosters communication and innovative problem-solving, collaboration and cooperation, and empowers all crew members to take responsibility for each other's safety (IAFC, 2002). CRM provides a junior emergency medical technician (EMT) the same opportunity as a seasoned paramedic to speak out about safety issues. All of these elements can contribute to reduced risk of incidents and injury.

An environment of empowerment

Building a culture of safety is centered around employee empowerment. All team members must be, and feel, empowered to speak up about unsafe practices and to propose changes for safer operations. This empowerment is particularly important for EMS practitioners. Every responder, regardless of level of training or tenure, should be empowered to act in the best interest of responder and patient safety.

Conflict resolution

During emergency operations, conflicts will inevitably arise due to the stressful nature of a call. Some conflict is healthy; it can drive innovation and creativity that results in change and can improve future outcomes and procedures (Zalar, 2021). Thus, conflict should not be avoided entirely. Instead, it is important to foster avenues for healthy conflict and positive conflict resolution.

Trust and clear, open and honest communication are at the heart of effective conflict resolution. Leaders should find 1 central goal to accomplish, or element to change, rather than attempting to please many individual goals. Active listening and flexibility are 2 key elements of positive conflict resolution (Zalar, 2021). Instead of shutting down other people's ideas, give them the space to speak. They will be less likely to become upset or angry and more likely to work with others to compromise or find a solution. Positive conflict resolution values diverse opinions and perspectives and seeks to work with many people to achieve the best possible solution.

Conflict resolution practices should emphasize preserving the dignity of all involved. Ideally, accomplishments and achievements should be publicly praised, whereas remediation and discipline should be conducted in private. Overall, conflict provides an opportunity for the team to grow and learn together and to improve future operating procedures, policies or situations in a way that is beneficial to the group as a whole.

Training and feedback

Training and feedback are essential components of a culture of safety. In 2012, Eliseo et al. found that of the 6 themes Gershon et al. identified, only training and feedback were significantly associated with increased adherence to safe work practices. Ideally, all providers should take an active role in both giving and receiving feedback. In a department with a strong culture of safety, providers of any level will feel comfortable speaking up and giving feedback to any member of their crew. This helps providers keep each other accountable and gives each individual a clear responsibility to uphold the culture of safety.

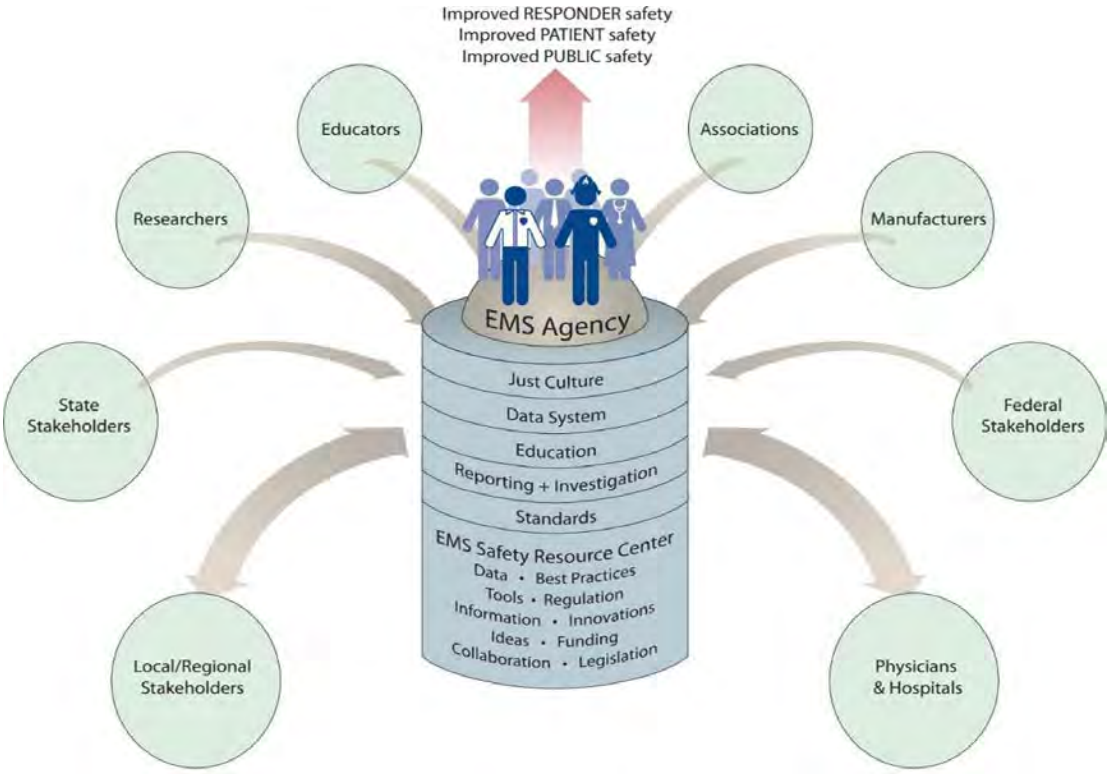
The USFA recognizes that agencies may have limited resources to implement advanced training programs or provide training beyond minimum requirements. However, agencies should consider that training can take many forms: formal training for new provider hires, training at set intervals, or quick demonstrations as reminders of proper procedures. This should be an ongoing process that reinforces safety behaviors and concepts. By providing frequent training and feedback, EMS departments can demonstrate their level of commitment to safety rather than just verbally discussing it.

National EMS Culture of Safety Strategy

The "Strategy for a National EMS Culture of Safety" was published in 2013 by EMS stakeholders, including NHTSA, the Health Resources and Services Administration's (HRSA's) EMS for Children Program and the American College of Emergency Physicians (ACEP) (NHTSA et al., 2012). The report developed recommendations to create a nationwide EMS culture of safety. The goal was to engage stakeholders to implement these recommendations and improve the safety of responders, patients and the general public. The 6 elements identified to create a national EMS culture of safety are:

1. Promoting the values of "just culture," including the duties to act, follow procedural rule and avoid causing unjustifiable risk.
2. Coordinating resources and assistance among stakeholders.
3. Utilizing a national, standardized data system to improve the safety of patients and providers.
4. Making adequate changes to EMS educational standards and curricula to emphasize a culture of safety.
5. Promoting safety standards and making them more widely known and accessible.
6. Reporting and investigating safety-related incidents.

These recommendations, goals and stakeholders were molded into a strategy framework to visualize how a national culture of safety can be created (NHTSA et al., 2012).



National EMS Safety Council

Following the publication of the report, the National EMS Safety Council was formed in 2015 with several member EMS stakeholder organizations. The council's purpose is to "ensure that patients receive emergency and mobile healthcare with the highest standards of safety, and promote a safe and healthy work environment for all emergency and mobile healthcare practitioners" (NAEMT, 2020). The council is tasked with finding ways to implement the recommendations from the "Strategy for a National EMS Culture of Safety." To do so, it assesses recent data, research and proposed best practices. It also works within the EMS industry to raise awareness of safety-related issues and works to identify additional areas for improvement (NAEMT, 2020).

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Chapter 3: Developing a Safety Program

Introduction

A fire or EMS agency should have a comprehensive safety program designed to reduce incidents, injuries, medical and hazardous material exposures, and damage to equipment and facilities. A basic safety program seeks to employ strategies that would ensure the following:

- Provide high-quality, approved equipment and protective clothing, including PPE.
- Establish a safety committee to include management, workforce and labor.
- Reduce the likelihood of sustaining injuries by maintaining a workforce that is physically and mentally fit.
- Conduct regular safety inspections of worksites and equipment.
- Clearly communicate with all department members regarding the status of safety programs, issues and departmental safety performance.
- Observe safety performance and provide feedback.
- Simulate events, like a medication error or an ambulance crash with a patient in it, to allow the safety team to practice and prepare.
- Ensure effective treatment and rehabilitation services are provided to department members.
- Create a clear and feasible infection control policy in a comprehensive exposure control plan.
- Collect and analyze incident, injury and exposure information. Report data where appropriate.
- Formulate specific action plans to improve safety and manage risk, focusing on risk avoidance, reduction and transfer.

NFPA 1500

Since its enactment in 1987, NFPA 1500 has served largely as the fire and emergency services standard for setting guidelines pertaining to occupational safety. This is an extensive guidance that spans over 320 individual sections, but the general requirements are as follows (NFPA, 2018):

- Implement occupational safety policies, including a risk management plan.
- Appoint a safety officer for the department.
- Implement a training program that is geared toward educating the employees regarding safe practices to minimize occupational injuries.
- Maintain departmental equipment and PPE.
- Implement incident management system for emergencies.
- Implement member assistance programs that focus on the physical and mental health and wellness of the workforce.

NFPA 1500 stands out from other guidance as it requires that the department designate a safety officer. The safety officers are responsible for the following (NFPA, 2018):

- Meeting standards set by OSHA.
- Reporting and investigating accidents or job-related injuries.
- Approving PPE and other safety apparatuses.
- Conducting department-wide safety training.

Root cause analysis

Root cause analysis (RCA) provides a framework by which agencies can develop systems to evaluate error and prevent their recurrence. There are several steps to consider when establishing a program to perform RCA, including formation of the investigation team, gathering and analyzing supporting evidence, and formulating and implementing service improvements. RCA involves complex nonlinear tasks to look at how a problem developed and what future mitigation efforts may be employed to ensure the mistake is not repeated (e.g., new safety technologies, provider reeducation, etc.). The goal of RCA is establishing sustainable service improvement — not for the investigation to become the sole objective (Nicolini et al., 2011).

One approach to RCA is utilizing "The 5 Whys" technique. This technique first involves identifying the problem and then drilling down to explore why each causal factor occurred (Serrat, 2017). In some instances, it may take fewer or additional "whys" to determine the root cause.

Example of "The 5 Whys" technique for RCA

Problem: An obstetrical (OB) kit was not available when needed during an incident.

Why was an OB kit not available when needed? Answer: The station ran out of OB supplies and, due to its infrequent use, the lack of OB kits was not realized.

Why did the station run out of OB Kits? Answer: There had not been an inventory assessment in the last month.

Why had the inventory not been assessed in over a month? Answer: The individual responsible for inventory and supply orders was on extended injury leave and no one was assigned to fill the role.

Why was no one assigned to fill the role? Answer: The personnel were not aware of the agency policies requiring redundant roles for supply ordering and had not previously identified a member to fill this role when a vacancy occurred.

Why were the personnel not aware of the policies? Answer: The agency did not hold training or regular review of the policies, and violation of policies were often left unaddressed. The personnel in the station had become complacent and did not identify or anticipate the need for coverage of this role.

In the above example, the reason why an OB kit was not available can be traced back to awareness and adherence to policies that were overlooked. In addition, the crew had become both complacent and reliant on a single individual to fill this role. By practicing RCA, problems can be traced back to the underlying contributing causal factors. This provides opportunities for systemic changes that will reduce the risk and recurrence of such issues.

Monitoring safety trends

Monitoring safety trends through data and reporting of incidents is a critical way to assess current practices and procedures, and to determine whether changes are needed to improve the safety of EMS practitioners. Several databases and initiatives exist to monitor EMS safety trends. The information provided by them is often used in scientific studies and by EMS departments to evaluate impacts on overall safety, incidents and injuries.

National Fire Fighter Near-Miss Reporting System

The National Fire Fighter Near-Miss Reporting System (NFFNMRS) is online-based and is the first emergency services reporting system of its kind. It is managed by the IAFC and allows employees to confidentially submit reports of near-misses or incidents that could have had worse outcomes, including injury, illness, damage or death (Near Miss, 2020). Although the reporting system is primarily focused on firefighters, it also accepts and disseminates reports from EMS practitioners. The goal is to help other providers learn from a potentially adverse experience or incident, highlight the surrounding circumstances, and decrease first responder injuries and fatalities (Near Miss, 2020). The NFFNMRS accepts reports from first responders around the world and aims to improve first responder outcomes internationally.

EMS Voluntary Event Notification Tool

In March 2012, another near-miss project launched, focused on EMS practitioners. The Center for Leadership, Innovation, and Research in EMS (CLIR), the NAEMT, and the National Association of State EMS Officials (NASEMSO) developed the EMS Voluntary Event Notification Tool (E.V.E.N.T.). This tool was created for EMS practitioners to anonymously share near-miss information by answering a series of questions using an online form. The platform also allows EMS workers to report patient safety events and incidents involving violence.

The collected data is analyzed and used to develop EMS policies and procedures (CLIR, 2020). E.V.E.N.T. reports are also used for the purpose of training, education and preventing similar events from occurring in the future. Individual responses are not shared or transmitted to other parties and reports are submitted anonymously (CLIR, 2020). Please note, the E.V.E.N.T. system does not collect EMS events resulting in illness, injury or damage. These events should be reported to the worker's EMS agency as directed by the agency's policy.

Center for Firefighter Injury Research and Safety Trends

Founded in 2015 by Dr. Jennifer Taylor, the Center for Firefighter Injury Research and Safety Trends (FIRST) is a research center based in Philadelphia, Pennsylvania, at Drexel University's Dornsife School of Public Health. It is dedicated to supporting "the fire and rescue service through objective data collection and analysis on safety culture, stress, mental health, and injury." Developed by FIRST's team of epidemiologists, data and organizational scientists, and psychologists, the center utilizes 2 important tools for research:

1. The Stress and Violence Against Fire-Based EMS Responders Systems-Level Checklist.
2. The Firefighter Organizational Culture of Safety Survey.

Additionally, in 2015 the National Fallen Firefighters Foundation (NFFF) invited FIRST to assist in the development of the National Fire Service Research Agenda. The result of this project was the development of 16 Firefighter Life Safety Initiatives which has since guided the research conducted by FIRST (Drexel University, n.d.).

National EMS Information System

The National EMS Information System (NEMSIS) database is a national effort across the United States. It is run and operated through NHTSA's Office of EMS and the University of Utah. Although it does not directly capture data on EMS injuries, the data collected by NEMSIS can be indirectly used to evaluate events, such as ambulance crashes. Its goals are to standardize data across the United States, store it in one location, integrate electronic EMS documentation systems into every EMS department, and aid in planning and preparing for future EMS operations (NEMSIS, 2020).

NEMSIS explains that the data can be used for the following:

- Developing EMS education standards and curricula.
- Evaluating outcomes of patients and EMS departments.
- Examining disaster preparedness resources.
- Scientific research.
- Providing data for EMS care reimbursement rates.

NEMSIS provides the national, standardized data that are key to the recommendations found in the Strategy for a National EMS Culture of Safety Report (NHTSA et al., 2012).

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Section II: Physical and Mental Health

Chapter 4: Physical Health

Introduction

Physical injuries pose a large threat to EMS practitioners. Each year, thousands of providers visit the emergency department (ED) due to injuries that may result in lost days of work, loss of a career or even loss of life.

During a call, injuries can happen in many ways, such as overextension from lifting or lowering a patient; slips, trips or falls; or exposures to hazardous substances. EMS practitioners must always maintain situational awareness due to the underlying risk of violence inflicted by others, as well as injury or death caused by transportation accidents.

This section will highlight important terms and definitions; the scope of physical injuries; an overview of the nature and mechanism of frequently reported physical injuries; violence, assault and inflicted injuries to EMS practitioners; fatalities and causal factors; and current standards and protocols. This section will also provide recommendations and proposed guidance to reduce the burden of physical injuries on individual providers and the EMS workforce as a whole.

Relevant terms and concepts

Physical injury: Generalized term referring to harm or damage caused to the body via various mechanisms such as moving objects/people or exposure to heat, electricity, chemicals and radiation. Injuries can include penetrating, nonpenetrating, compressions or burns (Songer, n.d.).

Inflicted injury: A harm or damage caused to the body, usually with intent by another person (New York State Office for People with Developmental Disabilities, n.d.).

Workplace violence: Acts or incidents where employees experience abuse, threats and/or assaults while performing their job or while traveling to or from their job (NIOSH, 2021).

Nature of injury: Describes the type of injury; for example, sprains, strains, fractures, burns, cuts or lacerations.

Overexertion: Results from physical exertion to a state of abnormal exhaustion, such as heat exhaustion (Farlex, 2009).

Overextension: Results from extension of a limb or other body part beyond the normal limit (Farlex, 2012).

Strain: An injury to the muscle from being overworked, overstretched or if used in a weakened state. Strains can vary in severity (IAFF, 2020a).

Sprain: An injury to the ligaments responsible for holding joints together. Such injuries can typically occur as a result of sudden movements of ligaments that haven't been properly stretched (i.e., stiff or weak ligaments) (IAFF, 2020a).

Nature and mechanism of physical injuries

EMS practitioners face higher injury and fatality rates than most other occupations. In fact, data from the United States Department of Labor and Bureau of Labor Statistics (BLS) show that injury and fatality rates tend to be 2 to 5 times higher for EMS practitioners than the national average for other occupations. These injury and fatality rates are on par with police and firefighters (Murray et al., 2019).

The National Registry of Emergency Medical Technicians (NREMT) reported a membership of 403,995 personnel on July 27, 2020 (NREMT, 2022), but the actual estimate of paid and unpaid EMS practitioners in the United States may be much higher. In 2013, Maguire and Smith estimated that there are more than 900,000 EMS practitioners nationally.

Between 2003 and 2007, EMS practitioners sustained over 99,400 injuries which required an ED visit, equating to an average of 24,850 injuries per year (Reichard et al., 2011). Of these injuries, 27.5% were due to overextension (mainly sprains and strains), while 21% were due to exposures to hazardous substances (primarily body fluids).

Most common type of injury: sprains/strains

During this time period, 21,690 of those injuries resulted in lost days of work for the EMS practitioner (Maguire & Smith, 2013).

More recent data from 2010 to 2014 shows a total of 89,100 EMS practitioner injuries were treated in EDs, which equals an average of 22,300 visits to the ED per year (Reichard, 2016). Like the older data, the majority of injuries came from overextension, mostly during lifting and lowering. The 2 other most common injury categories were falls, slips and trips, followed by transportation incidents. Over half of all injuries included sprains, strains and tears, with soreness and pain being the second most common nature of injury.

Most common location of injury: back

Strains/sprains and overextension

The NAEMT reported that, out of 100,000 non-fatal injuries, the most common injuries EMS practitioners sustain are a result of strains and sprains, most often as a result of lifting and moving patients. These injuries contributed to 38% of all non-fatal EMS injuries.

NAEMT concludes 43% of all strains and sprains involved injury to the back (NAEMT, 2017). According to the IAFF, 50% of the working population report back pain annually, and 80% report having the same symptoms at some point during their life (IAFF, 2020a). EMS practitioners face an increased risk of developing back issues as they are in a physically demanding profession that requires a great deal of physical stamina due to the strenuous nature of their work.

Back injury and pain can be attributed to several different causes such as disc herniation, osteoarthritis, sciatica, osteoporosis, spinal stenosis and, most commonly, a lumbosacral sprain or strain (IAFF, 2020a). While the symptoms may overlap between these conditions, it is important to seek a physician's opinion rather than relying on self-diagnosis and treatment.

While back strains are among the most common injury sustained, EMS practitioners are also at risk of injuries to other joints, such as ankles and knees, due to the strenuous, physically demanding and unpredictable nature of their work.

Reducing risk of strains/sprains

In order to prevent musculoskeletal injuries, physical fitness and flexibility must be maintained so the body is able to support the rigor of EMS practitioners' professional duties. Stretching and core strength are important components to reducing risk of injury. The IAFF lists the following recommendations to help prevent injury, especially of the back (IAFF, 2020a):

- **Exercise.**
  - Exercise is a good way of strengthening and improving endurance, which lowers the risk of injuring muscles and ligaments. Exercise also keeps the individual's weight in a healthy range, which is very important as obesity has been linked to increased risk of injury.
- **Proper sitting and standing posture.**
  - While not actively working, maintaining proper posture while sitting or standing is essential to avoid injuries. While standing, maintaining a neutral pelvic position and even weight distribution lowers the load on the lower back and decreases the overall stress on joints. While sitting, providing proper lower back support and keeping knees and hips level will help to avoid undue stress on the back and other joints.
- **Practicing proper lifting technique.**
  - EMS practitioners are often expected to lift a range of weight throughout the course of their professional duties. Whether it is while extricating a patient from a motor vehicle, placing patients on a stretcher, moving the stretcher from the incident scene to the transport unit, or loading the stretcher into the ambulance, there are ample opportunities for practitioners to incur injury. Lifting with the legs, while keeping the back straight, will help reduce the chance of injury. Bending only at the knees will also lower pressure in other injury-prone areas.
- **Get plenty of rest.**
  - Research has shown that getting proper rest can lead to injury prevention. Adults secrete hormones during sleep which aid in muscle recovery, immune system function and control of the body's inflammatory response (Winter, 2018).

- **Tobacco cessation.**
  - Programs should be implemented to support the cessation of tobacco use in all forms, including vaping and chewing, as well as smoking. Along with a multitude of health issues attributed to smoking alone, research has also shown that smokers are 2.5 times more likely to incur injury compared to nonsmokers (Brooks et al., 2019).

U.S. Fire Administration recommendations

The "Emergency Services Ergonomics and Wellness Report," published by the USFA, concluded that occupational injuries among EMS practitioners were most likely a result of duties such as lifting patients and bending, followed by pathogen exposure, and inflicted injuries by patients (USFA, 2020a). Even though assault on EMS practitioners ranked third, the data suggests that the likelihood of assault against first responders is 22 times higher than any other occupation (USFA, 2020a). To mitigate these occupational hazards, USFA recommends the following generalized strategies in that report:

- Become familiar with and practice proper lifting techniques.
- Exercise so that muscles are strengthened to sustain the rigor of the job.
- Report assaults so they can be addressed, recorded and used by lawmakers to draft future policies to protect EMS practitioners.

Hearing loss

EMS practitioners are also at an increased risk of hearing loss due to their acute exposure to high-intensity noises. OSHA has set the occupational permissible exposure limit (PEL) of 90 A-weighted decibels or dBA. A study done within the ambulance service in Minneapolis, Minnesota, observed the hearing ability of paramedics over the course of 14 years. It was found that these workers were exposed to a mean noise level of 102.5 dBA within the ambulance (i.e., the siren, horn, engine and noise from other equipment). Persistent exposure to this sound level resulted in hearing loss at a faster rate compared to other professions (Johnson et al., 1980). In another study done in Houston, Texas, 192 EMS practitioners were enrolled in a study to understand the potential degree of hearing loss within this population. This study found that the rate of hearing loss among EMS practitioners was 150 times greater than individuals who are not exposed to typical levels of siren noise (Pepe et al., 1985).

In addition to hearing loss, chronic exposure to noise can also have detrimental cardiovascular effects. According to the NFFF, an increase of 5 decibels of chronic noise exposure is correlated with a 0.5 mm Hg increase in systolic blood pressure (2015).

Reducing risk of hearing loss

OSHA requires all employers to provide hearing protection for all employees exposed to 85 dBA or greater. OSHA further recommends the following hearing protection practices (2008):

- Employers should ensure their employees are provided with proper training for use and care of all provided hearing protection.
- Employers should ensure employees comply with all hearing protection practices and policies.

- Employees should be trained when to use hearing protection and should comply with all policies regarding their use.
- Employees should report and seek treatment for any hearing issues or complications.
- Records should be maintained documenting hearing results at regular intervals, and medical professionals should monitor for any changes or potential hearing loss.

Cardiovascular disease

A 2015 study was conducted to measure the prevalence of risk factors of cardiovascular disease (CVD) among EMS practitioners. The study was based around a self-reported questionnaire with 44 questions. Results showed that over 88% of respondents indicated that they had at least 1 of the risk factors associated with CVD (Hegg-Deloye et al., 2015).

The following risk factors for developing CVD have been identified (Texas Heart Institute, 2020):

- **Hypertension.**
  - According to the American Heart Association, normal blood pressure should be less than 120 mm Hg systolic and less than 80mm Hg diastolic. Elevated blood pressure increases risk of CVD, heart attacks and strokes.
- **High cholesterol.**
  - An increase in blood cholesterol, especially low-density lipoprotein, results in the formation of plaque in the blood vessels. Buildup of such plaque can lead to potential heart attacks, strokes or even pulmonary emboli.
- **Diabetes.**
  - CVD is a leading fatality cause among people with diabetes, specifically type II, which means that this population must receive the appropriate treatment to reduce cardiac morbidity.
- **Obesity.**
  - Obesity can cause or contribute to the above conditions including hypertension, high cholesterol and diabetes.
- **Smoking.**
  - Tobacco smoking can cause an increased or irregular heart rate, elevated blood pressure and tightening of the blood vessels.
- **Inactivity.**
  - A lack of proper physical exercise can contribute to obesity, which can contribute to or result in the risk factors mentioned above.
- **Stress.**
  - Stress can have grave consequences on the human body. Stress acts as a contributing risk factor for CVD by raising blood pressure. Stress will be explored further in the mental health chapter.

Firefighters, EMS and cardiovascular disease

In addition to traditional EMS practitioners, firefighters are also at an increased risk of CVD. Considering the fact that a significant percentage of firefighters engage in some form of EMS, interventions need to be put in place at fire departments to address these risk factors. Since the inception of tracking fatality data by the NFPA in 1977, sudden cardiovascular death continues to be a leading cause of deaths among on-duty firefighters. According to a report published in the "Journal of the American Heart Association," a majority of the autopsies of firefighters who died from cardiac death revealed that they had underlying cardiac conditions such as coronary artery disease, narrowed arteries, and structural abnormalities such as cardiomegaly (enlarged heart) and hypertrophy (increased vessel wall thickness) in the left ventricle (Haller et al., 2018).

Addressing cardiovascular disease

According to a 2015 report published by the NFFF, evidence-based practices for reducing risk of CVD were recommended for first responders, including EMS practitioners (2015). While individual-level interventions are necessary to lower CVD rates, organizations can influence policy and regulations to ensure that EMS practitioners meet certain standards.

- **Individual actions.**
  - Maintain physical fitness.
  - Go in for an annual physical.
  - Monitor blood pressure and get appropriate treatment for hypertension cases.
  - Prevent obesity by maintaining healthy weight.
  - Consume a healthy diet.
  - Refrain from tobacco smoking.
  - Avoid excessive alcohol consumption.
  - Maintain appropriate cholesterol levels.
  - Sleep adequately.
- **Organizational actions.**
  - Mandate medical evaluations prior to employment.
  - Require those medical evaluations to be performed annually and that they meet the NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*.
  - Require medical evaluations prior to returning to work.
  - Favor a tobacco-free work environment.
  - Put physical fitness programs in place.
  - Put comprehensive wellness programs in place.
  - For emergency incidents, ensure rehabilitation programs are implemented.

It is also important to note that the above measures are not strictly limited to addressing CVD. Programs requiring physical fitness and other health interventions can also help prevent leading causes of physical injuries such as strains/sprains.

Traffic incidents

NHTSA reports that between 1992 and 2011, there was an annual estimated mean of 4,500 motor vehicle collisions (MVCs) involving ambulances resulting in an annual mean of 33 fatalities. Additionally, in regard to non-fatal collisions, there are about 1,500 ambulance collisions annually that result in various injuries.

The report also found that based on data collected from 1992 to 2011, 84% of EMS practitioners reported that they were not using any restraints, such as seatbelts, while seated inside of the ambulance. Though these numbers may seem high at first glance, it is important to keep in mind that across the nation the death count as a result of MVCs is significantly higher. For example, just in the year 2013, there were 32,719 fatalities as a result of MVCs (Smith, 2015). Still, further work needs to be done to lower the EMS traffic incidents in order to lower injury and death counts.

Seatbelts save lives

NHTSA reports that 47% of the 37,133 passengers who died in MVCs in 2017 were not wearing seatbelts. It is estimated that in 2017 alone, approximately 2,549 lives could have been saved had the victims worn seatbelts. On the other hand, approximately 14,955 lives were saved that year due to use of seatbelts.

Additionally, NHTSA states that wearing seatbelts in a light truck (including ambulances) can reduce a person's chances of fatal injury by 45% and reduce chances of moderate to critical injury by 50% (n.d.). This indicates that if 84% of EMS practitioners are reportedly not wearing restraints inside the ambulance, they have at least a 50% chance of experiencing moderate to fatal injury in a crash.

Finally, unbelted practitioners pose a risk to their patients. In one study, NHTSA found that occupant-to-occupant contact was one of the causes of patient injuries or deaths in ambulance crashes (Smith, 2015). It is crucial that EMS practitioners wear seatbelts while in ambulances to reduce the rate of death and injury in the event of a crash.

Fatigue

Fatigue plays a large role in injury risk. Not only does it lower an individual's level of focus and precision, but it also affects the body's ability to respond to physical and mental stress. Fatigue increases the body's cortisol levels and changes the balance of hormones and chemicals. Shift work can increase fatigue and increase the risk of developing CVD and diabetes over many years (Fass, 2015).

Fatigue has become a common theme in emergency services. A study of nearly 7,000 firefighters showed that 37% screened positive for any sleep disorder including, most commonly, obstructive sleep apnea (28%), insomnia (6%), shift work disorder (9%) and restless legs syndrome (3%) (Paruthi, n.d.). Getting less than 6 hours of sleep can affect coordination, judgment and reaction time, potentially resulting in a crash, error and/or injury. Performance of a sleep-deprived person is similar to an intoxicated or impaired person. In one study, people who remained awake for at least 24 hours could be compared to a person with a blood alcohol level of 0.10% (Dawson & Reid, 1997). Studies of simulated driving have had similar results. People who drove after being awake for 17 to 19 hours performed worse than those with 0.05% load alcohol content (Dawson & Reid, 1997).

Furthermore, staying awake for 24 hours can have the same performance impairments as if one had 0.096% blood-alcohol content. It is illegal to drive with a blood-alcohol content of 0.08% or higher in all 50 states.

A common phenomenon among shift workers is something known as microsleep. According to Healthline, microsleep is defined as a period of sleep lasting no more than a few seconds up to 1 minute (Higuera, 2020). Microsleep results from fatigue and sleep deprivation and is often unrecognized. People who experience microsleep may be unaware of it, believing they have been awake the entire time. Their partners may be the first to recognize this problem.

Additionally, high cortisol levels and fatigue can impact the body's mechanics. The longer a person is awake, the more likely they are to become dehydrated. Levels of dehydration can reduce flexibility of joints, tendons, muscles and the spine (Fass, 2015). This increases the risk that an overextension or sprain injury will occur. Although fatigue will set in on long shifts, some of the negative effects on the body can be reduced by properly hydrating and eating healthy, well-balanced foods. Each agency should implement work restriction policies that best fit the organizational safety goals (e.g., establishing a standard as to the maximum number of hours an individual can work continuously).

Need for sleep

Humans' sleep architecture is composed of two types of sleep. Non-rapid eye movement (NREM) sleep is most important for normal bodily functions' rest and repair, and dream or rapid eye movement (REM) sleep is needed for learning and mental health. Achieving adequate amounts of both is critical for health.

"The Effects of Sleep Deprivation on Firefighters and EMS Responders," IAFC

Fighting fatigue-associated risks

- Encourage EMS practitioners to communicate their needs with others in the field, get adequate sleep when possible, and be aware of their level of fatigue.
- Encourage EMS practitioners to practice proper sleep hygiene, or good sleep habits, both on and off duty. The Centers for Disease Control and Prevention (CDC) makes the following recommendations when it comes to establishing sleep hygiene (2016):
  - Try to engage in physical activity and exercise throughout the day.
  - Establish a routine and try to go to bed at the same time each night, especially when off duty.
  - Keep the bedroom dark, quiet and at a comfortable ambient temperature.
  - Avoid the use of electronics such as cell phones, TVs and computers in the bedroom and especially prior to bedtime.
  - Avoid caffeine, alcohol and large meals prior to bedtime.
- EMS agencies could consider limiting 24-hour shifts and/or eliminating 48-hour shifts. Agencies can also consider rotating providers to spread the workload, and call volume, among providers.

- Examine fatigue as a contributing factor to transportation-related incidents.
- Invest in new technologies. There are devices on the market that monitor drivers' eye closures. If the monitored person becomes drowsy, the monitor picks up the eye closure rate and then sounds an alarm (Rostaminia et al., 2019). Small cameras are also available that can be installed to monitor travel lanes while the ambulance is in motion. If the vehicle begins to drift across the road, an alarm sounds to alert the driver (Sahayadhas et al., 2012). However, it is important to note that these technologies cannot replace getting the proper amount of rest.

Violence, assault and inflicted injuries

The BLS describes workplace violence as "intentional injury by another person" and categorizes and counts such incidents by industry and occupation (2019).

Of all industries, health care workers, including EMS practitioners, experience the highest rates of workplace violence, most often perpetrated by patients. In fact, on average, more than 1 EMS practitioner is violently killed while on duty every year (Maguire, Browne, O'Neill, Dealy, Clare, & O'Meara, 2018). A review of available studies found that up to 93% of EMS practitioners experienced at least 1 incident of verbal or physical violence during their careers, with verbal violence being most common. The USFA report, "Mitigation of Occupational Violence to Firefighters and EMS Responders," highlights that inflicted violence, whether verbal or physical, can lead to psychological impacts, such as cumulative stress and burnout (USFA, 2017).

On average, the CDC estimates that approximately 2,000 EMS practitioners are injured each year as the result of violent acts (O'Meara et al., 2019). Outside of the United States, studies show between 67% to 88% of EMS practitioners report some form of violence within the last year (Murray et al., 2019).

Between 2003 and 2007, patients caused 37% of injuries resulting in missed workdays among private EMS practitioners. A total of 530 assaults occurred, or an average of 132 incidents of violence per year. Assault accounted for 8% of all EMS fatalities during this same time period (Maguire & Smith, 2013).

Types of violence

There are 6 primary classifications of violence toward EMS workers: verbal abuse, property damage/theft, intimidation, physical abuse, sexual harassment and sexual assault. While violence can be perpetrated by anyone, including family, friends and bystanders, it is most often perpetrated by the patient (Bigham et al., 2014).

The scientific literature demonstrates that the mental status of the patient is a strong predictor for violence. For example, if they are experiencing mental illness, an acute mental health crisis, excited delirium or certain physical ailments, such as seizures or hypoglycemia, there is an increased risk of violence (Murray et al., 2019).

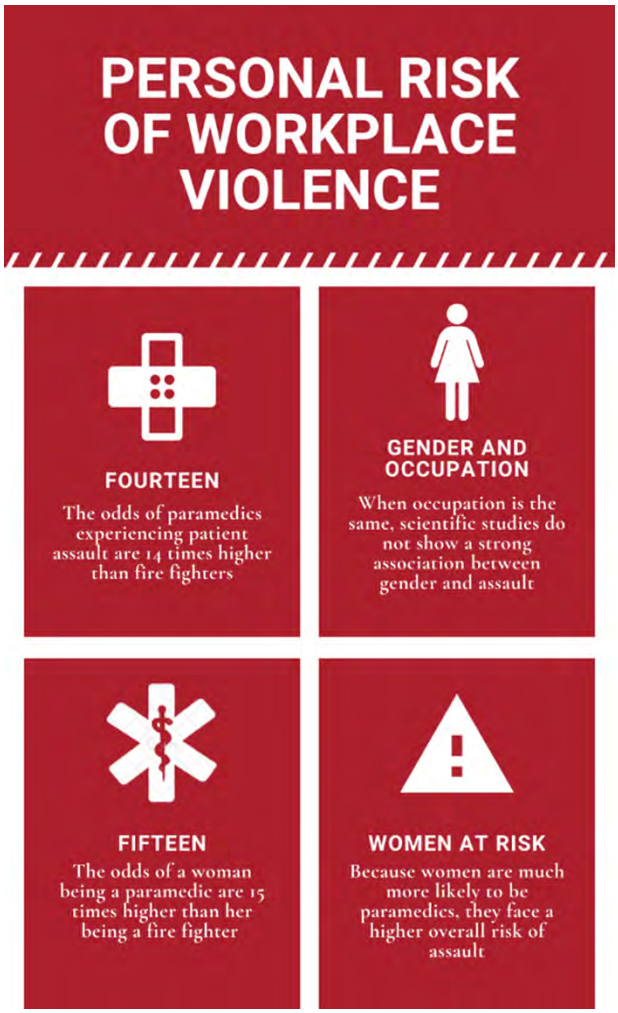
Risk and lack of reporting

An individual EMS practitioner's risk of experiencing violence increases with patient exposure. For example, the odds of paramedics experiencing patient assault are 14 times higher than for firefighters. It is important to note that females are much more likely to be EMS practitioners than firefighters (Taylor et al., 2016) and there are growing indications that females may face a higher overall risk of assault (Maguire & O'Neill, 2017).

It is likely that actual rates of assault and inflicted violence are higher than available statistics. One of the main drivers for this is a lack of reporting. In a Canadian study, 61% of participants did not report violence, despite the fact that three-quarters had experienced violence in the previous 12 months.

Additionally, 81% did not officially record violent incidents that had occurred (Bingham et al., 2014). All acts of violence against EMS providers should be reported to the agency and law enforcement officials when applicable.

There are many reasons violence is not reported or recorded. For example, more experienced providers may accept violence and assault as part of the job. They may be less likely to think of an assault or inflicted injury as an event worth reporting. Furthermore, providers may not report incidents to protect the patient from consequences, including legal proceedings. They may accept the injury, especially if the patient was in an excited or altered mental state. There may also be a desire to appear strong to supervisors and fellow EMS practitioners. By not reporting or recording an instance of assault, violence or inflicted injury, they do not risk their image within their unit. Lastly, there may be a fear of losing workdays. If an injury is reported, providers may have to take time off from work or reduce their shifts, which can translate into significant financial losses for paid EMS practitioners.



Reducing risk of violence, assault and inflicted injuries

To better understand the scope and impact of workplace violence toward EMS workers, reporting systems need to be improved and clear procedures should be put in place to respond to an incident of violence or assault. Some recommendations include encouraging legislators to classify assault to an EMS practitioner as a felony. In fact, a number of states, such as Massachusetts, have considered charging assault to a health care worker (including EMS practitioners) as a felony instead of a misdemeanor. While this may deter some assaults from occurring, it is important to note that many patients who perpetrate assault and violence experience mental distress such as excited delirium or a mental health disorder. Such legislation would disproportionately affect these patients and must be considered before passing legislative measures.

Scientific literature has identified 6 different themes to reduce violence and inflicted injuries through interviews with EMS practitioners (Maguire, O'Neill, O'Meara, Browne, & Dealy, 2018). The themes and suggestions include the following (many of these measures are discussed further in Chapter 11: Hostile Incidents):

1. Provide more comprehensive training such as cultural competency, safety, de-escalation or defusing techniques, and self-defense tactics.
2. Improve situational awareness of EMS practitioners through training, exercises and by encouraging providers to help each other in the field.
3. When absolutely necessary, use approved physical or chemical restraints. Note that restraints should be used only when no other options will suffice. It is important to acknowledge that sometimes this is the only way to prevent a patient from harming themselves or others. Restraints should not pose any additional threat to a patient's health or safety and should not hinder their ability to breathe or perform basic bodily functions. A restraint should not be used if the provider has not received training on how to properly and safely execute restraint. Only soft physical restraints should be used, and chemical restraints should be dosed according to local protocols and/or online medical direction. Chemical restraints, even where approved, remain controversial and have caused harm.
4. Create public messaging campaigns to raise awareness of violence and assault towards EMS workers, as well as within EMS units. Messaging campaigns toward the general public may include basic statistics, numbers to call, general information and awareness of consequences of inflicting assault. Campaigns within EMS units may center around the prevalence of violence/assault, what workplace violence is, and the reporting process, including policies and steps.
5. Improve advanced communication between and among health care workers and dispatch. Alerting a receiving team of health care workers that a patient, or address, may pose a potential threat gives providers time to plan and prepare for a given situation.
6. Create opportunities for more cooperation between health and safety entities (i.e., EMS, police and other health care workers at facilities). This was the most frequent theme in EMS practitioner interviews and can be improved on all sides. By working together and communicating, employees in these key public services can communicate and protect one another from violence in the workplace.

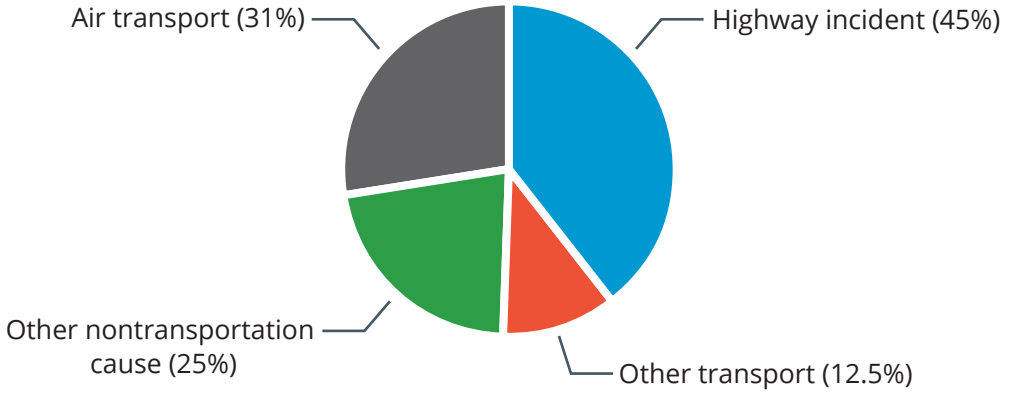
Fatalities

Data and literature repeatedly show transportation incidents as the leading cause of EMS fatalities. Between 2003 and 2007, 86% of fatalities among private sector EMS were due to transportation incidents (Maguire & Smith, 2013). During the same time period, the BLS Census of Fatal Occupational Injuries reported 65 fatalities among EMS practitioners. The majority (88.5%) were related to transportation incidents. Overall, 45% of fatalities were caused by highway incidents, 31% occurred during air transport, and 12.5% were "other transportation incidents," such as being struck by a car. Only 12.5% of fatalities were not related to transportation (Reichard et al., 2011).

Fatalities: Air and ground transportation fatalities

For air transportation, a review of previous crashes demonstrated that poor weather conditions, darkness and post-crash fire significantly contributed to increased risk of fatality. Darkness increased the risk by a factor of 3.2, poor weather by a factor of 8, and post-crash fire increased the risk of fatality by a factor of 16. Crashes in the dark accounted for nearly 50% of all crashes and 68% of fatal crashes (Baker et al., 2006). Avoiding air transportation in conditions leading to reduced visibility, such as poor weather conditions and darkness, not only reduces the risk of a crash from occurring, but it also reduces the risk that a crash will be fatal.

Percent of fatalities by cause 2003 - 2007



Source: Reichard et al., 2011.

Ground transportation is also very risky, especially when lights and sirens are utilized. The use of lights and sirens has been demonstrated to increase the overall risk of crash rates, as well as injury and fatality rates (National EMS Quality Alliance (NEMSQA), 2021). In fact, the majority of fatal crashes occur while lights and sirens were in use. In one study, siren use was examined both in the response and transport phase compared to runs without siren use. Researchers found that siren use during the response phase increased the risk of crash slightly, but siren use during transport increased the risk of a crash from 7.0 to 17.1 per 100,000 calls (Watanabe et al., 2019).

This may be partially explained by the differences in driving practices based on whether a patient is being treated and transported in the unit. En route to a call, typically 2 providers ride in the front cab of the ambulance, whereas during patient transport there is usually 1 provider in the front cab driving while the second provider rides in the back with the patient. The focus of the providers generally shifts from the road and the route to providing patient care and delivering the patient to their destination as soon as possible (Watanabe et al., 2019). This may result in more distractions and riskier driving behaviors. This topic will be explored further in Chapter 12: Emergency Vehicle Operations.

Fatalities: Assaults, violence and resulting inflicted injuries

Assaults also pose a significant risk of fatality to EMS practitioners. As discussed in the Violence, Assault and Inflicted Injury section, physical violence is frequently encountered by EMS practitioners in the field. Occasionally, such assaults and violence can be fatal. Between 2003 and 2007, assaults accounted for 8% of fatalities among private sector EMS practitioners (Maguire & Smith, 2013). Besides transportation-related incidents, these data show that assault is the next-leading cause of emergency medical provider fatalities.

Fatalities: Other important risk factors

Certain demographic characteristics may be risk factors for fatalities. An example is employment status. Between 2003 and 2007, of 65 EMS fatalities, 86% were paid EMS practitioners (Reichard et al., 2011).

Although volunteer EMS practitioners make up a large proportion of the EMS workforce, they accounted for only 14% of fatalities. One possible explanation for this is that paid EMS practitioners spend a greater amount of time in the field and on calls. This provides more opportunity for a fatal incident to occur. Additionally, paid EMS practitioners may be more likely to work longer shifts, which can increase fatigue and other risk factors.

Fatigue itself is an important risk factor for fatalities. As providers become more tired, they lose their ability to focus and work precisely. This is especially dangerous while operating a vehicle such as an ambulance. Previous overviews of EMS safety have determined that fatigued driving is as dangerous as drunk driving. Fatigued EMS practitioners are more likely to be involved in ambulance crashes or have an incident while driving home from a shift (Fass, 2015). The nature of shift work, particularly 24- or 48-hour shifts, increases fatigue and the risk that a fatal crash could occur.

Other considerations for injury and fatality risk reduction

Emergency incident rehabilitation

The IAFF produced a detailed manual that describes the emergency rehabilitation program (2008). In association with the USFA and Federal Emergency Management Agency (FEMA), this manual was drafted to enact a program to address first responders' health after stressful or prolonged incidents. The manual is built on the following NFPA standards:

- NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program.*
- NFPA 1582.
- NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members.*
- NFPA 1584, *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises.*

NFPA 1584, which was originally developed in 2003, predominantly contained guidelines for developing standard operating procedures (SOPs) in regard to rehabilitation, emergency operations and training (IAFF, 2008). The emergency incident rehabilitation manual as issued by the IAFF, FEMA and USFA contains important information on:

- **Heat stress.**
  - Discusses the various heat exposures and how the human body is affected by such exposures, including heat exhaustion and heat stroke.
- **Cold stress.**
  - Discusses various cold exposures such as hypothermia and frostbite, and how the human body is affected by this exposure.
- **Setting up a designated rehab area.**
  - Establishes criteria for choosing the area of rehab operations on site, as well as the type of equipment needed.

- **Responder care at the designated rehab area.**
  - Establishes protocols for rehab operations, including hydration as well as fluid and food management.
- **Post-incident considerations.**
  - Once the situation is addressed at the scene, further need for care can be established and recommended.
  - Highlights the need to monitor the first responders' hydration and well-being, and provides guidance for referral to support programs, if needed.

International Association of Fire Fighters Wellness-Fitness Initiative

This initiative is designed to strengthen first responders from both a mental and physical standpoint (IAFF, 2020b). The program mandates participation by all members of a department and has currently been adopted across the country by numerous agencies.

When a department or agency adopts the IAFF Wellness-Fitness Initiative, the program design must incorporate and ensure the following items:

- Confidentiality of the various performed evaluations.
- Physical and wellness programs must be educational and rehabilitative (i.e., programs must be rewarding rather than punitive).
- Wellness programs must be holistic and address medical, physical, mental, behavioral and rehabilitative items as a whole, rather than only meeting or focusing on select criteria.

Members who excel in the Wellness-Fitness Initiative can then lead a Peer-Fitness Trainer Program, which seeks to rely on first responders to train and hold their peers accountable for maintaining physical fitness.

Firefighter Safety Through Advanced Research recommendations for physical fitness

Since 45% of fire departments provide EMS transport and 90% provide some form of EMS (Evarts & Stein, 2020), firefighters should also be trained adequately so that they maintain a level of fitness needed to perform their duties. Firefighter Safety Through Advanced Research (FSTAR) conducted a research study in 2011 which showed that workers' health and safety would greatly improve if they followed a proper physical fitness program (Smith, 2011). They acknowledge that even though the current guidelines require firefighters to engage in a training program, it is at the individual departments' discretion to mandate such programs. For these programs, FSTAR recommends the following:

- **Aerobic training.**
  - Aerobic training can improve cardiovascular health while preparing first responders for the endurance demands of the job. Additionally, it helps to improve body composition metabolism and lipid concentration.

- **Sprint interval training.**
  - High-intensity interval training helps mimic energy expenditure at incident scenes. Similar to high-intensity interval training, this training plan serves to improve endurance, performance and anaerobic threshold.
- **Functional training.**
  - This training plan seeks to mimic the full-body movements as performed on duty. Functional training can help improve strength and endurance by using equipment such as resistance bands and medicine balls.
- **Resistance training.**
  - Resistance training helps improve muscle strength and endurance, which can be protective against injuries stemming from overextension such as strains and sprains, the leading cause of workplace injuries.
- **Lifestyle modifications.**
  - Combining training plans with an appropriate diet to ensure that workers maintain a healthy weight to be able to safely perform on-the-job tasks.

Nutrition

Consuming a healthy diet is important to keep the body in optimal condition. This will reduce the risk of injury as well as chronic diseases, such as CVD and diabetes. It is equally important to eat healthily both on and off shift. While on shift, it is often easier to get a meal from a fast-food restaurant or quick-service store. However, many of these foods do not provide proper nutrition. Eating meals high in carbohydrates and fats provides short-term energy, so providers' energy levels may "crash" faster.

On the other hand, eating meals with complex carbohydrates, fruits and vegetables results in long-lasting energy that makes the provider feel full longer (American Heart Association, 2018). It is very important to choose healthy options whenever possible but especially while on shift. Choosing meals with more nutritional value, even from fast-food restaurants, can improve overall health and reduce the risk of injury.

Obesity in emergency services generally reflects the same trends that are seen in the American population overall (Poston et al., 2011). One study, conducted by researchers from the Boston University School of Medicine, Harvard University and the Cambridge Health Alliance found that over 75% of their fire and EMS recruits were either overweight or obese (DiGravio, 2009).

The incidence of obesity among EMS practitioners may be attributed to the stresses and dietary inconsistencies that occur because of the nature of EMS work. For example, EMS practitioners are taught that a normal blood glucose level (BGL) is somewhere between 80 and 100 decigrams per milliliter. The consumption of sugar from soft drinks or other unhealthy snacks high in refined sugars pushes the blood sugar over 100 decigrams per milliliter, thereby triggering insulin secretions which promote the generation and storage of fat. Common foods such as breads, drinks containing high fructose corn syrup, cereal and products with refined flour all trigger similar spikes in BGL and insulin secretions.

Dietary Guidelines for Americans, 2020-2025

Hydration

Water helps the body effectively burn fat and prevents dehydration. Hydration plays an important role in overall performance, especially in hot climates or environments. Without proper hydration, job performance and endurance may suffer, and practitioners may be at higher risk for heat-related illness and/or injury (Belval et al., 2019). Hydration levels can usually be assessed by examining the color of urine. Dark urine represents severe dehydration; pale yellow to clear urine represents proper hydration. The science indicates there are benefits to hydrating prior to responding to an incident or performing any tasks that require hard labor (Sawka & Pandolf, 1990).

There are 3 considerations when selecting fluids for hydration: taste, tolerability and nutritional value. Water should be the EMS practitioners' primary source of hydration, and they should have ready access to it throughout the course of their workday. The IAFF

incident rehabilitation program requires all responders entering rehab to drink at least 12 to 32 ounces of water for rehydration and replenishment after an incident and prior to returning to active work.

During times of strenuous physical activity, drinks containing electrolytes should be considered. The osmolality level in drinks is another factor for consideration. Osmolality is the number of particles in solutions. The higher the osmolality, the longer it takes to absorb the fluid and digest it. Sports drinks should contain between 270 and 330 mOsm/kg water (milliosmoles per kilogram of water). If the drinks contain more than 350 mOsm/kg, they should be diluted with water (Convertino et al., 1996).

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Chapter 5: Mental Health

Introduction

Mental health consists of a comprehensive set of characteristics that affect a person's well-being. Per the CDC, this topic "includes our emotional, psychological and social well-being...It also helps determine how we handle stress, relate to others, and make healthy choices" (2021). According to the World Health Organization (WHO), there are various determinants of a person's mental health that come in the forms of psychosocial and biological variables. Across all ages, life experiences can have an effect on an individual's mental state. Additionally, WHO states that "poor mental health is also associated with rapid social change, stressful work conditions, gender discrimination, social exclusion, unhealthy lifestyle, physical ill-health and human rights violations" (2018).

It is important to note that poor mental health does not necessarily indicate mental illness. However, prolonged periods of a poor mental health state can lead to the development of mental illness, including, but not limited to, depression, anxiety and post-traumatic stress disorder (PTSD). These conditions can be acute or chronic in nature. The National Institute of Mental Health (NIMH) reports that as of 2017, approximately 47 million adults in the United States suffer from some form of mental illness. This figure represents about 19% of American adults (2019).

With such a high prevalence rate of mental illness across the country, it should be no surprise that EMS practitioners are particularly at risk of poor mental health. About 85% of first responders indicated that they have experienced symptoms of mental health issues (Mental Health First Aid (MHFA), 2022). This alarming rate demonstrates the need to find immediate solutions that can address these problems; however, the stigma surrounding mental illness continues to be an obstacle. In a cross-country survey administered in a collaborative effort between the IAFF and NBC, 81% of respondents (which included EMS personnel assigned to fire apparatus as well as ambulances) indicated that they were reluctant to seek out help to address mental health issues as they "feared being seen as weak or unfit for duty" (Ushery et al., 2018).

First responders, especially EMS practitioners, work in complex and high-stress environments. It is important that these workers are in a good mental state as they are ultimately responsible to provide aid during emergencies. Thus, proper protocols and programs must be enacted to ensure that mental health stigma in the workplace is reduced so that employees are encouraged to seek out appropriate resources and support to improve their mental health if and when needed.

Relevant terms and concepts

Acute stress disorder (ASD): ASD describes acute stress reactions that may lead to PTSD. The symptoms of ASD typically manifest during the period from 2 days to 4 weeks post-trauma exposure (Bryant et al., 2011).

Any mental illness: Mental, behavioral or emotional disorder that can range from very little to severe impairment (NIMH, 2022).

Burnout: Resulting from a heavy workload and stress, burnout is the emotional exhaustion from these factors. Burnout occurs usually from excessive stress and not from trauma (American Institute of Stress (AIS), 2021).

Compassion fatigue: Burden of exposure from working alongside those who are suffering from symptoms resulting from exposure to a traumatic event (AIS, 2021).

Critical incident stress management (CISM): Incorporation of crisis intervention tactics to help individuals who have been exposed to critical traumatic events, as the program serves to reduce impact of event exposure, accelerate recovery and manage referrals to other programs for continued care (National Interagency Fire Center (NIFC), n.d.).

Depression: A mental health disorder that can vary in severity and detrimentally affects a person's daily activities including sleep, appetite and other functionality (NIMH, 2018).

Moral injury: The psychological distress that results from actions, or the lack of them, which violate someone's moral or ethical code. Unlike formal mental health conditions such as depression or PTSD, moral injury is not a mental illness. But those who develop moral injuries are likely to experience negative thoughts about themselves or others (Greenberg et al., 2020).

Post-traumatic stress (PTS): Set of symptoms that occur as a common and adaptive response to a stressful event (Bender, 2013).

PTSD: While PTS simply refers to the symptoms of a stressful event, PTSD is officially classified as a mental health disorder that can result in sleep disturbances and other, more intense, symptoms of PTS. (Bender, 2013)

Resilience: Ability to adapt and recover from significant stressful events (American Psychological Association (APA), 2020).

Serious mental illness: Any mental illness that results in significant functional impairment which consequently affects life activities (NIMH, 2022).

Lack of a central mental health database

It should be noted that unlike physical/inflicted injury and infection spread statistics, no centralized database exists to quantify and analyze mental health data for EMS practitioners across the United States. Instead, current mental health data relies on a combination of studies that have been conducted in different parts of the country.

Mental health injuries should be looked at in a similar way to an individual's physical injuries. Establishing and tracking mental health cases will help us better understand the extent of the problem and lead to better recommendations for overall risk reduction.

Firefighters' role as EMS practitioners

According to the NFPA's "United States Fire Department Profile 2018," 45% of all departments across the country provided emergency medical transportation services, and 90% provided some form of EMS (Evarts & Stein, 2020). The report also mentions that fire department expenditures have increased. One of the many factors attributing to this rise is the fact that there has been an increase in EMS-related call volume for a majority of fire departments across the country. These added impacts include increased training and continuing education needs, increased staffing, and purchasing additional equipment, to name a few. With fire departments administering a significant percentage of EMS care, data presented here is reflective of firefighters as well.

Mental health injuries

Mental illness, similar to physical injuries, can be treated, rehabilitated and recovered from with proper treatment. Mental health symptoms can tend to overlap, which is why it is imperative that EMS practitioners seek the opinion and diagnosis of a licensed mental health professional rather than relying on a self-diagnosis. EMS practitioners should seek treatment from mental health professionals that are well acquainted with the nature of EMS work and the types of trauma EMS practitioners regularly encounter.

Depression/suicide

People tend to mistake depression as simply a feeling of sadness. Depression is a mental health disorder that can be very serious in nature. The American Psychiatric Association defines this illness as a common but serious illness that has a detrimental effect on how a person can feel, think and act (American Psychiatric Association, 2020). Fortunately, this illness, much like the others listed in this manual, is treatable.

It is possible for an individual to experience feelings of sadness that are temporary in nature or that self-resolve. However, persistent, chronic symptoms can be early signs of a much more serious underlying condition that needs to be treated. If symptoms of a depressive episode last for 2 weeks or more, the individual could be suffering from depression and should seek immediate treatment.

Without intervention, depression can lead to more severe complications such as self-harm, substance abuse and addiction, life disturbances, and, in extreme cases, suicide.

Depression can also lead to other physiological health conditions. According to NIMH, people who have been diagnosed with depression are at a greater risk of developing diabetes, CVD, stroke, Alzheimer's disease and even osteoporosis (2020). The mechanism of action is unclear, but depression has been attributed to physical health changes such as increased inflammation, fluctuations in heart rate and circulation, abnormal stress hormones, and changes in metabolism (NIMH, 2021).

The IAFF Center of Excellence for Behavioral Health Treatment and Recovery reports that symptoms of depression can be mental or physical in nature and are as follows (2021a):

Mental	Physical
Persistent sadness. Feeling empty. Negative thoughts. Issues with memory. Concentration difficulties. Indecisiveness. Guilt. Anxiety. Frustrated/irritable. Diminishing interest in previously fun activities.	Inexplicable body aches. Poor appetite. Weight fluctuations. Sleep issues. Fatigue. Slowed speech and movements.

Post-traumatic stress/post-traumatic stress disorder

PTS may be experienced by anyone following exposure to a traumatic event. Responding to incidents involving significant motor vehicle accidents, severe illness, injury or death (especially when children are involved), as well as numerous other emergencies, can trigger symptoms of PTS. According to Dr. James Bender, "PTS is a common, normal, and often adaptive response to experiencing a traumatic or stressful event" (2013). It is normal for EMS practitioners to exhibit symptoms of PTS, and the symptoms in many cases self-resolve as the provider processes the experience. PTS is not considered a mental illness, but if symptoms do not self-resolve, it can evolve into PTSD.

PTSD is clinically diagnosed and officially classified as a mental illness that requires treatment. The IAFF is more specific when it comes to defining PTS versus PTSD. PTS is defined as experiencing any 1 of the symptoms in categories B-E shown in the table below, while PTSD is classified as experiencing at least 1 symptom from categories B and C, as well as at least 2 symptoms from categories D and E (IAFF, 2020). Symptoms of PTSD last for over a month and cause a significant degree of impairment in daily activities.

Category B: Reliving the event	Category C: Avoiding things that tend to be a reminder of the event
❯ Memories and thoughts that are intrusive. ❯ Stressful dreams. ❯ Flashbacks. ❯ Feeling of intense distress when exposed to cues that remind you of the event.	❯ Avoiding people, places and things associated with the event. ❯ Avoiding feelings or thoughts pertaining to the event.
Category D: Negative emotions/thoughts	**Category E: Feeling on edge**
❯ Negative thoughts that are persistent. ❯ Self-blame stemming from the event. ❯ Persistent poor emotional state. ❯ Unable to feel positive emotions. ❯ Unable to remember aspects of the event. ❯ Diminishing interest in daily activities. ❯ Social detachment.	❯ Anger; having outbursts or an irritable feeling. ❯ Self-destructive behavior. ❯ Paranoia/hypervigilance. ❯ Easily startled. ❯ Diminishing concentration. ❯ Poor sleep quality.

Symptoms of PTS and PTSD (IAFF)

PTSD can have grave long-term consequences if left untreated, the most severe of which is suicide. In a study published in the "Emergency Medicine Journal," of the 1,029 EMS practitioners surveyed, the results indicated that 22% were suffering from symptoms of PTSD (Bennett et al., 2004).

Acute stress disorder

In addition to PTS and PTSD, first responders are also at risk of developing ASD. ASD is defined as experiencing at least 9 of the symptoms listed above, and can persist anywhere from 2 days up to a month, while resulting in significant impairment on a regular basis (IAFF, 2020). Unlike PTS, ASD is classified as a mental health disorder with the potential of developing into other mental illnesses such as PTSD.

Substance abuse and addictions

According to the WHO, substance abuse is defined as the "harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs" (2019). First responders might turn to substances, such as alcohol, for a temporary relief from the psychological burden resulting from on-the-job events. EMS practitioners may use other high-risk behaviors as coping mechanisms as well (e.g., excessive spending, promiscuity, gambling, etc.).

While alcohol is the most commonly abused drug, illicit substances, steroids and prescription drugs may also be abused. Due to the fact that EMS practitioners work in a profession that is prone to physical injuries, they are subject to opioid prescriptions, which can inadvertently result in dependence and addiction (IAFF Center of Excellence for Behavioral Health Treatment and Recovery, 2021c). Recognizing the early warning signs of substance abuse can prevent it from developing into an addiction. This is also beneficial in terms of avoiding withdrawal symptoms, which are usually experienced by people trying to quit a substance after long-term usage. The IAFF Center of Excellence for Behavioral Health Treatment and Recovery lists the following warning signs for identifying potential cases of substance abuse or addiction (2021b):

- Cravings for regular substance use (can be physical or psychological).
- Inability to stop, or even decrease, substance use.
- Increasing dosage of the substance to counter developing tolerance.
- Going the extra mile (such as stealing or lying) to acquire substance.
- Prioritizing substance use over other daily tasks.
- Spending more time and money for substance use.
- Inability to adequately perform daily obligations due to substance use.
- Mood swings and irritability.
- Substance use in dangerous circumstances such as at work or while driving.
- Lying to others to hide substance use.

The Substance Abuse and Mental Health Services Administration conducted a national survey which showed that 29% of American firefighters are abusing alcohol and about 10% are abusing prescription drugs (Hilliard, 2021). With fire departments providing a significant percentage of EMS, substance abuse rates must be addressed in this community.

Suicide

One of the most serious issues to address among first responders is the topic of suicide. When symptoms of mental health disorders like depression and PTSD are present, it can increase the risk of suicide. Individuals who are particularly at risk of suicide may exhibit the following symptoms (IAFF Center of Excellence for Behavioral Health Treatment and Recovery, 2021d):

- Visible mood swings.
- Increased drug and alcohol consumption.
- Inability to find reasons to live.
- Vocalizing desires to die or feeling trapped.
- Feeling like a burden to others.
- Feeling hopeless.
- Isolating and withdrawing from social company.
- Sleep issues (too little or too much).
- Engaging in reckless behavior.

Support resources

It is critical to note that the following practices are the most effective only when an individual voluntarily seeks support. It is also imperative that only properly trained professionals administer treatment. Ideally, EMS practitioners should seek out professionals familiar with the job requirements of EMS providers and with professional experience in treating first responders. The NVFC maintains a regularly updated directory of vetted behavioral health professionals that either have firsthand experience with the fire and emergency services or have completed a training course through the Firefighter Behavioral Health Alliance to educate them on the fire service and the specific challenges they face (NVFC, 2022).

Peer support programs

Peer support programs intersect with resilience training, as they emphasize community-driven mental health management. Whereas CISM programs and employee assistance programs (EAPs) are usually led internally through agency management, peer support comes from external organizational resources with no biases.

In a study designed to improve program guidelines, the authors stated that these "programs have emerged as standard practice for supporting staff in many high-risk organizations... such as emergency services..." (Creamer et al., 2012). The program is based on the premise that the EMS community can lean on each other for support. Detrimental mental health symptoms can be minimized by ensuring individuals have someone they can turn to for support. Formal peer support programs, such as the one administered by the IAFF, train individuals to be a source of support for their colleagues if and when needed.

IAFF Peer Support Program. The IAFF 2-day Peer Support Training Program establishes a curriculum to train willing employees in the following areas (IAFF, 2022b):

- Being able to properly approach an individual of concern.
- Building rapport to instill trust.
- Providing appropriate care and evaluating the severity of the crisis.
- Providing additional resources.
- Actively educating and initiating dialogue with peers about mental health.

REACT peer support program. Agencies have other alternatives to implement peer support programs. A number of researchers worked with public safety agencies to develop the REACT peer support program. REACT, which stands for Recognize, Evaluate, Advocate, Coordinate and Track, is conducted in 1 day with 4 different modules (Marks et al., 2017):

- **Module 1:** The initial module prioritizes educating the attendees, who are employees of the department seeking to be a peer support provider (PSP), so that they are aware of all the available treatment options. This is important as PSPs are responsible for providing treatment options to employees in need. This module also educates PSPs regarding PTSD and emphasizes that they are prohibited from officially diagnosing any mental health disorders.
- **Module 2:** During this phase, PSPs are trained to identify various stress injuries. A shared mental model of stress injuries is provided to create a common language among all providers.

- **Module 3:** The goal of this module is to make providers practice their knowledge by conversing with peers to encourage them to follow through and get adequate help. PSPs are trained for motivational interviewing, normalizing reactions, etc.
- **Module 4:** This module deals with management of acute stress such as anger management. PSPs are trained regarding psychoeducation pertaining to anger management.

Throughout modules 2 to 4, PSPs are also taken through a skills training phase that occurs in 5 steps:

1. Modeling the targeted skill.
2. Role-playing with another group member.
3. Feedback from the group.
4. Assisting role-playing of targeted skill within the group.
5. Distributing feedback.

The researchers concluded that REACT "is an effective approach for providing knowledge and skills needed to address the psychological impact of potentially traumatic events" (Marks et al., 2017). It should be noted that a program such as this one can be used for a wide array of mental health disorders and is not just limited to PTSD.

Critical incident stress management

Although there have been recent movements away from CISM programs, they still remain one of the most widely adopted practices to address first responder mental health needs. CISM was introduced to EMS in the early 1980s, and the program acts primarily as a post-exposure intervention that is intended to limit the detrimental effects of critical incidents and the resulting stress (Tilbe, n.d.). It first serves by "defusing," which takes place immediately after a traumatic event. Then a "debriefing" occurs a few days after the event to further examine how the individual may have been affected by the trauma (Tilbe, n.d.). Individuals are then guided to a customized crisis intervention plan after meeting 1-on-1 with trained peer support members, mental health clinicians or department chaplains.

The current practices of CISM, particularly debriefing, are subjected to some skepticism as research has shown that there is "no evidence that debriefing reduced general psychological morbidity, depression, or anxiety" (Kagee, 2002). Due to scientific evidence indicating that CISM is ineffective and at times even harmful, the industry is moving away from the practice and instead focusing on peer support programs which provide more evidence of mitigating the effects of critical incidents (Lanza et al., 2018). The recommended practices below are much more in-depth and backed by scientific research in their effectiveness of treating first responders' mental health.

Employee assistance programs

Treatment programs, such CISM and others listed in this section, may be provided through the department's or municipality's EAP. The IAFF describes this program as a "cost effective, humanitarian, job-based strategy to help individuals whose personal problems impact their work performance" (2022a). The coverage of EAP varies among departments/municipalities.

Resilience training

Resilience is an important trait for first responders. It indicates their ability to recover as soon as possible from a traumatic event. Training to increase resilience can strengthen mental

health so that traumatic events do not take such a severe toll on a provider's mental and physical well-being.

IAFF resilience training program. The IAFF offers resilience training in a 1-day, 8-hour course (2022c). The program particularly emphasizes 6 concepts:

1. Assess current resiliency level.
2. Positive thoughts.
3. Positive emotions.
4. Positive interactions.
5. Mind-body connection.
6. Nutrition and exercise.

The NVFC resilience recommendations. The NVFC recommends 8 core practices that workers can use to become more resilient. NVFC believes that resilience training can act as a theoretical "vaccine" against mental illnesses such as PTSD, among other disorders. Their recommended practices, which use PTSD management as the primary example, are as follows (Wilson, 2018):

1. **Understanding PTSD:** EMS practitioners should view the disorder as an injury than can betreated and rehabilitated, rather than as a sign of weakness.

2. **Strategic stress coping:** It is important to actively develop coping mechanisms to deal with stress in a healthy way. This may include practices such as breathing exercises, counseling orphysical activity.

3. **Regular exercise:** In addition to being beneficial for first responders' physical conditioning, exercise can greatly benefit mental health as well. These benefits do not require hours of gymtime — activities such as walking and running can improve resilience.

4. **Optimistic mindset:** Acknowledging certain work-related stressors as being limited in time, rather than permanent, can help maintain an optimistic mindset that enables individuals to avoidpoor mental health.

5. **Community participation:** Engaging within a community, such as with colleagues, allows individuals to feel less alone in dealing with their experiences. By connecting within their community, individuals have the opportunity to take note of shared experiences, which can helpreinforce positive community-driven perspectives.

6. **Sense of purpose:** Understanding that witnessing traumatic events is inevitable in the line ofduty, but that performing the job of a first responder actually ensures the greater good of the society, will help individuals have a renewed sense of purpose.

7. **Transforming thought processes:** It is important to acknowledge that emergencies do happen, and most often, their emergence is out of the individual responder's control. However, itis beneficial to acknowledge that an individual has the ability to serve others when they need help the most.

8. **Mental detachment from work-related emergencies:** Ultimately, being emotionally detachedfrom a traumatic scene could help EMS practitioners better perform their duties as a first responder. Emergency scenes can be emotionally draining, so it is important to not invest emotions into these events whenever possible.

Substance abuse treatment

High-stress environments can lead to individuals resorting to alcohol and/or other harmful drug use to alleviate their pain. To combat this problem, the IAFF Center of Excellence for Behavioral Health Treatment and Recovery offers the following programs (2021e):

- **Clinically managed detox:** Suitable for patients dealing with addictions to opioids, stimulants and sedatives.

- **Inpatient residential:** In addition to undergoing treatment sessions during the day, patients may want to live at the residential care facility. Living at the facility will have extra benefits, such as the opportunity to participate in therapy sessions (group or individual), where they can learn coping mechanisms to help achieve sobriety.

- **Partial hospitalization:** In cases where patients do not want to live at the facility, they are still able to access all the available resources even while living off site.

- **Intensive outpatient:** This stage involves drafting a plan to help ensure patients are able to stay sober. Therapy sessions continue and may even include family members, as they can continue to be a source of support after the patient leaves the facility.

- **Teletherapy:** Individuals even have the option to electronically attend sessions and receive the appropriate care via teletherapy. Upon registration, they are matched with a licensed professional at the facility. This is a good resource for those with minor conditions, as they are able to be treated virtually. More severe cases may be referred for in-person attendance.

Psychological first aid

While interventions like resilience training and peer support programs are efficient in building mental strength and providing early detection of warning signs, there needs to

be a program in place to address the mental health of an EMS practitioner post exposure to a traumatic event. This is an important intervention to address PTS in its early stages. Researchers at Johns Hopkins created and implemented a psychological first aid (PFA) program known as RAPID-PFA (Everly et al., 2014). The program, which is administered in a 6-hour workshop, is broken down into the following modules:

1. **Reflective listening:** Emphasizes active listening as well as the ability to empathize. Listening is crucial to understanding what part of the individual's experience is important in terms of being able to provide the proper care for it.

2. **Assessment:** The individual is screened through binary response questions (Y/N) to see if there is a need to further explore their mental and behavioral functioning. They are also asked questions to demonstrate their ability to follow direction, understand instruction and express emotions properly.

3. **Prioritization:** After the assessment, the individual's areas of concern should be prioritized so that proper intervention plans can be laid out according to severity.

4. **Intervention:** Once emergency medical needs are taken care of, proper interventions can be put in place such as stress management or cognitive techniques.

5. **Disposition:** At this stage, the supervisor needs to determine if the individual is able to proceed with normal, daily functions as they did prior to the traumatic exposure, or if they need to be referred to more intensive support programs.

All training modules end with an emphasis on self-care, which is crucial in management of symptoms and maintaining good mental health.

Researchers concluded that completion of the RAPID-PFA course was associated with an increase in crisis intervention knowledge, self-confidence in the ability to perform PFA, and personal resiliency (Everly et al., 2014).

National Volunteer Fire Council: Share the Load™ program

The NVFC's Share the Load™ program provides access to critical resources and information to help first responders and their families manage and overcome personal and work-related issues. This program includes a directory of behavioral health professionals to find local assistance behavioral wellness needs as well as a resource for departments looking to implement or enhance a behavioral health program.

International Association of Fire Fighters treatment for mental health

In cases where patients have to be referred for further treatment, like in the case of PFA referrals, the IAFF established the Center of Excellence for its members, which offers a range of treatment options for mental health disorders.

These therapy options can help treat a wide array of mental health disorders (e.g., depression, anxiety, PTSD, etc.), and can be delivered by the Center of Excellence or

through an independent professional mental health provider familiar with first responders (IAFF Center of Excellence for Behavioral Health Treatment and Recovery, 2021f):

- **Cognitive behavioral therapy (CBT):** A form of psychotherapy that is usually short term and goal oriented, CBT helps change the pattern of thought contributing to a person's poor mental health.
- **Dialectical behavioral therapy (DBT):** This is a 4-part treatment that revolves around mindfulness. Unhelpful behavior that can cause suffering is addressed via emotional regulation and validation of internal experiences.
- **Eye movement desensitization and reprocessing (EMDR):** A form of psychotherapy that promotes the idea that the body can naturally heal mental wounds, just as it does with physical injuries. A therapist guides the patient to use certain eye movements and other sensory inputs to process a traumatic event.
- **Group and family therapy:** Drawing from 1 of the principles of a basic resilience training program, the sense of belonging and participation in a community is greatly beneficial to mental health. This also helps to improve communication pathways between peers and families.
- **Pharmaceutical therapy:** In certain cases, medication is a suitable treatment option. Only medically trained and licensed practitioners can diagnose severe mental health disorders and provide prescriptions for first responders.

All Clear Foundation

The All Clear Foundation (ACF) was founded by Global Medical Response in 2019. The ACF is a 501(c)3 public charity whose mission is to improve the overall well-being and longevity of those who serve our communities. More information on the ACF and finding assistance can be found at allclearfoundation.org.

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Section III: Infection Control, Hazardous Materials and Protective Equipment

Chapter 6: Infection Control

Introduction

Infection control refers to the processes, policies and practices that stop or prevent the spread of infectious agents in the health care or emergency medical setting (CDC, 2020b). It involves many theories, disciplines and practices, including knowledge of microbial transmission, hygiene and disinfection. Infection control must be a key component of all EMS practices, as infectious diseases remain a significant occupational threat for EMS practitioners of all levels. This chapter will provide an overview of the scope of infectious agents EMS practitioners may encounter, relevant terms and concepts, and will outline current policies and practices. It will also review the data contained in recent scientific literature and provide evidence-based recommendations and suggested best practices.

Relevant terms and concepts

Airborne infectious diseases: Diseases spread by pathogenic microbes small enough to be discharged via coughing, sneezing or by other close personal contact. Most notable diseases for occupational exposure are the common cold, tuberculosis (TB), measles, influenza, smallpox and COVID-19 along with its variants.

Bloodborne infectious diseases: Diseases spread through whole cell blood, plasma, etc. Most notable or relevant diseases for occupational exposure are hepatitis B, hepatitis C and HIV, although other bloodborne diseases do exist.

Chain of infection: A theory showing how infectious agents grow, spread and are transmitted (CDC, 2021a).

Cleaning: The process of removing visible dirt or debris from a surface.

Contamination: The presence of an infectious agent on a body surface; also, on or in clothes, bedding, toys, surgical instruments or dressings, or other inanimate articles or substances including water, milk and food, or that infectious agent itself (Farlex, 2012a).

Designated Infection Control Officer (DICO): An individual who works at the EMS agency but receives additional training and is expected to create and enforce infection prevention and control policies. The DICO serves as the link between the EMS agency, EMS practitioners and public health authorities.

Disinfection: The process of killing or eliminating microbes on surfaces or objects, excluding many bacterial spores.

- **Low-level disinfection:** Kills most bacteria, some viruses and fungi. Can be used for noncritical equipment that only touches intact skin.
- **Intermediate-level disinfection:** Kills bacteria and most viruses and fungi.
- **High-level disinfection:** Kills all microbes with the exception of some microbial spores. Can be used for semicritical equipment that comes into contact with mucous membranes or nonintact skin.

Donning: To put on an item, such as an article of clothing or a piece of equipment.

Doffing: To take off an item, such as an article of clothing or piece of equipment.

Engineering controls: Technology such as sharps containers, retractable needles or blunt end needles to prevent EMS injury. Usually used in the context of bloodborne infectious diseases (OSHA, 2019).

Exposure: The condition of being subjected to something, as to infectious agents, which may have a harmful effect (Farlex, 2012b).

Infection control: Processes, policies and practices that stop or prevent the spread of infectious agents in the health care setting (CDC, 2020-b).

Other potentially infectious materials (OPIM): Another way to discuss body fluids, including semen, vaginal secretions, cerebrospinal fluid, fluids surrounding lungs or joints, fluids visibly contaminated with blood, and fluids of an unknown source (OSHA, 2019).

PAPR: Powered air purifying respirator.

PPE: Items worn to prevent spread of infection. Includes articles such as gloves, gowns, masks and eye protection.

Sterilization: The process of killing or eliminating all microbes from surfaces or objects, including bacterial spores.

Standard precautions: Preferred term over "universal precautions." Should be used with every patient and assumes body fluids are infectious. Includes:

- PPE chosen for the specific situation.
- Proper use of PPE, including donning and doffing.
- Hand hygiene (i.e., hand washing).
- Respiratory hygiene (i.e., covering coughs/sneezes).

Transmission-based precautions: Used in addition to standard precautions to prevent the spread of disease from known or suspected patients. Split into 3 categories: contact precautions, droplet precautions and airborne precautions (Assistant Secretary for Preparedness and Response Technical Resources, Assistance Center, and Information Exchange (ASPR TRACIE), 2017).

- **Contact precautions:** Preventing diseases spread through direct contact (i.e., touching blood, urine or feces) or indirect contact (i.e., touching contaminated objects or environment). Examples include methicillin-resistant Staphylococcus aureus (MRSA), Clostridium difficile (C. diff), excessive wound drainage.

- **Droplet precautions:** Preventing diseases spread through large droplets. Examples include influenza and pertussis (whooping cough).

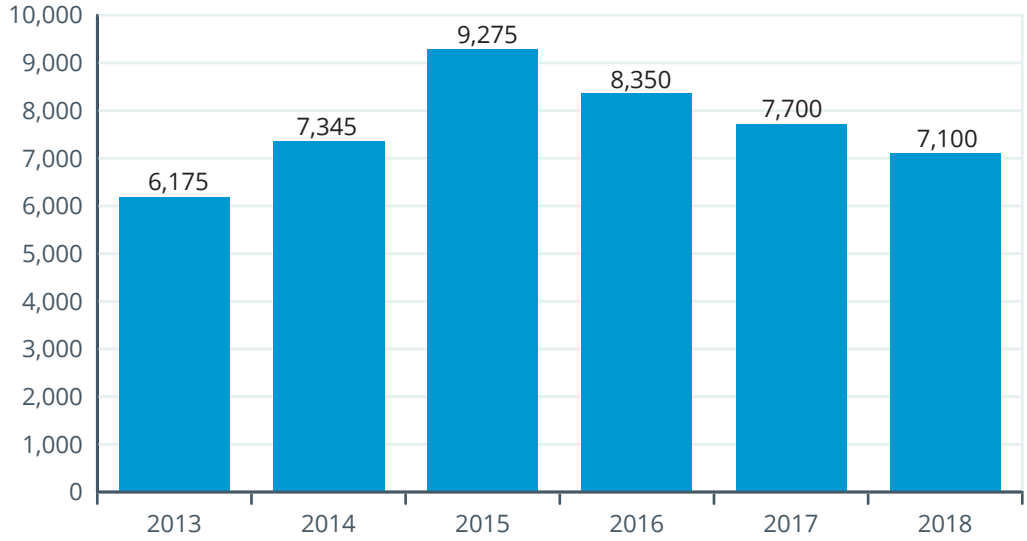
- **Airborne precautions:** Preventing diseases spread through smaller droplets that remain in the air for longer periods of time. Examples include TB and measles.

Work practice controls: Changing employee behavior to reduce the risk of injury. For example, banning needle recapping (OSHA, 2019).

Infectious disease exposures

Each year, the NFPA publishes data on injuries and exposures in a report titled "Fire Fighter Injuries in the United States." In the report, the number of exposures to infectious diseases are documented for EMS calls. Between 2013 and 2018, there was an average of 7,657 exposures per year (NFPA, 2020). The highest number of exposures was in 2016 at 9,275, while the lowest was in 2018 at 6,175 exposures. This data is visualized in the following graph.

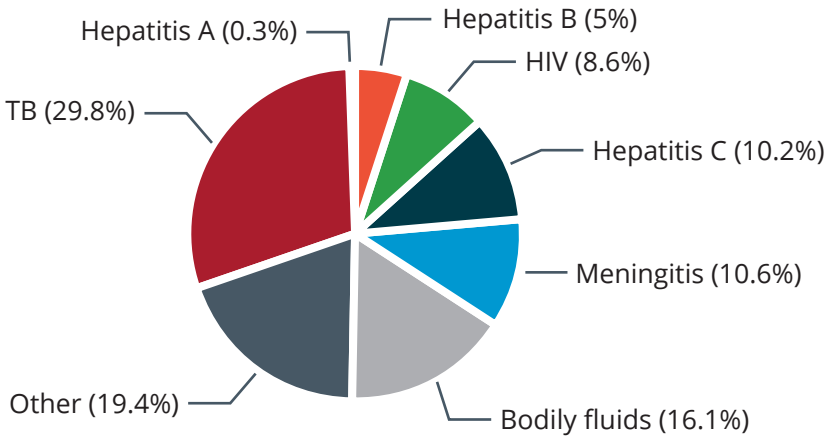
Number of exposures to infectious diseases 2013-2018



Source: NFPA's "Fire Fighter Injuries in the United States."

Monitoring trends in infectious disease exposures and resulting illness is important to evaluate how well current infection control practices are protecting EMS practitioners and to identify areas for improvement. In the Death and Injury Survey, the IAFF releases data of infectious disease exposures of personnel. The most recent data available show 29.8% of exposures are to TB, 10.6% are to meningitis, 10.2% to hepatitis C, and 19.4% of exposures are to some other communicable disease (IAFF, 2022b). This information is summarized in the following chart.

First responder communicable disease exposure



Source: IAFF Death and Injury Survey.

In 2020, the most notable exposure to infectious diseases came from the COVID-19 pandemic. Beyond COVID-19, EMS practitioners are routinely exposed to other infectious agents, as data from the IAFF Death and Injury Survey show.

Scientific literature also describes the role that EMS practitioners may play as asymptomatic carriers of various kinds of bacteria through bacterial colonization. One of the most well-documented is MRSA. While the general population has an estimated prevalence of 1.5% MRSA colonization, a study conducted across the mid-Atlantic states found a MRSA prevalence of 6.4% among EMS practitioners (Al Amiry et al., 2013; Gorwitz et al., 2008). These findings are important because they show that EMS practitioners are at a higher risk of being exposed to, or being carriers of, MRSA, which poses a danger both to themselves and their patients. These data demonstrate why infection prevention and control must be taken seriously by all EMS practitioners, as well as their agencies.

Understanding individual behaviors and practices

Recent data from scientific journal articles show how current policies and practices influence infection control behaviors among EMS practitioners. The data reveal which areas have high adherence, as well as areas where improvement is much needed. This information can be used to evaluate current practices and to develop and implement new recommendations for best practices.

Individual behaviors and practices of EMS practitioners are among the most researched areas for monitoring infection control in emergency medicine. Many of these studies relate to hand hygiene, although some studies evaluated EMS practitioners' disinfection techniques and current knowledge of infection control.

One survey, involving 1,494 respondents working in EMS, found that most practitioners had poor hygiene related to hand-washing and cleaning of stethoscopes. For example, only 13% of respondents reported cleaning their hands prior to patient contact "every time" and 26% reported doing so "most of the time" while the same percentage reported "rarely" cleaning their hands before patient contact. When asked if they cleaned their hands after skin contact, just over half (54%) reported doing so "every time," and 29% reported hand-washing after contact "most of the time." Further, under the "every time" category, only 52% of practitioners reported using gloves during patient contact, only 22% reported cleaning equipment after use, 33% cleaned hands or equipment after invasive procedures, and only 13% regularly cleaned their stethoscopes (Bucher et al., 2015). This study indicates the risk of disease transmission some EMS practitioners pose to themselves and their patients due to neglecting basic infection control practices. The importance of regular hand-washing and equipment cleaning must be emphasized by department leadership and SOPs.

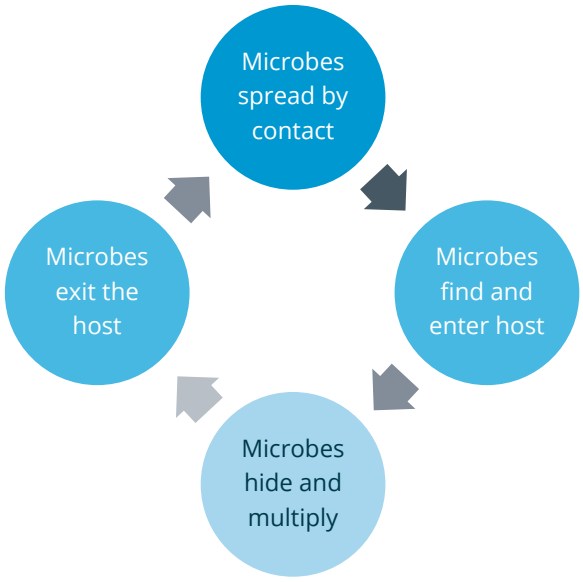
Another observational study of 423 patient transfers in Las Vegas, Nevada, showed that only 56.9% of EMS practitioners wore gloves upon arrival to the receiving facility. The study also found only 27.8% of providers washed hands after patient contact. Stretcher disinfection occurred after 55% of transfers, while missed opportunities to disinfect other equipment stood at 68.4% (Bledsoe et al., 2014).

Limiting exposure, reducing risk

Currently, there are many policies and practices in place to limit EMS practitioners' exposure to infectious diseases. Examples include classifying disease precautions by type of transmission, and recommendations for hand hygiene, disinfection practices, preventing bloodborne disease exposure and standardizing education requirements.

Standard precautions

According to the CDC, PPE, hand hygiene and respiratory hygiene should be key components of standard precautions (2021a). EMS practitioners are expected to anticipate potential exposures and adequately prepare. Under standard precautions, all body fluids should be considered potentially infectious, and providers should take steps to prevent exposing themselves, other providers or patients to infectious agents.



Hand hygiene

Hand hygiene is one of the easiest and most effective measures to reduce the spread of communicable diseases. Proper hand hygiene must always be performed before and after each patient, even if direct contact was not made with the patient (CDC, 2021a). It is critical to note that glove use does not replace hand hygiene. It is equally important to perform hand hygiene before and after PPE use. The WHO lists 5 moments when health care providers should perform hand hygiene (WHO, 2009):

1. Before touching a patient.
2. Before performing a clean or aseptic procedure.
3. After direct contact with body fluids.
4. After touching a patient.
5. After touching surfaces around the patient.

Hand-washing. Thoroughly washing hands at each of these 5 moments reduces the risk of microbial transmission. Even if a patient may not have clinical signs of disease, they may still carry bacteria or viruses which can be spread to EMS practitioners, other patients or even family members. However, data from scientific literature show low rates of hand hygiene adherence among all levels of EMS practitioners.

One observational study of EMS practitioners in Baltimore, Maryland, found that only 34% of participants performed hand hygiene before interacting with patients, and only 24% performed hand hygiene between patients. The study also found that 77% of the EMS practitioners observed had heavy microbial growth on their hands after treating patients (Teter et al., 2015).

Another study sent an electronic survey to EMS practitioners across the United States (Liang, 2015). Of the 516 responses received, 16.1% reported “almost always” washing hands before glove use, while 29% reported “hardly ever” washing hands before glove use. Additionally, 84.9% reported “almost always” wearing gloves while in contact with patients. While this represents the majority of respondents, this percentage should be much closer to 100% to comply with standard precautions. 3 of the most frequent reasons given for not practicing hand hygiene were: lack of time, interfering with patient care and the belief that exposure to blood or OPIM is unlikely.

To protect both patients and providers from infectious diseases and microbes, hand hygiene rates and technique must be improved. The following recommendations aim to do so through techniques which are noninvasive and which do not require many resources.

1. **Increase access to hand hygiene opportunities.** While there is no running water on an ambulance, alcohol-based hand sanitizer should be used and should be easily accessible. Placing hand sanitizer in locations that are easily accessible will increase hand hygiene. Supplies must be monitored and immediately replenished when they run low. When soap andwater is available, it is preferable to use this method, as the water physically washes away microbes and residue. It is important to note that while the CDC and WHO both recommend alcohol-based hand sanitizer for health care settings, OSHA recommends soap and water.

2. **Education and training should increase knowledge of infection control theory and hygiene among providers.** While having a deep knowledge is not essential, EMS practitionersshould know how diseases are spread, understand how transmission routes relate to the different levels of precautions, and be familiar with the chain of infection. Additionally, training and education should include information on hygiene with both soap and water and alcohol-based hand sanitizer. Providers should learn the proper technique for using both methods and the pros and cons of each.

3. **Special attention must be paid to hand hygiene surrounding the use of PPE.** The survey ofknowledge and attitudes by Liang et al. emphasizes the need to increase hand hygiene both before and after glove use. The proportion of reported hand hygiene before glove use was especially low and provides an opportunity for contamination of patient and provider.

4. **EMS practitioners should wear gloves and keep fingernails short.** The CDC recommends that EMS practitioners not wear artificial nails or nail polish and that nail lengths be kept under 1/4 inch long (CDC, 2021b). Having long nails or wearing nail polish is a barrierto performing proper hand hygiene. It becomes harder to scrub under and around the fingernails, and dirt may be hidden by fingernail polish.

Proper hand-washing. When washing hands with soap and water, the hands should first be wet under the water before applying soap. Once soap is applied, hands should be scrubbed for 15 to 20 seconds, focusing on thumbs, fingertips and under the nails. After scrubbing hands, the soap should be rinsed off and a disposable towel should be used to dry hands. Turn off the faucet with a disposable towel and discard (CDC, 2021b).

While regular soap and water is less effective at killing or neutralizing microbes than some alcohol-based hand sanitizers, using water cleans the hands of dirt and physically washes microbes and residue from the hands.

Antiseptic soap and water, which has both the benefits of using water and enhanced antimicrobial properties, can increase the efficacy of hand-washing; however, this option is usually the least accessible to EMS practitioners. Note that some form of soap and water is the preferred hand hygiene method for patients with infectious diarrhea (CDC, 2021a).

Alcohol-based hand sanitizer. There are several different methods for effective hand hygiene. As running water is not available on ambulances, alcohol-based hand sanitizer is considered the best option during calls. Using hand sanitizer is also fast and easy for EMS practitioners, which is key when quick transport times are necessary. WHO recommends

hand sanitizers which contain 75% to 85% alcohol (i.e., ethanol or isopropanol), while CDC recommends concentrations of 62% to 90% (CDC, 2021a; WHO, 2009). These concentrations are shown to have high antimicrobial activity.

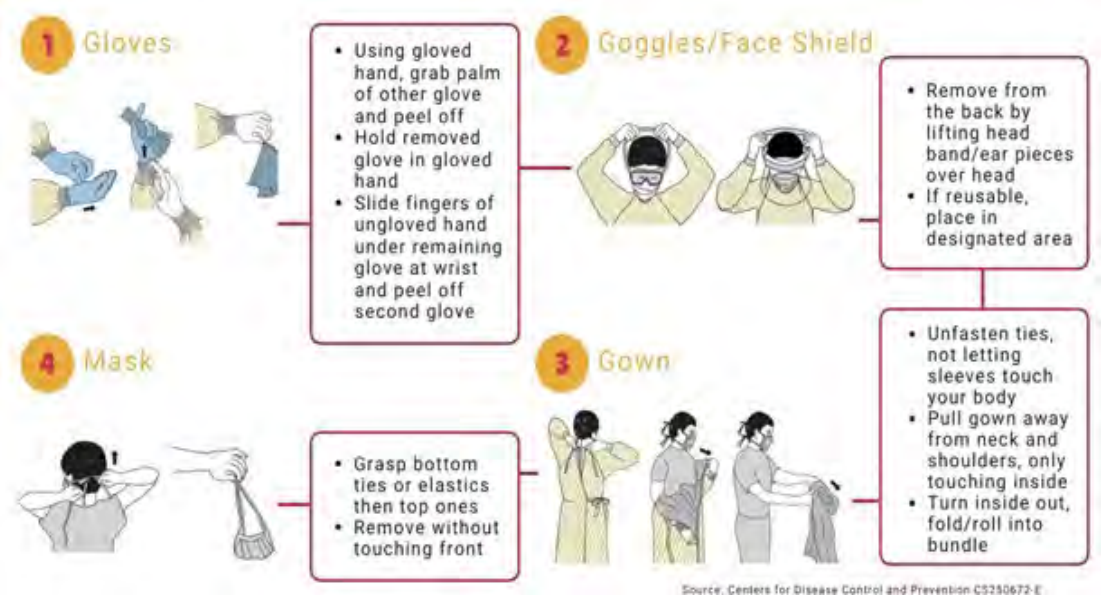
When using alcohol-based hand sanitizer, the WHO recommends using enough to cover the palm (WHO, 2009). This ensures there is enough product to cover the entire hand. Providers should be sure to focus on their fingertips, especially around and under the nails, and between the fingers. Hand hygiene should continue until the hand sanitizer has dried completely.

Common personal protective equipment

Gloves should be used whenever there may be exposure to blood, OPIM or nonintact skin. If wearing other forms of PPE, gloves should always be donned last and doffed first (CDC, 2021a). Gowns should be worn when a provider may encounter body fluids such as blood. Face masks and/or eye protection should be worn when procedures or situations may result in splashes or sprays, or when particles may become aerosolized.

Donning PPE. According to the CDC, PPE should always be donned in the following order: gown, face mask, face shield/goggles and gloves.

Doffing PPE. Doffing should occur in the reverse order. When using PPE, it is extremely important to be mindful while doffing. Every effort must be made to peel off gloves properly, only touch the inside of gowns, and remove face masks by the loops. This limits the opportunity for self-contamination. It is extremely important to remember that hand hygiene should always be performed both before and after PPE use.



Transmission-based precautions

Transmission-based precautions are designed to protect providers from exposure to infectious agents and from patients with a known or suspected communicable disease. When transmission-based precautions are necessary, they should always be used in addition to standard precautions. There are 3 types of transmission-based precautions: contact precautions, droplet precautions and airborne precautions. With any level of protection, after a provider finishes treating a patient, they should doff PPE, discard properly and immediately perform hand hygiene (CDC, 2021a).

- **Contact precautions:** Contact precautions prevent diseases spread through either direct contact of body fluids and secretions or indirect contact with the patient's environment. This level of precaution should be taken when a patient has a known or suspected case of MRSA, C. diff or diarrhea of an infectious nature. They should also be used when there is excessive wound drainage present (ASPR TRACIE, 2017). When using contact precautions, EMS practitioners should consider objects, equipment and environmental surfaces to be contaminated.

- **Droplet precautions:** Droplet precautions prevent diseases spread through large droplets which are then inhaled. Such droplets can come from a patient coughing, sneezing or talking (CDC, 2021a). These precautions should be used when a patient has a known or suspected case of diseases like meningitis, influenza or pertussis (whooping cough) (ASPR TRACIE, 2017; CDC, 2021a). For droplets, close patient contact is considered a distance of 6 feet or closer. Ideally, both suspected patient and EMS practitioner should wear a single-use mask. This limits both the number of microbes coming from the patient's nose or mouth and places a physical barrier in front of the provider's airways. Thus, the risk of exposure and infection is greatly reduced. Patients requiring low-flow oxygen can be administered oxygen via a nasal cannula under the protective barrier (e.g., surgical mask or N95).

  Patients requiring high-flow oxygen should have a vent filter applied, if available, and EMSpractitioners should wear an N95 throughout the course of treatment.

After the patient has been delivered to the hospital, the provider should doff all PPE, discard and perform hand hygiene.

- **Airborne precautions:** Airborne precautions prevent infection with diseases spread through small particles which remain airborne for long periods of time. This level of precaution should be taken for diseases such as COVID-19, TB, measles and chickenpox (ASPR TRACIE, 2017; CDC, 2021a). For airborne precautions, close patient contact is considered to be 12 feet or closer. If a patient is a known or suspected case of an airborne disease, they should be given a face mask to wear, and EMS practitioners should wear an N95 mask with a fit check or a PAPR (CDC, 2021a). Note that the IAFF does not support CDC recommendations to use face masks if N95 masks are not available. Instead, the IAFF recommends using an increased level of respiratory protection, such as a PAPR or self-contained breathing apparatus (SCBA). To prevent the spread of airborne microbes inside an ambulance, providers should consider increasing air flow inside or using exhaust and ventilation fans (ASPR TRACIE, 2017). Similarly, other tools should be utilized to lessen viral spread, such as the use of viral filters, especially when performing aerosolizing procedures like placement of advanced airways and continuous positive airway pressure applications. During disinfection after airborne exposure, the ambulance doors must remain open for passive ventilation. After 23 minutes, approximately 90% of airborne particles will be released, reaching 99% elimination after 46 minutes and 99.9% after 69 minutes (IAFF, 2022a).

Other precautions to consider

In some rarer instances, it may be important to consider the use of other transmission-based precautions, including special respiratory precautions and viral hemorrhagic fever precautions. These are often reserved for diseases which are particularly lethal and require additional steps, resources and considerations. For these precautions, hand hygiene and proper PPE use is of critical importance. Planning and preparation are key to reducing the risk of EMS practitioner exposure.

- **Vaccines.** Vaccines serve as frontline protection against a number of potentially life-threatening diseases. The CDC recommends health care workers, including EMS providers, as a minimum standard, receive the following: hepatitis B series, an annual influenza shot (flu shot), MMR (Measles, Mumps & Rubella), Chickenpox (Varicella), TDAP (Tetanus, Diphtheria & Pertussis), and Meningococcal vaccines (CDC, 2016). The CDC also recommends that all health care workers receive a full COVID-19 vaccination series (CDC, 2022).

- **Special respiratory precautions.** These precautions are used for diseases such as SARS, MERS, novel influenza strains and smallpox. Note that smallpox is now eradicated but remains a threat for bioterrorism. PPE, in addition to standard precautions, includes an N95 mask with a face shield or a PAPR, gowns, 2 pairs of gloves and boot/shoe covers. Patients should wear a mask during transport and exhaust, and ventilation fans should be used, ensuring recirculation is off (ASPR TRACIE, 2017).

- **Viral hemorrhagic fever precautions.** These precautions are used for diseases such as Ebola, Lassa, Marburg or Crimean-Congo hemorrhagic fever. In addition to standard precautions, PPE includes 2 pairs of gloves (1 with extended cuffs), gowns, a surgical mask, and a face shield. If the patient is actively bleeding, vomiting or experiencing diarrhea, the provider should also wear rubber boots and a PAPR. Patients should wear a mask during transport and the receiving facility should be notified as soon as possible (ASPR TRACIE, 2017).

Environmental/surface disinfection

In terms of environmental disinfection, 85.9% of respondents reported disinfecting stretchers between each patient, but only 14.1% of providers reported disinfecting the ambulance after each patient. This indicates a gap in disinfection practices. When asked about multidrug-resistant organisms, 96.1% of all EMS practitioners knew of MRSA, but only 44.4% of basic life support providers (i.e., EMTBs) knew of vancomycin-resistant enterococcus (VRE). Approximately 63% of all participants described their knowledge of multidrug-resistant organisms and C. diff as "fair" or "poor." Overall, 62% of providers only reported having 1 to 5 hours of infection control training annually. This study reveals significant behavior, knowledge and training gaps that should be addressed to improve both patient and provider safety.

Beyond alcohol and bleach, scientific research has explored the use of other chemicals for cleaning and disinfection of surfaces. Data show the potential for hydrogen peroxide to be used in a health care setting. More specifically, improved hydrogen peroxide (IHP) in liquid or wipe form is safer than unimproved hydrogen peroxide. IHP has a lower EPA-rated toxicity level than regular hydrogen peroxide and various companies sell concentrations for both low-level decontamination (0.5%-1.4%) and high-level disinfection (>2%). These concentrations have shown to be effective in a health care setting with a contact time between 30 and 60 seconds (Rutala et al., 2012).

In the hospital setting, IHP spray reduced microbial load by 96.9% on hospital curtains, while wipes reduced microbial load by 88%. Using both methods greatly reduced the growth of clinically important pathogens, including MRSA and VRE (Rutala et al., 2014). However, this small study did not compare the efficacy of IHP to other existing chemical disinfectants.

One study in Tucson, Arizona, followed EMS practitioners on calls and actually placed nonpathogenic microbes (phages) in key places in the ambulance. The difference in microbial load was measured at 3 different points (Valdez et al., 2015):

1. Without performance of any decontamination.
2. After using current disinfection techniques.
3. After disinfecting with hydrogen peroxide wipes.

The researchers found that the hydrogen peroxide wipes significantly reduced the microbe load when compared to samples without any disinfection. Current disinfection practices did not significantly reduce microbial load.

These findings are important because they show that current disinfection practices may not actually be killing or neutralizing as many microbes as they should. The need for proper and effective disinfection is made even more clear in a study by Bhalla et al. After touching environmental surfaces, such as the bed rail or side table for 5 seconds, the hands of health care workers were sampled and found to be contaminated with organisms such as MRSA, VRE and C. diff in 24% of cleaned rooms (2004). Thus, even the areas that had already been disinfected contained potentially dangerous microbes.

Current practices for disinfection of ambulances and equipment

Current environmental and surface disinfection practices of ambulances are not standardized across EMS agencies. Even within agencies, disinfection practices often vary from call to call (Valdez et al., 2015). Additionally, research shows the need to increase disinfection of ambulances after each patient (Liang, 2015). It is important to remember that

different types of exposures require different levels of disinfection, for example, after an influenza patient versus a suspected case of viral hemorrhagic fever. However, some sort of standardized guidance or operating procedures could help to increase disinfection rates and efficacy. Currently, there is a lot of variation in disinfection methods, timing and techniques between and even within EMS agencies. To better clean and disinfect ambulance surfaces, EMS practitioners should receive standardized guidance to be used on every call. This may be the most important improvement for cleaning and disinfection practices.

Currently, the IAFF recommends using 70% ethyl alcohol or a ratio mixture of ¼ cup bleach to 1 gallon of water for high-level disinfection of equipment between patients, such as from COVID-19 exposure (IAFF, 2022a). Other alternatives for cleaning environmental ambulance surfaces include UV-C light, chloride dioxide gas and hydrogen peroxide vapor (IAFF, 2020a).

If selected, UV-C light should be used in conjunction with other disinfection techniques, as the light cannot penetrate soft surfaces and fabrics. This technique reduces EMS practitioner exposure to microbes and harsh chemicals and is very effective in neutralizing microbes on hard, flat surfaces. However, the effectiveness depends on where the lights are located, as the UV rays cannot equally reach angled surfaces. If using UV-C light decontamination, the ambulance must first be cleaned of dirt or debris, then disinfected using a chemical disinfectant, and lastly disinfected with a UV-C light source (IAFF, 2022a).

Standard and transmission-based precautions should be evenly and consistently used and enforced across the EMS agency. Standard precautions must be used on every call as they reduce the risk of exposure or infection, even from patients who may not be a known or suspected case of an infectious disease. The EMS Infectious Disease Playbook lists the following steps for decontamination of various levels (ASPR TRACIE, 2017):

- **Standard, droplet and airborne precautions.**

    1. Visibly soiled surfaces should be disinfected with an Environmental Protection Agency (EPA)-registered hospital disinfectant.
    2. All high-touch surfaces, including the stretcher or potentially contaminated surfaces, should be disinfected with EPA-registered hospital disinfectant.
    3. All equipment that touches patients should either be disposable or disinfected between patients.

- **Contact precautions.**

    1. Visibly soiled surfaces and equipment should be disinfected with an EPA-registered hospital disinfectant.
    2. All equipment that touches patients should either be disposable or disinfected between patients.
    3. C. diff disinfection should consist of hypochlorite.

- **Viral hemorrhagic fever precautions.**

    1. Select a decontamination site with secured boundaries.
    2. Fully prepare for decontamination, including cleaning supplies, checklists and a plan for safe waste disposal.

3. Decontaminate spills and surfaces.
4. Disinfect the patient care department thoroughly with an EPA-registered hospital disinfectant.
5. Dispose of all waste properly for Category A infectious waste.
6. Consider additional disinfection with UV-C light, chloride dioxide gas or hydrogen peroxide vapor.

Standards and policies

Numerous organizations and agencies, such as the NFPA, OSHA, NIOSH and NHTSA, have created policies and standards that EMS systems must follow. The goal of these policies is to prevent exposureand infection before they happen and to appropriately and efficiently respond when exposures do occur.

NFPA 1581: *Standard on Fire Department Infection Control Program*

NFPA 1581 was most recently updated in 2015 and requires fire departments and fire-based EMS agencies to develop and follow their own infection control program. It states that all fire departments must have or provide the following (NFPA, 2022):

1. A written bloodborne diseases policy.
2. A DICO.
3. A pathway to determine what constitutes exposures.
4. Hepatitis B vaccines for all employees.
5. Infection control training upon hire, whenever new technology is implemented, and annually.
6. Clearly written records documenting infection control training.
7. A plan to implement standard precautions, engineering controls, work practice controls and PPE use.
8. A plan for post-exposure reporting, prophylaxis, evaluation and follow-up.
9. Clearly documented records of any sharps injuries.

Ryan White HIV/AIDS Extension 2009 (Part G)

In 2009, the Part G extension of the Ryan White HIV/AIDS Act was passed by the United States Congress. This law aims to improve notification to EMS practitioners when they have been exposed to a select list of life-threatening infectious diseases such as hepatitis B and C, HIV, measles, and novel influenza strains (CDC, 2013). In March 2020, the CDC and NIOSH updated the list of potentially life-threatening infectious diseases to include COVID-19, the disease caused by the novel coronavirus, SARS-CoV-2 (CDC, 2020a).

Part G states that medical facilities must notify EMS practitioners when they have been exposed to any of these diseases. When the exposure is a disease spread via airborne transmission, facilities must make the first contact to EMS practitioners. If the disease is spread via other means (i.e., contact or droplet), EMS practitioners can initiate a notification request from the medical facility.

OSHA 1910.1030: Bloodborne Pathogens

OSHA 1910.1030 was specifically created to protect employees from bloodborne pathogens; however, many of its requirements also function to reduce exposure to and risk of contracting other infectious diseases (OSHA, 2019). Under this policy, all EMS agencies must have a written and easily accessible Exposure Control Plan that is evaluated and updated annually. The plan must include:

1. Any new technologies, including engineering and work practice controls.
2. A section on exposure determination based on the different jobs in the agency and their respective exposure risk.
3. A plan to implement and enforce standard precautions.

In addition, departments are required to provide clean, accessible PPE to all employees with the following stipulations:

1. If contaminated, PPE must be removed "as soon as feasible."
2. Disposable PPE cannot be used multiple times.
3. PPE should always be changed between patients.

OSHA 1910.1030 also provides guidance on preventing sharps injuries. Needles should never be bent or recapped after use and should always be discarded in OSHA-approved sharps containers.

National Highway Traffic Safety Administration National EMS Education Standards

In 2009, NHTSA published a set of education standards and competencies all EMS practitioners should learn in their training course (NHTSA, 2009). The standards are broken down by expected knowledge level for emergency medical responders (EMRs), EMTs, advanced EMTs and paramedics. Generally speaking, EMRs are expected to have surface-level knowledge, while paramedics are expected to learn topics with greater breadth and depth.

National Institute of Occupational Safety and Health

Many recommendations to prevent exposure to bloodborne infectious diseases can be found in NIOSH Alert #2000-108: Preventing Needlestick Injuries in Health Care Settings (NIOSH, 1999). While it is nonbinding, some binding policies such as OSHA 1910.1030 have adopted many of NIOSH's recommendations. Some additional precautions for needle use found in NIOSH Alert #2000- 108 include only using needles when necessary and using safer needles (needles with engineering controls) such as blunt end needles and retractable tips. Annual training should include information about safe needle use and disposal. Additionally, the alert states that all infection control policies should be simple and easy to follow and that a culture of safety is crucial to strong infection control policy implementation and sustainability.

Adopting an infection control plan

Forming a culture of safety is a key component of creating an effective and sustainable infection control policy within EMS systems. A 2012 paper found that of 6 identified aspects of safety culture in health care, only frequent feedback and training were

significantly associated with adherence to safe work practices. Respondents who reported following safe work practices also had a high level of perceived safety culture (Eliseo et al., 2012). These findings support the need to create a strong culture of safety within an EMS system to improve infection control. If providers are comfortable receiving training and providing feedback, they may be more likely to follow the training received and model behaviors for other coworkers.

Emphasizing the importance of infection control throughout the year, not only at annual training, will make following infection control policy an expectation of the workplace and will create an environment where providers take infection control more seriously.

Education and feedback

One of the most important aspects of an effective infection control policy is creating opportunity for education and feedback. Not only does this reinforce behaviors, but it also helps create a culture of safety. It should be emphasized that feedback can be given or received by anyone, including supervisors and fellow EMS practitioners. This encourages providers to be aware of both their actions and the actions of those on call with them. It also removes any barriers that structural hierarchy may play in hindering rates of hand hygiene, PPE use and disinfection. Feedback can be formalized by procedures like reviews or observations, or it can be informal, such as brief conversations.

Education should be an ongoing process that also occurs outside of the annual infection control training; quick reminders, topic reviews and feedback can all serve as education throughout the year. Informal education can help boost adherence for the long-term, not just immediately following training. Training topics should also introduce how to both recognize and protect against emerging infectious diseases.

The NHTSA National EMS Education Standards list requirements for EMS teaching courses and formal education. According to these standards, only paramedics are expected to learn about antibiotic-resistant infections such as MRSA or VRE (NHTSA, 2009). Lower-level EMS practitioners should be taught about drug-resistant organisms in training, even in a basic capacity. Poor EMS practitioner practices can quickly spread these organisms. Thus, a lack of knowledge is both a danger to patients and providers (Liang, 2015). As drug-resistant microbes become more prevalent within both health care settings and communities, EMS providers should ensure they are not playing a role in the spread of drug resistant pathogens.

Changing how infection control practices and behaviors are taught may also help boost adherence and effectiveness of infection control policies. Operating under a patient-centered approach would shift the focus of infection control from personal protection of EMS practitioners to protection of patients. Thus, adherence would not be based on perception of personal risk from infectious diseases, but rather the danger of patient exposure.

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Chapter 7: Hazardous Materials Response

Introduction

This chapter discusses emergency responder and EMS practitioner safety during hazardous materials incidents. It details considerations for hazardous materials events and includes defined areas of operation, PPE and decontamination practices. The chapter also stresses the need for comprehensive hazardous materials response planning and practice, including integrating fire-based and nonfire-based EMS to ensure all responders receive training to understand proper hazardous materials response. EMS responders should be trained to the HazMat Operations level at a minimum (including proper donning and doffing of Level B suits), as they may be called upon to treat and provide initial decontamination of a patient.

Hazardous materials scene size-up

Like most medical emergencies, assessment of an incident starts upon dispatch. The EMS practitioner should be alert for signs and symptoms of a hazardous materials release or exposure. Some of these signs may include eye irritation, coughing or reported pungent odors. In addition, providers should be aware of more obvious clues while on scene, such as wet areas, vapor clouds and spilled materials (Noll et al., 2014).

Upon arrival at the scene of a hazardous materials incident, initial positioning of responders is crucial to ensure that they do not put themselves in harm's way. Generally, EMS practitioners should approach and position their apparatus upwind and uphill from the incident. If providers find themselves unable to safely position upwind, then take a position a significant distance away from the incident. Take note of local weather conditions and be prepared for potential wind shifts or other environmental changes. The DOT Emergency Response Guidebook is an excellent reference for initial isolation and evacuation zones on transportation incidents (Noll et al., 2014).

Exposure and contamination

Understanding the principles of exposure and contamination plays a large role in EMS practitioner safety. It will also help the provider deliver an effective and accurate patient care report to a receiving facility.

Contamination

Simply put, contamination is a material in an unwanted place (U.S. Department of Health and Human Services (HHS), 2021b). Contamination on a patient can be external or internal. External contamination occurs when hazardous materials are present on a person's body or clothing. Often, as you will learn below, 80% to 90% of contamination is removed by doffing the first layer of a patient's clothing (U.S. Army Chemical Biological, Radiological and Nuclear School, 2013). When a material is present on a patient's skin or eyes, they are also being exposed to contaminants.

Internal contamination occurs when material enters the body through 1 of 4 ways. These 4 routes are called routes of exposure.

1. **Inhalation:** breathing in a material.
2. **Ingestion:** by eating or drinking a material.
3. **Injection:** can occur through a puncture of the skin or through an open wound.
4. **Absorption:** direct transfer to the internal body through the skin or eyes.

Exposure

Exposure occurs when an individual is in the presence of a hazardous material. For example, when dealing with radiation, an exposed individual is one that is within a field of ionizing radiation but does not have the radioactive isotope on them. When dealing with gas or vapors, the exposed individual is one that is in the presence of the gas or vapors. In many cases, removing the person from the exposure area is the first step in mitigating any negative effects. As noted above, there are 4 routes of exposure into the body. These should be considered when selecting PPE.

According to the HHS, Chemical Hazards Emergency Medical Management, the exact effect of an exposure depends on several elements, including (HHS, 2021b):

- The toxicity of the chemical involved.
- The amount and/or concentration of the chemical.
- The duration of contact.
- The route of exposure.
- The individual's age and general health.

Hazard control zones

The incident commander of a hazardous materials incident will ensure responder safety by establishing hazard control zones. Hazard control zones are broken down into 3 distinct areas: hot zone, warm zone and cold zone. Each zone, from greatest to least risk, is defined based on the level of hazards present and contain the following characteristics (HHS, 2021a; EPA, 2021):

- **Hot Zone.**
  - Actual or potential contamination is present.
  - Highest potential for exposure.
  - Appropriate PPE required and number of personnel is limited.
  - Patient removal is a priority, but no patient treatment is rendered in this zone.
- **Warm Zone.**
  - Transition area where responders enter and exit Hot Zone.
  - Contamination control and decontamination occur here.
  - Appropriate PPE is required.
  - Life-saving emergency care can be provided.
- **Cold Zone.**
  - Area free of exposure and contamination hazards.
  - Treatment and transportation of patients can be conducted.
  - Medical monitoring and rehabilitation are conducted.
  - Location of Incident Command Post.

While hazard control zones are often depicted in outdoor settings, it is important to remember that hazard control zones may be established indoors as the incident dictates. Hazard control zones may be expanded or contracted as an incident progresses (Noll et al., 2014).

Protective equipment

PPE used while responding to a hazardous materials incident decreases the risk of exposure or bodily harm sustained from chemicals or biohazards. OSHA and the EPA classify PPE into 4 different levels: A, B, C and D. Selection of PPE is a complex process and is specific to both the hazards present and work task involved. Permeability charts can be used to aid in the PPE selection process (CDC, 2001).

Level A

Level A equipment provides the highest level of chemical and respiratory protection. The suit fully encapsulates the body to protect the skin and an SCBA is worn inside the suit to provide respiratory protection. Chemically resistant gloves and boots are also worn and are either integrated into the suit or taped at the glove and boot interfaces. While this level of PPE provides the highest level of protection, it is also the most strenuous on the wearer and often requires both pre- and post-entry medical monitoring (Radiation Emergency Medical Management (REMM), 2021).

Level B

The suit worn for level B is not fully encapsulating; however, it still covers the body and is chemical resistant. Level B still makes use of an SCBA, which is worn on the outside of the suit. Chemically resistant gloves and boots, or boot covers, are also worn. Level B PPE affords the wearer more dexterity and maneuverability than level A (REMM, 2021).

This level of PPE is generally used by responders working in the warm zone on decontamination (Anderson & INHS, 2008).

Level A suit.

Level B suit.

Level C

Level C equipment consists of chemically resistant suits, gloves, boots and eye protection. An air purifying respirator is also worn. It should be noted that Level C PPE is not adequate in low oxygen or immediately dangerous to life and health environments. Level C PPE is often worn when dealing with patients contaminated with radiological material (Anderson & INHS, 2008; REMM, 2021).

Level D

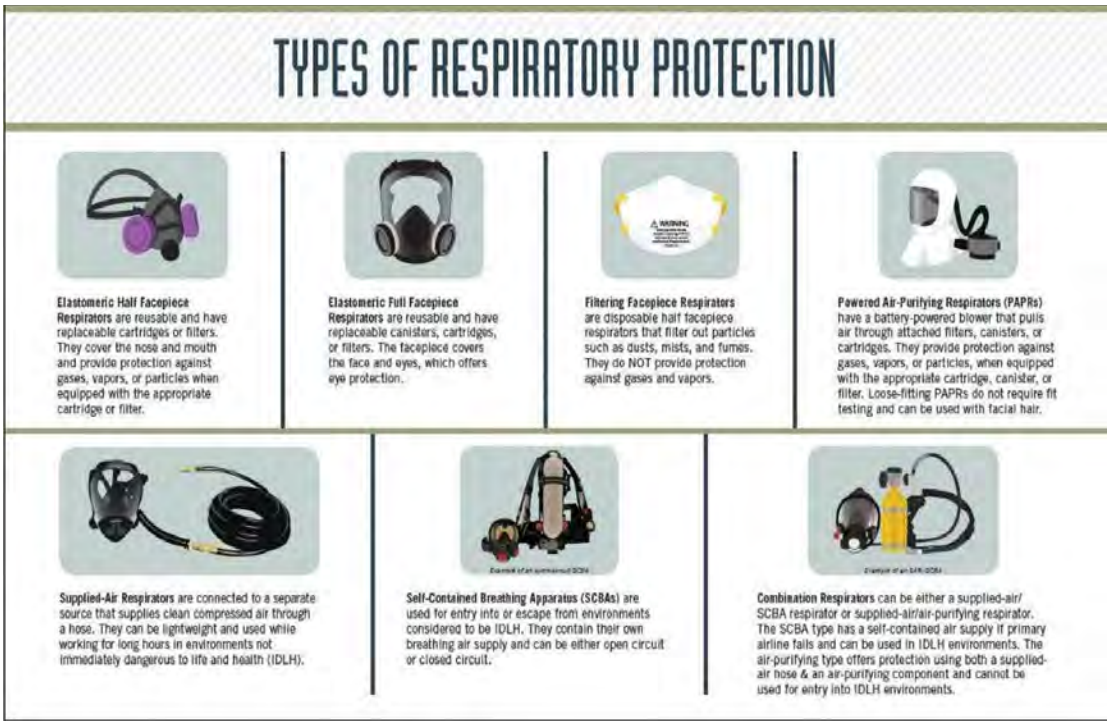
Level D equipment includes basic work gear and protective equipment. Garments such as eye protection, gloves, surgical gowns and structural firefighter clothing fall into the Level D category. Level D PPE may include basic splash protection. While structural firefighting clothing may not offer chemical protection, it may be the most appropriate level of protection when dealing with flammables or combustibles (Anderson & INHS, 2008; REMM, 2021; Noll et al., 2014).

Level C suit.

Level D suit.

Respiratory protection

A vital part of PPE selection is determining the appropriate level of respiratory protection. Respiratory protection, like the above PPE levels, is determined by the materials involved and the work task to be performed. Any agency that issues respiratory protection or breathing apparatus to protect the health of their workers is required by OSHA to have a written respiratory protection plan. EMS practitioners should be familiar with the general types of respiratory protection as outlined in the following infographic (CDC, 2019).



Hazardous materials training

Hazardous materials training involves multilevel certifications as outlined by OSHA Standard 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER). There are 5 HAZWOPER training levels related to the functions a practitioner might be expected to perform. These levels are (OSHA, 2019):

HAZWOPER Level I should be attained by any individual who may be the initial observer of an accidental release (e.g., laboratory workers).

HAZWOPER Level II is considered First Responder Operations level training. At this level, practitioners should be able to perform a risk assessment and provide basic containment, control and confinement of incidents. Any individual that might respond to a release, or potential release, of hazardous materials should be trained to this level at a minimum.

HAZWOPER Level III is considered Hazardous Materials Technician-level training. At this level, practitioners can perform more advanced containment and control of hazardous material releases.

HAZWOPER Level IV and V provides more advanced, specialized training for command and support during incidents involving the release of hazardous materials.

Hazardous materials decontamination methods

EMS practitioners should be familiar with the following 3 general types of decontamination whenever working at or near an incident involving potentially hazardous materials.

Decontamination tip

Removal of clothing can be effective in removing 80-90% of physical contamination during hazardous material incidents.

U.S. Army Chemical, Biological, Radiological and Nuclear School

Emergency decontamination

"Emergency decontamination is the physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor" (Noll et al., 2014). Emergency decontamination can be used on emergency responders or the public if the need for decontamination is immediate. This may be dictated by signs and symptoms of chemical exposure, or if a responder's PPE is breached and contamination is present (Noll et al., 2014).

Mass decontamination

Mass decontamination is used when large numbers of people need to be decontaminated. A department's mass decontamination technique can be as simple as utilizing 1 or 2 fire engines with fog nozzles, or as complex as portable showers or trailers.

The key component, as is with emergency decontamination, is time. Mass decontamination should be established as expeditiously as possible to reduce the amount of time a contaminant is present on an individual. Mass decontamination often involves removing the patient's clothing to a level they are comfortable with. Crowd control is extremely important during mass decontamination to ensure the crowd stays calm and to reduce the risk of injury. During mass decontamination, triage will occur to determine if the individual needs to be decontaminated or not. This should not be confused with medical triage, which will generally occur after a patient has been decontaminated.

Technical decontamination

Technical decontamination is the process of systematically removing contaminants from a patient or responder. This method of decontamination is a multistep process that is adjusted based on the hazards involved in the incident. Technical decontamination at a hazardous materials incident occurs in the warm zone and should be conducted by properly trained individuals.

Additional decontamination considerations

- Not all contaminants may be liquid.
- Dry decontamination (i.e., wipes or air fans) may be a more appropriate approach.
- Provisions to decontaminate nonambulatory patients and patients with access and functional needs are a must.
- Pets may also need to be decontaminated and can present safety risks of their own.

Forming an emergency decontamination plan

Forming an emergency decontamination plan within each EMS agency allows the unit to prepare ahead of time for a hazardous materials incident. The plan can then be activated when an incident arises, and appropriate personnel can respond quickly. It also plans for the rapid delivery of necessary materials to the scene. Many agencies have designated teams, such as decontamination teams, composed of personnel who have received adequate training to respond to hazardous materials incidents. Having an emergency decontamination plan in place protects EMS practitioners from exposure to hazardous materials.

Planning in advance helps ensure that proper and sufficient decontamination equipment will be available at a hazardous materials incident. With planning and an appropriate chain of command, patients and the environment can effectively be decontaminated while protecting others from secondary contamination.

A patient that has been exposed to hazardous materials should be adequately decontaminated prior to being placed into an EMS transport unit. Additional recommendations to ensure adequate decontamination include (CDC, 2020):

- EMS practitioners should wear PPE (mask, gloves, gown and eye protection) and should be aware that a higher level of PPE may be required based on the recommendations from the authority that has jurisdiction.
- EMS practitioners should promote air exchange inside the transport vehicle by opening windows and/or using the fan.
- Another method to prevent contaminants from escaping is to wrap or "cocoon" the patient with blankets or sheets, only exposing their face (as long as it does not hinder patient care).

Collaboration with receiving facilities

One of the most important principles of handling hazardous materials is to prevent further contamination. There may be times when a solitary victim is transported by ambulance for the purpose of being properly decontaminated at the medical facility. Because some facilities refuse to accept patients who are not fully decontaminated, it is critically important to coordinate with local hospitals. When a patient's complete decontamination is not done at the scene, there should be a decontamination room at the receiving medical facility, with dedicated entry and preestablished arrival procedures, that will protect the facility and the people inside.

Decontamination of the ambulance and equipment

Decontamination must occur for all individuals and equipment involved in a hazardous materials incident response. The EMS vehicle should go out of service after transport is complete until it has been appropriately decontaminated. Post-decontamination vehicle inspections and personnel inspections should test for the specific substance(s) involved in the hazardous materials incident.

Even those who never went closer than the cold zone but were in contact with patients coming from the hot zone need to be checked and cleared of residual contamination. Additionally, all materials used for decontamination, such as the water used for washing and flushing the area, must be properly contained and disposed of. Proper decontamination depends on good planning, where the principles of hazardous materials control can be applied to each unique instance.

OSHA outlines the following 14 steps EMS practitioners should follow for patient decontamination in "Best Practices for Protecting EMS Responders During Treatment and Transport of Victims of Hazardous Substance Releases" (2009):

1. Activate the emergency decontamination plan.
2. Obtain as much information as possible, such as patients' location, the chemical/exposure, its hazards and symptoms.
3. Plan for delivery of decontamination equipment.
4. Gather the decontamination team. This group of people should be specified ahead of time according to the emergency decontamination plan and should have proper training. Have a plan in place to decontaminate patients in critical condition.
5. Conduct medical monitoring of the decontamination team (e.g., recording vital signs) prior to entry if outlined in the emergency decontamination plan.
6. Don the appropriate level of PPE.
7. Evaluate patients to determine necessary medical treatment and decontamination.
8. Have or assist patients in removing contaminated clothing and gathering personal property.
9. Place all contaminated clothing and property in a sealed plastic bag or approved hazardous waste container. Ensure that the bag/container remains outside and away from responders and bystanders to avoid further contamination.
10. Use water to complete gross decontamination and provide technical decontamination if necessary.
11. Assess the patient to determine whether decontamination is complete. If complete, bring the patient to the medical treatment area to receive care.
12. Decontaminate all equipment.
13. Doff PPE. The decontamination team should decontaminate themselves.
14. Perform final check to ensure contamination has not spread.

Recovery and incident termination

Everyone involved in a hazardous materials incident should be debriefed at the scene and should attend a more intensive post-incident critique scheduled at a later time. During the debriefing, responders should be advised of the signs and symptoms of exposure to the hazardous materials and should be aware of procedures to follow if symptoms develop. It is important to obtain information during the debriefing that will help chronicle the sequence of events that occurred during the incident. This information plays a vital role in the post-incident critique process.

During the post-incident critique, the sequence of events should be reviewed, and operational strengths and weaknesses should be identified. The agency administration will use this information to develop a post-incident analysis and a methodology for improving future response. All hazardous materials incidents must be critiqued, even relatively minor ones. For minor incidents, critiques may be carried out by a company officer who will communicate findings and information to the proper administrative officer for review and action.

In addition to the debriefing and post-incident critique process, exposure reports should be completed for any individuals who may have been exposed to the hazardous materials. If the exposure was above the legally allowed PELs, follow-up medical evaluation may be indicated. Both the employees involved and the agencies should keep a log of the exposure event(s). OSHA 1910.1020 dictates that employee exposure records shall be kept for 30 years by the employer.

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Section IV: Emergency Operations

Chapter 8: Outdoor Operations

Introduction

During the first contact stage of an EMS call, it is important that EMS practitioners gain safe entry to areas where EMS needs to be provided. This chapter will cover safety considerations when responding to a variety of outdoor incidents including mass gathering events and roadway events. Regardless of the incident type, situational awareness is of vital importance. During the initial phase, and throughout the call, EMS practitioners should be aware of any structural components or features, like stairways, gates, bushes or other obstacles, that may present challenges for patient movement or that may prevent rapid egress should the scene become unsafe. EMS practitioners must always ensure there is a clear exit. EMS practitioners should also always avoid working alone.

The EMS uniform

An EMS practitioner's daily uniform should be considered part of EMS workers' personal protection. This uniform should conform to NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations,* that outlines Class D protection levels (2018). This standard requires full body coverage, including shirt and/or pants, jumpsuit, or coveralls. Barrier garments like single-use Tyvek® suits should also be available for EMS workers. Protective clothing for the pelvis, groin and legs should be available as the Class D protection is often a standard uniform and does not allow for protection from blood and body fluids.

Additionally, PPE for standard and transmission-based precautions as well as hazardous materials incidents must be easily accessible. Labels of all PPE, such as gloves and masks, should be read and adhered to. Single-use products should not be used multiple times (NFPA, 2018).

Beyond clothing items, EMS practitioners' uniforms should include a portable radio. EMS practitioners who respond to an incident scene must have a means to signal for additional resources, if necessary. Thus, portable radios are considered essential equipment. EMS responders' radios should be charged, disinfected and checked for functionality at the beginning of the shift and periodically throughout the course of duty.

Protective footwear

EMS practitioners often engage in heavy lifting of patients and equipment up and down stairs, up and down embankments, in all kinds of weather, and where numerous hazards are present, including broken glass, debris, ice, chemicals and bloodborne pathogens. A misstep with a loaded stretcher can cause an injury and places both the patient and provider at risk. Thus, protective footgear is essential to the safety of EMS workers and their patients. The safest solution is to wear sturdy, ankle-high shoes with steel toes. Proper ankle support decreases the risk of an ankle injury while a steel-toed shoe minimizes the chance of foot fractures should heavy weights fall on workers' feet. EMS protective footwear should meet NFPA 1999. NFPA-compliant footwear offers the following list of features (NFPA, 2018):

- A minimum height of 4 inches.
- Toe protection.
- Cut, puncture and abrasion resistance.
- Chemical resistance.

Head protection

EMS activities often bring the provider into an environment where there are many opportunities for the workers to be struck in the head by falling debris, a damaged motor vehicle, or during an urban or frontier rescue. Therefore, EMS practitioners are encouraged to use a helmet or some other form of head protection during the course of their duties. Because there are numerous hard hats for emergency workers, many states have adopted American National Standards Institute (ANSI) Z89.1-2009, *American National Standard for Industrial Head Protection,* and/or NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, as requirements for EMS workers' helmets.

ANSI-Z89.1-2009 provides 3 classes of helmets approved for various circumstances: Class G for general helmets, Class E for helmets providing enhanced protection from electrical currents and Class C helmets for conductive helmets protecting from the impact of objects (Oregon State University, 2010). NFPA 1951 requires that helmets are tested for the following: heat resistance, force transmission to the provider's head, physical penetration resistance, electrical insulation, chin strap efficacy and corrosion (2020). Before purchasing a certain model of helmet, EMS agencies should ensure the model is approved by either of these 2 standards.

Arrival

Ensuring an emergency scene is safe begins with responders receiving the initial dispatch and taking the following actions:

- Ensure that the incident address is correct and, if available, verify the information on a mobile data terminal. EMS practitioners are often familiar with areas that pose a potential safety risk (e.g., sections of a freeway that are dangerous by design, certain business establishments where there is potential for a large or unruly crowd, or neighborhoods that have high call volumes for violence) and should maintain heightened awareness when responding.
- Certain calls may immediately alert personnel to a potentially violent situation (e.g., injuries from gunshot wounds or stabbings). If danger is suspected, law enforcement should be called as early as possible and EMS practitioners should stage until the scene is secure.
- When arriving on scene, be alert and avoid fixation.
- Conduct a proper scene assessment, surveying the overall environment and identifying potential risks prior to exiting the vehicle.
- Look for, and communicate to your partner(s), potential safe egress paths and establish a meetup site.
- Assess the demeanor of bystanders, including any angry or frustrated relatives.
- Attempt to determine if there are any potentially dangerous animals on scene. Dogs and other animals may be territorial. A pet may interpret patient treatment or movement as a threat to their owner, and they may respond aggressively.
- EMS providers should trust their instincts, call for law enforcement early and know how to call for emergency assistance (e.g., an emergency alert button on a portable radio) if needed.

First contact

EMS practitioners frequently encounter people who have sustained injuries due to trauma. They may be the first responders to make contact with the victims, family members or bystanders of an incident. Therefore, it is very important for EMS practitioners to ensure scene safety prior to entering. Such incidents may involve highly emotional individuals, and the EMS practitioners may have to build trust through what they say and do. The proper choice of words, body language and facial expressions can help establish the trust and confidence of all those on scene. If practitioners communicate poorly, however, emotions among the patient and/or their family members as well as bystanders can escalate. It is imperative that the EMS team continues to observe the situation, listen for expressions of anger, and watch bystanders, patients and family members.

Agencies can establish a discreet emergency signal or coded transmission to dispatch in case a crew finds themselves in danger (e.g., Code 5, Code Red, etc.). This code would alert dispatch to send immediate assistance, without follow-up questions and without drawing additional attention from an attacker.

Roadway operations

Because roadways are unpredictable and dangerous, it is important to make sure that EMS vehicles and other public safety apparatus are positioned safely. When responding to incidents on a roadway, it is important to monitor surroundings with the same vigilance used inside a residence or other building with an angry occupant or other hazards. Passing motorists who may be impaired, drowsy or distracted pose a safety threat to all the responders at the emergency scene. Nighttime incidents requiring personnel to work in or near moving traffic are particularly hazardous. Visibility is reduced and driver reaction time to hazards on the roadway is slowed.

The Federal Highway Administration's (FHWA's) "Manual on Uniform Traffic Control Devices" (MUTCD) defines the need for temporary traffic control (TTC): "When the normal function of the roadway, or a private road open to public travel, is suspended, TTC planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities" (DOT, 2021). In addition, "the primary function of TTC is to provide for the reasonably safe and effective movement of road users through or around TTC zones while

reasonably protecting road users, workers, responders to traffic incidents, and equipment" (DOT, 2021). Understanding the concepts of TTC will ensure the EMS practitioner is operating in the safest manner possible on roadway incidents.

Utilizing lights and sirens

According to NHTSA, between 1992 and 2011, there was an annual estimated mean of 4,500 MVCs involving ambulances, with an annual mean of 33 fatalities. These crashes continue to be a pervasive problem nationwide; it is estimated that as many as 12,000 emergency medical vehicle accidents occur each year in the United States and Canada as a direct result of lights and siren use. In addition, the "wake effect" of units responding with lights and sirens can disrupt, confuse and/or startle other drivers, resulting in up to 5 times as many accidents that do not physically involve the emergency vehicle itself (Clawson, 2017). This is why it is imperative that EMS providers practice judicious use of lights and sirens during both response to the scene as well as during transport from the incident (Kupas, 2017).

10 practical tips for responding and operating on roadway and highway incidents

1. Dispatch the appropriate apparatus.
2. Train for on-scene Positioning (blocking, safe positioning).
3. Conduct on-scene size-up report.
4. Set up lights for scene safety.
5. Follow protocols for use of TTC.
6. Wear appropriate PPE upon arrival.
7. Establish Incident Command and/or Unified Command.
8. Monitor and adjust TTC.
9. Manage noninvolved personnel.
10. Perform incident scene demobilization

Source: USFA – Emergency Vehicle and Roadway Operations Safety.

Upon dispatch, when determining whether to respond with lights and sirens, the emergency vehicle driver should consider the dispatch category, information available from dispatch and agency policies dictating the mode of response (NEMSQA, 2021). The EMS provider responsible for patient care should determine the level of response during transport and whether emergency lights and sirens are necessary based on policy.

Lights and sirens can be considered commensurate to a medical treatment and the EMS provider must determine if that treatment is warranted. The driver should remember that lights and sirens are only a request for the right of way, and drivers should stop at all red lights and stop signs until they are sure an intersection can be crossed safely (NEMSQA, 2021).

Roadway considerations

When arriving at the scene of a vehicle accident or other roadway incident, EMS practitioners should pay specific attention to apparatus positioning. Apparatus positioning is paramount in ensuring responder and patient safety. A few factors that will help determine apparatus position are:

- **Roadway type.** Are responders operating on a limited-access highway, or can they approach from either direction of travel? What is the roadway speed? How many lanes is the roadway and what is the volume of vehicles?
- **Scale of the incident.** Is this a single-vehicle accident, a medical emergency on the side of the road, or is this a multivehicle accident blocking multiple lanes? Consider the amount of work area responders will need based on the incident size.
- **Other responding agencies.** Are you the only resource responding to the scene? If so, consider requesting additional assistance from law enforcement, fire or your local transportation authority to assist with traffic management.
- **Linear and block positioning.** In linear positioning, responding units will position themselves directly behind or upstream of the incident in the same lane of travel. Vehicles will be positioned parallel with the lane. This type of blocking is used on small-scale incidents like single disabled vehicles on a shoulder or an incident on a residential street (Sullivan, 2016).

  Block positioning also places vehicles upstream of the vehicle accident. During block positioning,unlike linear positioning, vehicles park on an angle to physically block 1 or more lanes of traffic. This position creates a buffer area in front of the blocking apparatus for a safe work area, also known as the activity area. Having multiple vehicles in a block position can help reinforce your activity area and further define your taper lane.

Transportation tidbit

Because the likelihood of a secondary crash increases by 2.8% for each minute the primary incident continues to be a hazard, some states and jurisdictions have implemented fatal crash scene clearance goals (i.e., a 90-minute clearance time).

Source: Federal Highway Administration, 2020.

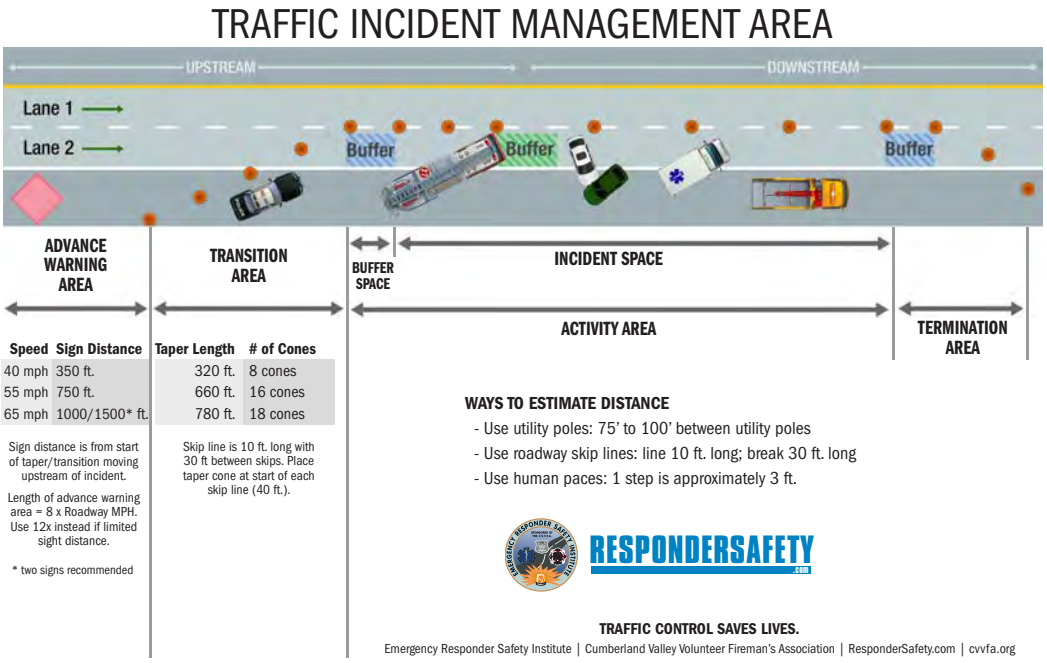
Traffic incident management

Developed by the DOT's FHWA, traffic incident management (TIM) programs aim to "safely and efficiently clear traffic incidents and incident-related debris." Efforts include an emphasis on reducing traffic congestion, which cost the nation $87.2 billion in wasted fuel and time in 2007. This is an important issue to address in relation to public safety, as 25% of road congestion is caused by traffic incidents, which are cited, along with struck-by incidents, as leading causes of death among firefighters, EMS practitioners and law enforcement personnel working traffic incident scenes. To protect the lives of public safety personnel, it is critical that departments abide by the recommended highway safety practices listed in the "Traffic Incident Management Handbook" (DOT, 2021).

There are several parts of a TIM area the EMS practitioner should be familiar with.

The **advanced warning area** is used to inform drivers of an upcoming incident. An advanced warning sign should be placed at a distance relative to the speed of the highway (i.e., the higher the speed limit, the more advanced warning is required). An advanced warning sign can be a single diamond sign, a flashing sign or a series of the aforementioned. If the EMS unit is equipped with an advanced warning sign and providers are able to safely deploy it, a sign should be dropped at an adequate distance prior to the incident area.

The **transition area** is the section of roadway where drivers are redirected out of the normal path of travel (DOT, 2009). This area involves the use of cones or other traffic control devices, such as sign boards, to direct motorists into an alternate lane of travel.



The **activity area** of the TIM area is where the activity, or work, takes place. Within the activity area are the buffer space(s) and the incident space(s).

The **buffer space,** located downstream of a blocking vehicle, is used to provide a separation of traffic flow and the activity area. Section 6C.06 of the MUTCD states, "neither work activity nor storage of equipment, vehicles, or material should occur within a buffer space" (DOT, 2009). This critical space can provide cushion area for an errant vehicle.

Incident space includes the incident itself and the work area. Take note of the EMS unit position in the Traffic Incident Management Area illustration above. When a blocking vehicle is present, the EMS unit should be positioned downstream of the incident, in a manner that points the patient loading area away from the lane of travel. Should the EMS unit be first to arrive, block positioning can be used to create a buffer area before additional units arrive. The EMS unit should be positioned in the same manner, with the patient loading area away from the lane of travel. Crew members should use extreme caution when accessing external compartments on the street side or travel lane side of the vehicle.

Lastly, the **termination area** redirects motorists back to their regular traffic path, past the incident areas and the buffer areas.

TIM will be unique to the EMS practitioner's area of operation. NFPA 1500 requires that every department provide roadway operations training to all personnel, with a focus on roadway hazards and safety practices (NFPA, 2018). Furthermore, NFPA 1500 calls on agencies to collaborate and coordinate with other response entities to develop SOPs for traffic incident response (NFPA, 2018).

Managing roadway risk

As the initial and subsequent risk assessments or scene size-ups are performed, the EMS practitioner should consider whether the patient and vehicles involved can safely be moved and evaluated off the roadway. To reduce risk of providers crossing over roadways, many agencies have implemented policies that automatically dispatch units to respond from both directions, or requirements that providers get out of apparatus only while on the same side of the incident.

The Emergency Responder Safety Institute (ERSI) has developed a resource for TIM training. The ERSI categorizes these incidents either as "Move It" or "Work It" incidents. Either move the incident to a safer location or work the incident in place. In either scenario, appropriate blocking should be employed to ensure safety. Here are a few factors from ERSI to help you determine if a scene is a "Move It" or "Work It" incident:

- Can the vehicle be physically moved? Is it operational?
- Can the vehicle legally be moved? Some states permit drivers to move vehicles off the roadway if there is minimal damage and no injuries. Does this law permit responders to move vehicles?
- Is the vehicle stable? Has the engine been turned off and emergency brake applied (if necessary)?
- Fire, extrication or hazardous materials? If any of these conditions exist, responders likely have a "Work It" scenario.
- Severity of injuries? What are the patient's injuries, and do they require immobilizing care, or can they be evaluated off the roadway?

Remember, as an incident progresses, it may change from a "work it" scene to a "move it" scene, orvice versa.

2019 responder struck-by-vehicle fatality statistics

Responder type	Law enforcement officers	Fire/EMS	Tow operators	Mobile mechanics	2019 totals
Fatalities	18	9	14	3	44

Source: ERSI.

Safety considerations for highway response

Since Nov. 24, 2008, the FHWA has required public safety officers, including volunteer firefighters and EMS practitioners, to wear a reflective safety vest when responding to an incident on the side of a federal highway (Worker Visibility, 2009). Although this policy only applies to responses on federal highways, all firefighters and EMS practitioners are recommended to wear safety vests approved by American National Standards Institute/ International Safety Equipment Association (ANSI/ISEA) when responding to any roadway or roadside incident.

Since transportation incidents are a leading cause of death for EMS practitioners, many other federal standards require the use of high-visibility vests for firefighters and EMS practitioners during roadside responses. These standards include the following:

- NFPA 1500.
- NFPA 1901, *Standard for Automotive Fire Apparatus.*
- OSHA 1910.132(d).

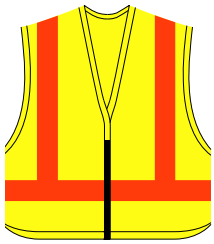
High-visibility safety vest requirements

There are several safety garments available to EMS practitioners to enhance visibility on both daytime and nighttime incidents. Specific equipment and its use, outside of those mentioned below, are dependent on local laws, regulations and SOPs.

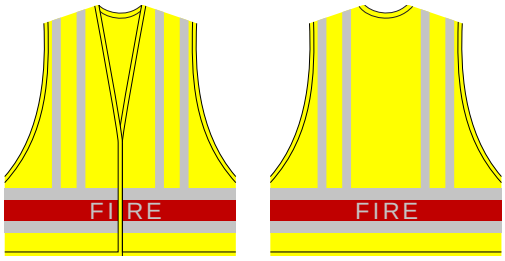
ANSI/ISEA 107-2020 defines 3 performance classes of high-visibility safety apparel (HVSA), 1 through 3, based on the needs of the user and the expected risk. The MUTCD states that all workers, including emergency responders, within the right-of-way who are exposed to traffic (vehicles using the highway for purposes of travel) shall wear HVSA that meets the Performance Class 2 or 3 (DOT, 2009). Similarly, NFPA 1500 states that "all personnel placed in conflict with motor vehicle traffic shall wear a high-visibility garment that meets ANSI 107..." (2021).

Safety vests for EMS practitioners and other public safety personnel have specific requirements according to ANSI/ISEA 107-2015. These requirements include the following:

- The safety vest must be type "P," allowing personnel to access other equipment.
- Vests must meet Performance Class 2 or 3.
- The garments must use fluorescent yellow-green, orange-red or red background material with 360-degree reflective visibility.
- Vests must have a 5-point breakaway design that allows the vest to be opened at either side, at either shoulder and in front. These openings allow easier access to equipment carried inside the vest.
- Reflective material stripes must be 50mm (2 inches) wide.

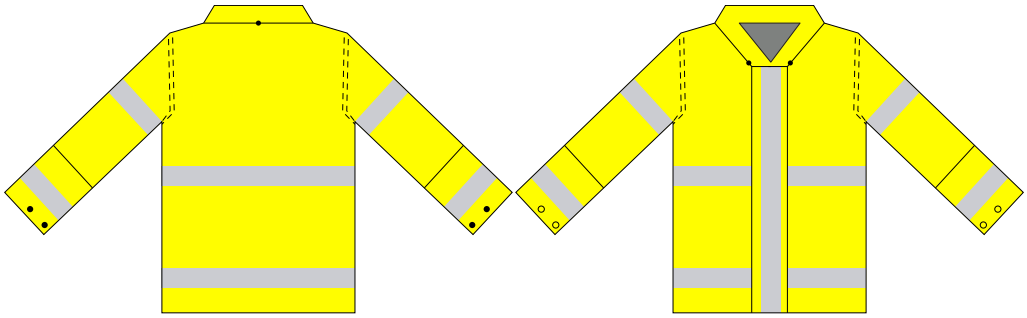


Type P, Performance Class 2 - Split Trim Vest. Source: ANSI/ISEA 107 - 2020.



Type P, Performance Class 2 - Vest. Source: ANSI/ISEA 107 - 2020.

Class 3 safety vests have the most visibility and contain more reflective and background material than the other classes. Reflective material must be at least 50mm wide and must be on the sleeves between the shoulders and elbow. There should be 0.5 m^2 of background material (Reflective Apparel Factory, 2016). Class 2 safety vests have slightly less visibility, requiring less overall background material (0.3 m^2) and less overall reflective material. However, strips of reflective material must still be 50mm wide (Reflective Apparel Factory, 2016). Below is an example of Class 3 compliant garments.



Type P, Performance Class 3 - Jacket. Source: ANSI/ISEA 107 - 2020.

EMS practitioners should don appropriate HVSA prior to exiting the EMS unit. EMS practitioners that also function in a fire suppression or hazardous materials role should be aware that HVSA should be worn over structural turnout gear when involved in suppression or hazardous materials mitigation activities (NFPA, 2021). In addition to HVSA, ERSI recommends that all providers wear a helmet while operating on the roadway (Respondersafety.com, 2020).

Mass gathering events

According to the WHO, "an organized or unplanned event can be classified as a mass gathering if the number of people attending is sufficient to strain the planning and response resources of the community, state, or nation hosting the event" (2015). These events can include visits from dignitaries or high-profile individuals, state and county fairs, concerts, major sporting events, or other planned or spontaneous protests, to name a few. A mass gathering event should take into consideration the following listed items:

- Venue characteristics.
- Communications.
- Access and egress.
- Situational awareness and civil unrest.
- Logistical support.

Venue characteristics

Event type. When considering the venue's characteristics, it is important to understand the event type, (e.g., a heavy metal concert, an orchestra's performance, tennis match, professional football game, planned or unplanned protest, etc.). Each of these examples may represent a different set of attendee demographics.

Anticipated attendance. A secondary consideration is the anticipated attendance. Generally, it is estimated that 1 EMS team should be provided for every 5,000 attendees (Calabro et al., 1996).

Weather and other considerations. Finally, the venue environment is a consideration for EMS responders. Will there be additional EMS call volume due to environmental conditions such as excessive heat or cold? Is the venue indoors or outdoors? How will responders enter and exit the event site? Altitude and availability of drinking water are also key considerations at the venue site.

Communications

Reliable, interoperative communication with all event agencies is an important safety consideration for EMS crews. If cell coverage or radio transmission is limited or impeded by noise, EMS crews' safety can potentially be enhanced if they have the ability to use the venue's internal phone/communication systems. Communication access locations should be determined before the event. Some agencies may elect to bring in a portable repeater system or portable cell towers to ensure that there are adequate communications, radio coverage and interoperability.

Access and egress

Having a plan for EMS access and egress into the event site is important to ensure timely patient care and transport.

In the event there is an angry crowd, gaining access to the patient often requires law enforcement's assistance. Preparation for gaining access onto areas such as the stage at a performance event, the infield at a race or athletic event, or the floor in a general or open seating attendance event needs to be planned well in advance. If a patient needs to be removed from an event area, EMS crews will need preplanned and proper access for motorized vehicles, stretchers and additional equipment into and out of the site.

In situations where access to an area where a patient can be loaded into an awaiting ambulance is notimmediately available, the EMS crew should plan for safe havens, or places where an EMS crew can retreat with the patient and provide care unobstructed by the influences of the crowd.

Situational awareness and civil unrest

It is critical for EMS practitioners to maintain heightened situational awareness at all times, but this is especially true while working at mass gathering events. EMS practitioners should have a heightened level of awareness during these incidents, as any mass gathering has the potential for civil unrest to occur. EMS practitioners should always assess the safety of a scene prior to entering, and request additional resources when, or if, needed.

If civil unrest does occur, all safety considerations should be taken, including staging until scene safety is secured by law enforcement prior to further engagement. The EMS crew should maintain situational awareness of the level of distress, anger and involvement the crowd directs at the patient at all times. In situations where anger or the inability to control the crowd is growing, EMS should be prepared to immediately retreat to a safe area and only reenter the site with the assistance of appropriate law enforcement. EMS and fire personnel should not be responsible for crowd control per NFPA 1500.

The USFA and NHTSA's Office of Emergency Medical Services recommend that personnel work in teams or pairs, and that company and chief officers remain accountable for staff and apparatus. Additionally, code words should be developed for secure radio communication regarding emergency actions, such as evacuation or station abandonment. Rally points for personnel should be designated in advance in case these measures become necessary (USFA, 2022).

Logistical support

As many mass gathering events occur over multiple hours or even days, it is important to ensure EMS crews have adequate food, water, shelter and sanitary facilities to sustain long-term operations during periods of continuous coverage. If adequate support resources are not available at the venue site, additional logistical support may be necessary to ensure operational continuity.

While water and food are the primary concern, additional equipment, such as radio and cardiac monitor batteries, oxygen, fuel, and medical supplies, should be readily accessible.

Whenever EMS crews are responding to, or assigned to, large-scale outdoor events or incidents, they should be prepared for unanticipated extended operational periods. EMS crews should consider having ready access to the following equipment:

- Reflective safety vest.
- Extra uniforms and undergarments.
- Safety boots.
- Sunglasses.
- At least 1 quart (or liter) water bottle/canteen with potable water.
- Raingear.
- 2 Meals Ready to Eat or equivalent.
- Toilet paper.
- Personal medications and medical documentation.
- Toiletries and other personal items as needed.
- Sunscreen.
- Bug/mosquito repellent.
- Blankets and/or sleeping bag.
- Hearing protection (ear plugs).
- Photo ID and petty cash.
- Clothing appropriate for climate conditions.

Event risk assessment

Each large-scale event should be assessed for potential risk. EMS leadership should perform a risk evaluation which takes into consideration a variety of factors, including, but not limited to:

- Event type and location.
- Time of day, year and weather forecasts.
- Expected attendance.
- Presence of alcohol.
- Likelihood of the presence/use of illicit drugs.
- Risk of potential violence or civil unrest.
- History and experience with similar events.
- Entry and egress routes.
- Presence (or absence) of security.

The table that follows may aide development of a risk assessment plan for mass gathering events.

State of New Hampshire general risk evaluation table - page 1

Risk factor	1 Low	2 Medium	3 High	4 Extreme	Score
Event and activity information					
Planned/ unplanned	Planned events	Planned events	Planned events	Unplanned events	
Type	Community and family based	Sporting events, runs/walks, concerts	Rallies, demonstrations, protests	Any spontaneous event	
Duration	Up to 3 hours	Up to 10 hours	Up to 24 hours	Over 24 hours	
Infrastructure and equipment	No structures, low to the ground such as tables, chairs	Soft structures, such as small- or moderate-sized tents	Hard, tall or heavy structures (stages), power cables and electrical equipment	Uncontrolled or nonpermitted structures and equipment	
Alcohol availability	None	Confined, controlled, limited access	Uncontrolled, unconfined, moderate to high use expected	Excessive use, uncontrolled, unconfined, movement through public areas	
Criminal activity	None expected	Potential law/ ordinance infractions	Criminal acts, minor property damage, potential assaults	Life/safety issues, excessive property damage	
Venue					
Type	Parks and public spaces that are not confined	Buildings or parks with controlled or confined spaces (plazas, theaters)	Buildings with uncontrolled access	Streets	
Route safety	Paths and sidewalks, no police assistance needed	Planned street route with some traffic control and signage	Unescorted, unmarked with no police or safety controls	Varied route, unplanned, uncontrolled, interacts with other users	

State of New Hampshire general risk evaluation table – page 2

Risk factor	1 Low	2 Medium	3 High	4 Extreme	Score
Organization and planning					
Organizers	Well-organized, compliant, experienced	New group, may be inexperienced	History of uncooperative behavior	Defiant, violent	
Event history	No problems, no police interventions	Minor incidents, minimal police interventions	Major incidents, arrests/charges, some impacts on town/city services	Critical upset to town/city services, history of violence	
Event planning	Maximum preparation time	Limited preparation time	Minimal preparation time	No preparation time	
Security	None needed or trained and in sufficient numbers	Needed, limited training, insufficient numbers	Needed, no training, insufficient numbers	No security	
Emergency response planning	Have emergency response plans including medical, security, evacuation, communications	Adequate emergency response plans and warning/ notification systems	Inadequate emergency response plans and/or warning/ notification systems	No emergency response plans and/ or warning/ notification systems	
Crowd assessment					
Crowd type	Family, corporate, business, elderly	Young adults, persons of interest	Disruptive, rebellious, criminal	Radical	
Crowd size and capacity	Small size, high-capacity venue for size of crowd	Moderate, up to maximum capacity of venue	Large numbers, exceeds capacity	Critical density, uncontrolled venue	
Crowd dynamics	Cooperative, peaceful	Celebratory	Anxious, aggressive	Violent	
Temporal considerations					
Time, day, season	Weekday	Weekend or weekday evening	Friday or Saturday evening, or other strained servicing capacity	Periods of strained response capacity (holiday, other major events)	
			Add total score		
Average: total score/16 = general risk level					

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Chapter 9: Indoor Operations

Introduction

When an individual calls 911, it may not automatically provide EMS practitioners with the legal authority to enter the home through use of force or without a personal invitation. Each state has laws that cover trespassing issues and levels of authority granted to public safety agencies attempting to gain access to patients or presumed patients. It is important for EMS practitioners to understand the laws and policies of their jurisdiction when entering private property. This chapter will discuss how EMS practitioners can gain access to patients located indoors, as well as potential risks and hazards associated with such incidents.

Indoor hazards

There are a variety of indoor hazards or safety threats that may exist upon arrival, such as poor lighting, poor ventilation and poorly maintained structures. For example, a narrow stairway can pose a risk for responders moving a patient from another level. There are numerous trip and fall hazards inside buildings as there are with any outside environment. The air quality issues of secondhand smoke or airborne disease in a crowded indoor environment also pose potential safety risks.

Additionally, some homes and businesses pose potential hazardous materials exposure for EMS responders. EMS responders should always be on the lookout for clues of hazardous materials stored or located in the area, such as signs, placards or large drums, or request information from the property/business owner. Also be on the lookout for a clandestine drug lab. If there is any possibility of a hazardous material incident, proper respiratory protection and PPE must be used. Fire department and hazardous material teams may need to be requested to respond to the scene.

At indoor construction sites, there are more opportunities for serious falls and the potential to be struck or cut by debris or building materials. Consequently, when EMS practitioners enter a construction job site to retrieve a victim or treat a patient, proper head protection and safety equipment should be used.

At times, a decision may need to be made to delay care and remove a patient to an area where effective treatment can be provided without additional risk to the patient or the providers.

Gaining access

Because they have the tools required, fire departments and some EMS agencies can perform forcible entry, including making an opening big enough to remove a patient (if necessary). If it is determined that forcible entry is needed to enter a secured home or building, it requires serious caution. Injury can occur when EMS practitioners try to gain access to a patient or presumed patient, especially if the patient is not expecting the arrival of first responders. Patients may act out violently or use weapons due to fear or confusion. Use of proper tactics for entry can reduce the risk; however, skills in gaining entry are not typically taught during EMS training.

EMS agency leaders should consider developing SOPs for gaining access to patients. While doing so, it is important to minimize any structural damage when forcing entry. Anytime a structure is compromised, EMS practitioners should also ensure that law enforcement, or other responsible authorities, remain on scene until the residence or occupancy can be secured after the patient has been transported from the scene.

Presence of animals

Service animals

Service animals may present a challenge to EMS safety. A guide dog is defined as any dog that is trained to aid a blind or visually impaired person (Americans with Disabilities Act (ADA) National Network, 2020; U.S. Department of Justice (DOJ), 2020). The term also applies to any dog owned by a recognized guide dog training center located within the state while a dog is being trained or bred for guide dog purposes.

There is a difference between a guide dog and a service dog. A service animal is defined as any animal that has been or is being trained to work or perform tasks for the benefit of a disabled person. Service animals may include dogs of any breed or size as well as other animals including but not limited to birds, primates and small horses. Some service animals are trained to detect impending seizures, diabetic episodes or other medical emergencies of their handler. The EMS practitioner may ask the following questions when presented with a service animal:

- Is this a service dog?
- Does your animal have legal allowances?
- Is the service animal required because of a disability?

The EMS practitioner should be concerned about the nature or extent of the patient's disability as it relates to patient care. Keep in mind that any stressed animal may bite or pose a risk during transport. Often, these animals make the difference between functionality and dependency for the patient. EMS practitioners should follow agency SOPs and local laws regarding the care and transport of service animals. Whenever possible, a service animal should be allowed to remain with the patient. If this is not possible, plans should be in place to care for the service animal and, upon the patient's discharge from the hospital, it is essential to reintegrate the service animal back into the patient's normal routine.

Dangerous and exotic animals

A patient's home or workplace may contain exotic animals such as snakes, birds and insects which may pose a danger to EMS practitioners. Farm animals, including bulls, hogs and goats, can also inflict serious injuries. When confronted by such situations, await the assistance of a trained and properly equipped animal handler. EMS practitioners should never handle a potentially dangerous animal, nor should they enter the scene until all potentially dangerous animals have been securely restrained or relocated.

Domestic animals may also pose a safety hazard to EMS practitioners for a variety of reasons including (CDC, 2018):

- Pets defending owners.
- Exotic or dangerous pets (e.g., snakes, scorpions and wild animals).
- Anxiety of animals during a medical emergency.

EMS agencies should develop SOPs for dealing with aggressive animals. It is equally important for EMS leaders to understand law enforcement's role in dealing with animals. For instance, EMS leadership may need to determine whether the use of pepper or chemical spray to control an animal(s) is legally allowed in their jurisdiction. EMS practitioners should also be aware of the law enforcement, fire department and animal control resources available. The multiagency response underscores the value of good interagency teamwork through positive relations and mutual commitment.

The following are listed safety guidelines for dealing with aggressive or dangerous animals:

- The presence of any animal should be regarded seriously.
- When possible, enclose animals elsewhere on the premises, regardless of how well the animal seems to be coping with the situation. If possible, delegate this task to someone who knows that animal. If no such person is available, summon an animal control officer to appropriately deal with the animal.
- Retreating from a violent or dangerous animal may be possible if the situation becomes obvious early enough in the encounter. Be aware of the location of potential protective barriers (such as the EMS unit, a fence or a door) while entering the scene.
- Although humane treatment should always be a primary consideration, there may be times when a life-threatening situation justifies harsh measures. Non-harsh options available to EMS practitioners may include using a blanket as a crude snare for a small animal, flashing a high-candlepower flashlight beam in an animal's eyes, or momentarily stunning an animal with a short blast from a CO2 extinguisher or fire hose.

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Chapter 10: Safe Patient Handling and Moving

Introduction

Lifting and moving patients exposes EMS crews and patients to risks and medical/legal losses for the following list of reasons:

- The unpredictability of the patient's location and medical status creates an environment with high potential for injury.
- Injury may occur if bystanders who are not trained in using proper lifting techniques are involved.
- Moving patients is a common source of back and shoulder injuries, risking crew safety. Request additional resources if necessary.
- Patient's physique or behavior may pose a danger to EMS crew members.
- Patients can potentially be located in difficult-to-access places and positions, which requires them to be accessed and removed through cluttered homes, downstairs and through narrow spaces. These issues increase the risk for patients and EMS crew members alike.
- Patients becoming injured as a result of being dropped, improperly restrained or both is a common point of litigation and financial loss for an organization. Research by the EMS Safety Foundation indicates that the application of the shoulder straps on the stretcher is the single biggest factor in protecting the patient from injuries when moved and transported.

Lifting and moving patients

Recognize a need for adequate resources

Workload and call volume are directly related to injuries in EMS. Researchers found the prevalence of lost-work injuries was highest among those with a very high call volume (22.3%), defined as 40 or more calls per week. They also found that the same group had a high incidence of back problems (21%) (Studnek & Crawford, 2007). Analysis of several years of data produced similar results. While an estimated 8.1% of professionals experienced an on-the-job injury or illness per year, the rates were much higher for those with very high call volume (18.9%) and self-reported back problems (12.5%). EMS employees working in an urban environment (defined as a community with a population exceeding 25,000) were 3 times more likely to report an injury with missed work time than their counterparts working in rural communities. It is important that agencies have adequate resources, especially personnel, in order to reduce fatigue and injuries. This is particularly important for agencies with high call volumes. Having adequate staffing can reduce personnel injuries and lost time from work (Elliot & Kuehl, 2007).

A similar study done in 2010 by the Fire Department of New York (FDNY) reported 5,534 cases of back strains or sprains reported since 2000. FDNY data also revealed that 26% of the service-connected illnesses and injuries were related to back strains and sprains that occurred while lifting and handling both patients and equipment.

Another critical element demanding the need for additional resources is the prevalence of obesity in the population served by emergency services. In an article published in the Journal of the American Medical Association, it was determined that the prevalence of obesity in the United States remains high, exceeding near 30% for all sex and age groups (Flegal et al., 2010).

Operating the stretcher

The majority of patient transportation in the pre-hospital setting involves the use of a mobile stretcher (or cot), with and without backboard application. Stretcher utilization occurs during the following 3 distinct phases of the EMS response:

1. Unloading the stretcher from the ambulance.
2. Loading a loaded stretcher into the ambulance.
3. Transporting/moving loaded stretcher over a variety of surfaces.

Ambulance stretchers come in a variety of models. Bariatric stretchers accommodate morbidly obese patients. Some ambulance stretchers feature ease-of-use and durability; others offer a hydraulic lifting feature. The increasing available options for ambulance stretchers present undocumented research and data for this high-risk part of EMS response and transport. Several changes have occurred in engineering stretcher designs. Current data indicate that there is not a set rate or a common denominator in stretcher-related injuries. One year-long study of an EMS transport agency included over 129,000 patient encounters. Of these, the agency recorded 23 adverse stretcher events (Goodloe et al., 2012).

Stretcher injuries can be precipitated by a variety of different causes. 1 study found common factors resulting in a crew injury, including:

- Patients weighing more than 450 pounds.
- Loaded stretchers moved over uneven surfaces (gravel or breaks in concrete).
- Stretchers being moved in a sideways manner.
- Patients not balanced on the stretcher.
- Patients moved over ice-covered, sloping driveways.

Equipment failure also provides an opportunity for EMS practitioner injury. 2 of the most dangerous situations for an EMS practitioner is when the stretcher is being loaded and, even more so, when the patient is being unloaded. A stretcher undercarriage failure can result in the need for a manual correction. The EMS practitioner has to quickly adjust their position to balance weight and perform the manual release of the undercarriage. This quick action can result in a tip or drop while the patient is on the stretcher.

Another common area where equipment failure occurs is at the point of connection between the stretcher and the ambulance floor. EMS crew injury can occur when a worn-out or poorly maintained, floor-mounted safety latch in the patient compartment of the ambulance breaks or malfunctions. This safety latch, when operating properly, is designed to stop the stretcher from coming out of the patient compartment before the legs of the stretcher have fully extended. The moment this mechanism fails, the stretcher and patient can be rapidly expelled from the ambulance, resulting in a dropped and potentially injured patient, as well as a potentially injured EMS practitioner.

Motorized stretchers

The advent of motorized stretchers is an attempt on the part of stretcher manufacturers to reduce the number of EMS practitioner injuries. Studies have shown that while the motorized stretchers do reduce back injuries, they may be increasing shoulder injuries (Studnek et al., 2012).

The additional weight of the stretcher, coupled with EMS crews' lack of training, may contribute to these shoulder injuries. EMS workers must be taught to maintain a 90-degree angle shoulder alignment to the stretcher to avoid stressing the shoulder joint and supporting muscles, tendons and ligaments.

Special situations and equipment

Stair chair

A stair chair is a type of patient moving equipment frequently used by EMS practitioners. When small, narrow staircases, offices, elevators and other tight areas of occupancies cannot accommodate a stretcher, the use of a stair chair device or wheelchair may be required.

Researchers have analyzed the biomechanics of paramedics using stair chairs and studied the comparison of compression forces on the practitioner's lower backs during the process of carrying a patient down multiple flights of stairs using different devices and carrying techniques. Stair chairs were found to allow the provider to descend the stairs facing forward. It was also found to reduce the biomechanical loads placed on each individual, thus reducing possible risk of injury (Butt et al., 2002).

Securing the patient for transport

While it is important for EMS practitioners to wear seatbelts when driving in an ambulance to prevent injury or death in the event of a crash, equally important is restraining patients. One NHTSA investigation found that while 96% of patients were restrained during an ambulance crash, only 33% of them were restrained with both shoulder straps and lateral belts and 61% with lateral belts. NHTSA reports that among the most serious crashes, 44% of patients had been ejected from their stretchers, indicating the increase in risk of injury or death when not restrained by both shoulder and lap belts (Smith, 2015).

It is also imperative that equipment, particularly heavier items such as automated external defibrillators and oxygen cylinders, be properly secured within the ambulance, as they can cause severe injury or even death if projected during a crash (Smith, 2015).

Child restraints

Each year, there are nearly 1000 ambulance crashes involving pediatric patients (Fidacaro et al., 2020). Properly securing children for transport can be challenging due to their size, weight and age. The goal of child restraints in an emergency ambulance is to prevent a

child's forward motion or ejection from the vehicle; secure the torso and protect the head, neck and spine of children being transported. A child who is uninjured or not ill should be transported in 1 of the following ways:

- Transport in a size-appropriate child restraint system appropriately installed in the front passenger seat with the airbags off in an emergency ground ambulance.
- Transport in a size-appropriate child restraint system appropriately installed inside the ambulance in a forward-facing EMS practitioner seat.
- Transport in a size-appropriate child restraint system appropriately installed in a rear-facing EMS practitioner seat.
- Consider delay of transport of the child with appropriate adult supervision until additional vehicles are available.
- Per the judgment of the EMS practitioners on the scene, consider delay of transport until an additional vehicle is available for transport.

For a child who is ill and/or injured and whose medical condition does not require continuous or invasive monitoring and/or interventions, the child should be transported in a size-appropriate child restraint system. As an alternative, the child could be placed in a size-appropriate and manufacturer-certified child restraint system that is integrated into the EMS practitioner's seat.

If a child needs to be restrained using spinal precautions, backboards are no longer the standard of care. Backboards are not evidence based and have been shown to be harmful when used for transport in certain populations. Spinal motion restriction without backboards is now the standard of care.

For a child or children requiring transport as part of a multiple patient transport (i.e., newborn with mother, multiple children, etc.), if possible, each patient should be transported in an appropriate-sized restraint system (Levick et al., 1998). Transport a mother and newborn with the child in a rear-facing EMS practitioner seat with a forward-facing belt path that prevents both lateral and forward movement.

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Chapter 11: Hostile Situations

Introduction

EMS responders work in unpredictable environments. Any scene can be safe one minute and become violent the next. Most EMS practitioners believe they will be safe at work, but there is a growing concern regarding violence toward EMS practitioners on duty as a large percentage of responders report being assaulted. This chapter will discuss the need to raise awareness of the violence EMS practitioners may be subject to, as well as the need to report such events.

Background

NIOSH estimates that about 3,500 EMS workers in the United States were sent to the hospital in 2016 with injuries resulting from work-related violence, but most experts agree that the actual figure is much higher (NIOSH, 2021). Currently, there is no single national data tracking system for assaults against EMS practitioners. As discussed in Chapter 3, the online E.V.E.N.T. collects anonymous reports of violence along with other safety-related incidents, and the NFFNMRS collects some voluntary reporting data for fire departments. This data has been analyzed by the FIRST Center, and 1 study found that assaults were the most common mechanisms of injury to EMS practitioners (Taylor et al., 2015).

A 2016 study completed by NASEMSO found that over two-thirds (69.0%) of EMS workers experienced at least 1 form of violence in the past 12 months. Verbal violence was the most common type of violence experienced and patients were the most common source of violence (Gormley et al., 2016). Women, in particular, experience more violence at the hands of their patients than men do, according to another FIRST study which found that injuries listing "struck or injured by" as the cause of the injury occurred among 21% of females compared to only 13% of their male counterparts (Taylor et al., 2015).

Many states have passed legislation that seeks to deter violence through tougher penalties for assaulting emergency responders including firefighters, EMTs and paramedics (NAEMT, 2019). Though these laws may not deter criminals, it does send a signal to the EMS profession, to law enforcement, and to the criminal justice system that violence against EMS practitioners is unacceptable. In May of 2019, Vermont passed Act No. 16, which expands the aggravated murder statute to include the killing of a firefighter or an emergency medical provider. As a result, if a person murders a firefighter or emergency medical provider knowing that the victim is performing their official duties, the person can be charged with aggravated murder and sentenced to life without parole (Vermont General Assembly, 2019).

Also, in July of 2019, Florida enacted state statute 784.07: "Assault or battery of law enforcement officers, firefighters, emergency medical care providers; reclassification of

offenses" increases the minimum sentences. The reclassifications are as follows: In the case of assault, from a misdemeanor of the second degree to a misdemeanor of the first degree; in the case of battery, from a misdemeanor of the first degree to a felony of the third degree; in the case of aggravated assault, from a felony of the third degree to a felony of the second degree; and in the case of aggravated battery, from a felony of the second degree to a felony of the first degree (Florida Senate, 2021).

Raising awareness

By increasing EMS leaders' and employees' awareness of the global violence against EMS practitioners, prosecution of those who perpetrate violence toward EMS practitioners could be more likely, as it has been the case for injured law enforcement personnel.

EMS practitioners should have training on the proper way to document a violent event, when an incident occurs during the course of treating a patient, and when an EMS practitioner is injured. The EMS practitioner also should have training on the legal process, including how to testify in court.

Workplace violence

Standard operating policies and SOPs related to workplace violence must be established and implemented throughout the agency. SOPs addressing workplace violence will provide a framework for EMS agencies to develop a cultural understanding that such actions are unacceptable. The goal with the SOP is to ensure EMS leadership and employees comply with the following list of objectives:

- Understand that violence in the workplace is a problem.
- Identify the unique risks present for EMS practitioners internally and externally.
- Create goals to reduce violence toward employees.
- Communicate the buy-in from the agency's human resources department and management staff who will incur the costs of training programs.
- Develop and implement training to teach employees how to identify potentially violent situations, how to avoid them, how to de-escalate violent situations, and as a last resort, how to protect themselves from attack.
- Remove any barriers for reporting incidents of violence against employees.
- Periodically evaluate agency success in reducing violence.

It is imperative that EMS leaders review the above listed objectives and build buy-in among the ranks of all employees to make the zero-tolerance attitude a reality.

NIOSH is currently developing a project on workplace violence prevention. The purpose of this project is to create occupation-specific workplace violence prevention courses that will provide relevant information for emergency responders such as EMTs and paramedics. NIOSH also has several publicly available, online training courses to educate health care workers, including EMS practitioners, on workplace violence (NIOSH, 2015).

In its publication "The Public Health Approach to Violence Prevention," the CDC describes a 4-step approach to violence prevention (CDC, 2020):

1. **Define and monitor the problem.** The first step in preventing violence is to understand the "who," "what," "when," "where" and "how" associated with violence. Grasping the magnitude of the problem involves analyzing data such as the number of violence-related behaviors, injuries and deaths.

2. **Identify risks and protective factors.** It is important to understand what factors protect people or put them at risk for experiencing or perpetrating violence. These factors help identify where prevention efforts need to be focused.

3. **Develop and test prevention strategies.** Findings from the research literature and data from needs assessments, community surveys, stakeholder interviews and focus groups are useful for designing prevention strategies.

4. **Assure widespread adoption (dissemination and implementation).** Communities are encouraged to implement strategies based on the best available evidence and to continuouslyassess whether the strategy is a good fit with the community context and achieving its goal of preventing violence.

Potential dangerous situations/red flags

EMS practitioners should always be on the lookout for red flags that signal a situation may become unstable or violent. Personnel should develop a heightened situational awareness for safety that begins as soon as the call is dispatched. If the call sounds like it could have the potential for violence, have the communication center gather as much additional information as possible. The following situations are just a few examples of call types that have the potential for a violent or unsafe scene:

- Civil unrest.
- Domestic violence.
- Drug-related crimes.
- Homicides.
- Known or suspected grow houses, growing fields or clandestine drug labs.
- Police standby.
- Roadway conflict encounters (i.e., road rage).
- Shooting(s).
- Stabbing/cutting.
- Other violent crimes.

Drug-related crimes

Crimes including the manufacture and/or sale of drugs often go hand-in-hand with violence. There may be weapons or other paraphernalia that can create a dangerous operating environment. Indicators of drug manufacturing or use at a scene may include:

- Previously identified location of drug use.
- Clandestine drug lab equipment/smells visible on approach.
- Clinical evidence that the patient has used drugs (e.g., overdose symptoms, track marks).
- Drug paraphernalia on scene.

Clandestine drug labs

Drug dealers may set up clandestine drug labs in homes, vacant buildings or even a car trunk. It is important to remember that such drug labs can be encountered anywhere and in any type of building. EMS practitioners may even encounter mobile labs in trailers on the roadway (Royal Canadian Mounted Police, 2020). These labs may contain dangerous chemicals that can explode or ignite when exposed to air, and they can pose extreme danger to EMS practitioners.

Commonly manufactured drugs include methamphetamine, MDMA, LSD and crack cocaine. Identification of clandestine labs frequently turn into hazardous material incidents and may require special response teams or bomb disposal operations.

When suspicious of a clandestine drug lab, EMS practitioners should adhere to the following (Royal Canadian Mounted Police, 2020):

- Evacuate the area immediately.
- Do not touch or inhale anything.
- Do not operate any electrical power switches or light switches.
- Do not open or move containers.
- Notify dispatch and law enforcement immediately.
- Perform decontamination to include clothing.
- Consider evacuation and isolation of the surrounding area.
- Document all observations as soon as possible.

Gang violence

Gang activity may also be a warning sign for potential for violence. Observable gang characteristics may include gang-related graffiti, tattoos, clothing and hand signals. A gang member's response to patient care may be unpredictable. In some cases, EMS practitioners may be exposed to a crime in progress. Sometimes gang-initiated violence is completed in the presence of the crew. EMS agencies may be able to rely on local law enforcement to provide training and information on local gang activity.

When approaching the scene, EMS practitioners should be alert for clues of escalating hostility, such as increasingly loud voices, pushing and shoving, and rapid increase in crowd size. When in doubt, EMS practitioners should request or determine that law enforcement is responding and stage until their arrival.

Crime scenes

Response to a crime scene is a common occurrence for EMS practitioners. The goal for performing medical care at a crime scene is to provide high-quality patient care while preserving evidence. Never jeopardize patient care for the sake of evidence. However, EMS practitioners should take care to not disturb the scene unnecessarily and should be aware of the criminal investigation that will follow. It is imperative that the movement of personnel at a crime scene is limited and the number of persons allowed into the crime scene is restricted to necessary personnel only. EMS practitioners may have to justify their actions to law enforcement and other authorities after the incident. If an item must be removed from the patient or crime scene, it should be placed in a brown paper bag. If an item of potential evidence is saturated in liquid (e.g., patient's clothing), it should be placed in a paper bag and then sealed in a plastic bag (Price & O'Neill, 2020).

The New York State Police employ a simple approach that EMS practitioners can use at a potential crime scene illustrated by the acronym **RESPOND**:

- **R: Respond.**
  - Personal safety: EMS practitioners' safety comes first. A provider cannot help others if they become injured.
  - Formulate a plan on how to respond to the situation and collaborate with law enforcement. Follow law enforcement requests as long as they do not jeopardize or interfere with care of the patient.
  - Make mental notes of all observations.
- **E: Evaluate.**
  - Evaluate the severity of the situation. Is the crime/incident in progress or not?
  - Identify all involved and uninvolved individuals in the area.
  - Be aware of weapons and hazards or potential evidence.
  - Do not touch anything unless necessary.
- **S: Secure.**
  - Clear away uninvolved people.
  - Establish a perimeter and use the same path for entry and egress.
- **P: Protect.**
  - Safeguard the scene: Work with law enforcement to limit and document any people entering the area.
  - Do not touch or disturb anything on scene unnecessarily.
  - Do not move items or furniture unless absolutely necessary.
- **O: Observe.**
  - Observe the surroundings, especially as it pertains to the patient's mechanism of illness or injury.
  - Write down all observations as soon as possible. Remember that incident notes could possibly be used to help with testifying in court, if necessary. It is also important to remember any notes regarding the incident may be subpoenaed at a later date.
- **N: Notify.**
  - Ensure law enforcement is on scene.
  - Request additional resources as needed (e.g., hazardous materials response teams).

- **D: Document.**
  - Take highly detailed notes, including time, date, individuals encountered at the scene and weather conditions. Seemingly small observations may be of great importance to law enforcement investigation, such as were the doors open or closed upon arrival? Were the lights on or off? How was the furniture positioned? Where was the patient found?
  - Be prepared to provide your notes and information to law enforcement but remember that the patient's privacy and medical information is protected information. Be sure to follow all internal policies and legal channels prior to sharing any protected health information.

Training for violent incidents

One way to reduce violence against EMS practitioners is to provide appropriate training. Some agencies espouse a cultural belief that because EMS practitioners are not law enforcement officers, and that their goals at an emergency scene are fundamentally different from those of law enforcement, they are not subject to violence. This belief is false and should not be embraced. EMS practitioners should be taught:

- Situational awareness to recognize a violent scene.
- How to safely retreat from a violent scene.
- Basic tactics to avert a physical attack and how to escape restraint if a physical attack does occur.
- Local law enforcement may be able to provide training and guidance for violent scenes.

Initial approach

When EMS practitioners are en route to a call that could potentially become violent, the crew should get as much information as possible from dispatch, perform an initial size-up and maintain periodic communications. When in doubt, EMS crews should request or determine that law enforcement is responding and stage until their arrival.

EMS practitioners must practice assessing situations so that choosing an appropriate interpersonal approach with each patient comes with ease. Some situations demand a stronger, more authoritative approach, whereas others work better when the approach is gentler and more comforting. A provider can choose an approach characterized as soft by using a gentle voice, kind facial expressions and a nonangular body language. A medium to hard approach is characterized by powerful and controlling body language and a louder, firmer voice. This continuum is a building block for improving one's ability to react appropriately to each field situation. When EMS practitioners achieve the skills necessary to approach a patient/scene in a variety of ways, those skills contribute to more successful encounters with strangers who are in crisis.

EMS practitioners should be familiar with the following law enforcement terms, in the event of any violent incident.

- **Concealment:** This means concealing or hiding from view of those who mean harm. Any object that prevents being seen is technically concealment (e.g., thick brush, a vehicle, building, etc.). A problem can arise when responders confuse concealment (not being seen) with cover (Hoff, 2012).
- **Cover:** This is any material that can reasonably be expected to physically protect an individual from the threat(s), such as ballistic rounds and shrapnel. Examples of cover are hardened, thick, bulky material; certain vehicle areas; and man-made structures. Brick and mortar, cinder blocks filled with concrete, and heavy wooden timbers are all considered good cover (Hoff, 2012).

Ballistic protection

The use of ballistic protection equipment (BPE) is recommended for EMS practitioners who have the potential to come in contact with hostile situations and work in high-crime areas. More information on body armor and ballistic equipment is discussed later in this chapter.

Emergency communications

EMS agencies should establish a radio code, other terminology or the use of an emergency button on the radio which indicates there is an immediate threat to EMS practitioners. When a threat is communicated, both the communications center and any other units must yield to the emergency traffic by keeping the radio air clear and open. During emergency traffic, if there is a need to communicate other messages, this should be done on an alternate radio frequency or through other means such as a cellphone.

Active Shooter/Hostile Event Response

NFPA 3000: *Standard for an Active Shooter/Hostile Event Response (ASHER) Program* defines an ASHER as "an incident involving one or more individuals who are or have been actively engaged in harming, killing, or attempting to kill people in a populated area by means such as firearms, explosives, toxic substances, vehicles, edged weapons, fire, or a combination thereof" (NFPA, 2021).

Active shooter incidents and hostile events have become a common occurrence around the world. From June 2016 until November 2017, there were 3 domestic attackers that inflicted nearly half the casualties that the United States witnessed during the 13-year period from 2000 through 2013. Since November 2017, there have been many more ASHER incidents in the United States from rural Kentucky to suburban Parkland, Florida, to YouTube's California headquarters and a Las Vegas music festival.

The table that follows compares the active shooter incidents that occurred in the United States in 2018 to events that occurred in 2019. The data highlights some disturbing trends.

The NFPA 3000 ASHER Program was developed for communities to establish a unified planning, response and recovery program long before a perpetrator strikes. The 4 main components of the standard are as follows (NFPA, 2021):

1. **Whole Community.** Realizing that these incidents affect all aspects of a community, it is imperative to work together to reduce risk and optimize training in the community in the following essential elements: "See something, say something"; Run, Hide, Fight Program; and training in how to control severe bleeding.

2. **Unified Command.** Prioritizing a unified command structure that considers scenarios, authorities, roles, responsibilities and communications with all key stakeholders involved in the process. All agencies that could be called to respond to an ASHER event must use the same terminology and utilize the Incident Command System. In addition, all agencies should train and conduct exercises together.

3. **Integrated Response.** Identifying organizational operations, incorporating the objectives of these agencies, and practicing integrated responses together as a cohesive, well-connected unit.

4. **Planned Recovery.** Establishing a recovery strategy (immediate, early and long-term) that is well-defined and turn-key for implementation.

Source: DOJ. (2020). ***Active shooter incidents in the United States in 2019.*** https://www.justice.gov/usao-mdpa/page/file/1272096/download

Preparing for an ASHER

The goal for EMS practitioners is to treat the victims and get the victims from the incident to the hospital. The priority is to provide rapid, lifesaving medical care and evacuation no matter what the situation is.

When there is a call for a known or suspected violent situation, EMS practitioners should not respond directly into the scene. They should stage in a safe location and request law enforcement to respond, access the scene and announce it is safe to enter. Responder safety is paramount and should be continually evaluated while en route and on scene. The EMS practitioner should get as much information from the communication center as possible and note general observations en route to the scene (especially noticing anything that seems to be out of place).

If EMS practitioners are on scene and decide there is a need to immediately retreat, if possible, they should wedge equipment in the doorway as they retreat or use an unconventional path to retreat. Anticipating the moves of the aggressor, overturning objects in the path of the attacker, and having pre-planned safety zones is a good idea.

There should be a method of alerting other providers to dangers by communicating warning signs that every team member knows without alerting the aggressor (e.g., radios that have an emergency button or establishing a code word).

All EMS practitioners should develop a consistent, thorough and objective method of documentation that includes initial observations, what their crews did or moved on the scene, the location where the victim(s) was found, location of injuries and any other pertinent information. Their reports may be used later by the legal system.

Zones during an ASHER (these may be dynamic locations during an incident):

Hot Zone. An area where there is a known hazard or direct and immediate life threat. Law enforcement will have a contact team (usually the first officer(s) on scene to enter the area and locate the assailant) in the zone and only trained EMS practitioners such as Special Weapons and Tactics/Search Rescue Team, Tactical Medics, etc., should operate in this area.

Warm Zone. An area where there is potential for a hazard or an indirect threat to life. EMS practitioners who are trained as part of an integrated response team, such as a rescue task force (RTF) and equipped with BPE may be able to enter, provide immediate lifesaving care and rapidly remove victims.

Cold Zone. Area(s) where there is little or no threat due to geographic distance from the threat or the area has been secured by law enforcement.

Policy development

All agencies should have SOPs for ASHER incidents. The guideline will provide a framework for training, exercises and response. An ASHER incident will require a multijurisdictional, multidisciplinary response. The training must be realistic and include all stakeholders that may respond together to an ASHER. Training should include the following:

- Use of common terminology.
- Practice establishing Unified Command.
- Identification of a mass casualty incident (MCI) Command Officer responsible for oversight and coordination of triage, treatment, transport and staging.
- Explore how to effectively communicate with all jurisdictions and disciplines that may respond, including the communication center(s) and hospitals.

- Establish an accountability system for all personnel.
- Train EMS practitioners and law enforcement officers to work together to form an RTF. An RTF includes law enforcement officers, and any combination of fire and EMS practitioners, to provide lifesaving care and victim extraction within the established Warm Zone of an ASHER.
- Practice victim evacuation, including lifts, drags and carries. Also consider training that uses alternative devices to move victims, such as wheeled office chairs or carts.
- Initiate coordinated transport to available facilities (to ensure a single facility is not overwhelmed) and practice early communication with the receiving hospitals.

Equipment to respond as an integrated response team/rescue task force

NFPA 3000 recommends BPE for emergency responders operating in the Warm Zone. This BPE includes a ballistic vest that shall have the minimum rating of Type III-A as determined by the National Institute of Justice (NIJ). Type III-A ballistic protection provides protection from most standard handgun and shotgun ammunition.

Additionally, EMS practitioners working as part of an integrated response team should consider the use of a ballistic helmet or shield, a flashlight, medical exam gloves, an individual first aid kit, a radio with shoulder strap, and remote microphones with earpiece for communication (NFPA, 2021). More information on body armor and ballistic equipment is available in Chapter 10.

Body armor and ballistic armor

While on duty, EMS and fire crews may face violent armed people, shooting events or crime scenes. 2 high-profile mass shootings in the United States have highlighted the role of EMS practitioners in saving lives. The after-action report on the Columbine school shooting incident recommended the deployment of tactical EMS, police and fire operations as a life-saving strategy (USFA, 1999). In 2007, quick deployment of EMS practitioners in the Virginia Tech University shooting was credited with saving lives (System Planning Corporation, 2009). As a result of these tragic events, EMS involvement has been highlighted and recommended for the protection of potential victims. For these instances, wearing body armor or ballistic armor may prove useful in protecting EMS practitioners themselves. It is crucial for body or ballistic armor to be properly fitted to each individual for optimal protection.

Before using body armor, it is important to note that it is not entirely bulletproof. Ballistic armor also does not protect against knives or an attempted stabbing; however, it may provide some degree of protection in the event of an ambulance crash (NIJ, 2014; Tan, 2018).

Body armor works by absorbing and distributing the impact of a ballistic missile. It is made of layers of extremely tough synthetic fiber, usually Kevlar®. Body armor has increasing levels of protection known as threat levels and is created according to the number of layers of the fiber placed into the vest. The higher the threat levels, the greater the protection

the armor will provide. However, there is an inverse relationship between the level of protection and the level of comfort and mobility the body armor provides. The agency has to decide whether the trade-off for comfort and mobility is warranted for the level of protection needed.

In general, there are 2 styles of body armor: continuous wear (concealable) and external wear.

Continuous wear. The major advantages with this type of body armor are that it is lightweight and already on the provider when needed (Tan, 2018). Typically, it is made of soft, flexible materials (NIJ, 2014). Additionally, the body armor is hidden so that potential assailants would not be able to see where the EMS practitioner is and is not protected. However, this type of armor is not very protective against bullets. Some models of continuous wear and concealable armor are wrapped around the body, while others are not. A reputable dealer should measure and custom-fit armor for its greatest comfort and mobility.

External wear. External wear body armor, commonly called a tactical vest, is donned when potentially hazardous situations arise. This type of armor is made of harder, more rigid panels or ceramic materials (NIJ, 2014). When a situation is known to be risky, EMS practitioners should not enter the area until cleared by law enforcement personnel and the scene is truly secure. In cases of armed attacks, it may sometimes be impossible to secure a safe scene and don body armor. In situations such as riots, incidents of workplace violence, and large-scale urban unrest, external vests can be deployed to EMS crews. External armor is heavier and more uncomfortable, especially in hot or humid environments (Tan, 2018).

Like all equipment, body armor requires maintenance and care. Periodic, manufacturer-recommended cleaning is important to ensure full protection.

Sometimes, the cost to outfit staff is often seen as prohibitive, especially for rural agencies or those with smaller budgets. In many agencies, concealed body armor is provided and must be worn during responses that involve weapons, shootings, active shooter calls, domestic violence, and police standby or standoff situations. In other agencies, individuals are personally accountable for purchasing their own body armor. It is important to note that all EMS practitioners are equally vulnerable to violence, regardless of location, and may benefit from wearing body armor.

Treating combative patients

EMS practitioners must often manage violent or combative patients. These patients are a risk to themselves as well as to the EMS practitioners rendering aid. Any attempt to physically restrain a patient poses great injury risks for responders and the patient. EMS practitioners must have established guidelines and training on restraining and/or sedating agitated, combative and other potentially dangerous patients. Physical or chemical restraints should only be used within an EMS practitioner's protocols determined by the medical director. Ideally, they should only be used when absolutely necessary after de-escalation techniques have failed.

Patients that are restrained have a high risk of sudden death, particularly those who are obese, under the influence of stimulant drugs, and/or have an underlying medical condition. It is crucial that EMS practitioners assess a patient for the risks of sudden death.

Signs of a patient's impending cardiac arrest while restrained include the cessation of struggling against physical restraints and/or the onset of shallow or labored breathing. EMS practitioners should consider alternative restraints (e.g., chemical restraints) if medical conditions allow.

De-escalation

EMS practitioners should employ de-escalation techniques to prevent further volatility of an incident. De-escalation techniques are used to reduce the risk of violence through the use of verbal and non-verbal communication. De-escalation should be the first line of defense when tensions rise during an incident and patients begin exhibiting signs of agitation. While de-escalation techniques will be specific and unique for each individual and incident, some techniques include (Price & John, 2012):

- **Demeanor.** Maintaining a calm, empathetic demeanor throughout the interaction.
- **Tone of voice.** Using a calm, soft tone of voice without appearing to be condescending or patronizing.
- **Body language.** Body language that conveys concern for the patient, without invading the patient's personal space.
- **Eye contact.** Using eye contact to facilitate communication but avoiding fixed eye contact that could be perceived as aggressive or threatening.
- **Active listening.** Practicing active listening which allows the patient to communicate their feelings and ensures the patient feels like they are being heard and understood. Validating a patient's feelings and allowing them to express anger without harming themselves or others has been shown to be a key factor in successful de-escalation (Duperouzel, 2008).

De-escalation is an acquired skill, and it should not be assumed that providers will be able to perform these techniques without proper education. Departments should ensure all EMS practitioners receivetraining and have the opportunity to practice de-escalation skills (e.g., through role-play).

Patient restraint

If de-escalation attempts fail, or if a patient suddenly becomes violent, posing a harm to themselves or others, restraint mechanisms may become necessary. Proper and safe restraint practices begin in the classroom and require training and practice to master.

Physical restraints. When physical restraint of a patient becomes necessary, the patient's dignity should be maintained to the greatest degree possible. Soft restraints are preferred, and the least restrictive method of restraint should be used to ensure both provider and patient safety. Restraints should be able to be removed quickly should the patient require advanced clinical treatment (The National Association of EMS Physicians (NAEMSP), 2016).

Physical or mechanical restraints are devices, materials or equipment that have the following characteristics:

- They are attached to or are adjacent to the patient's body.
- They prevent free bodily movement to a position of choice (i.e., standing, walking, lying, turning and sitting).

- They cannot be controlled or easily removed by the patient.
- They can be quickly and easily removed by the EMS practitioner should the patient's condition change.
- If law enforcement restraints are employed, a law enforcement officer should remain with the patient and crew throughout transport.

Ideally, restraining a patient should be conducted with a minimum of 5 personnel. This allows for 1 person to control each extremity while the fifth person applies the actual restraints. Continuous monitoring of the patient's airway, breathing and overall physiologic status is critical throughout the duration of restraint. A restrained patient should never be placed facedown or in a position where it is not possible to monitor their airway (Brice et al., 2003).

Chemical restraints. Access to and use of chemical restraints will be dictated by the authority having jurisdiction over department policies and protocols. Chemical restraints remain controversial, have caused harm and should only be used after de-escalation and other efforts have failed. If a chemical restraint is going to be used, EMS practitioners should consider nasal atomizers or intramuscular injection of the medication to lessen the risk to first responders. Some chemical restraint options include benzodiazepines, ketamine and butyrophenone, as well as other dissociative agents. Paralytic agents should never be used solely for patient restraint but only when an underlying medical condition warrants the use of such agents (NAEMSP, 2016).

Documenting restraint use

It is imperative that EMS practitioners practice proper documentation through the course of all patient encounters, especially when physical or chemical restraints are used. In addition to any treatments rendered, documentation should include (NAEMSP, 2016):

- The reason or demonstrated need for patient restraint.
- Contact with medical direction (if required).
- The type of restraint used and the location(s).
- Continual monitoring of vital signs and patient condition.
- Any modification made (e.g., if patient restraints were removed or relocated).

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Section V: Vehicle Operations

Chapter 12: Emergency Medical Vehicle Operations

Introduction

Emergency vehicle crashes are a national problem, causing injury and/or death of practitioners and civilians, as well as costly property damage (Hsiao et al., 2018). The 2018 Census of Fatal Occupational Injuries reported 16 EMS practitioner fatalities, 11 of which were transportation incidents (BLS, 2019), and the USFA reported 64 civilian fatalities and 217 civilian injuries during the period from 1996 to 2012 as the result of ambulance transportation incidents (Hsiao et al., 2018). The data overwhelmingly show that transportation is among the riskiest activity for EMS workers with regard to fatalities and potential liability. Many initiatives are underway to mitigate risk factors, including, but not limited to, the USFA "Emergency Vehicle and Roadway Operations Safety Program" and (in partnership with the IAFF) the "Emergency Vehicle Safety Program." This chapter will explore the risk of transportation hazards faced by EMS practitioners and highlight how these risks can be mitigated through education, proper training and policy development and enforcement.

Ground transport

When responding to an emergency incident, emergency vehicle operators may be permitted to employ practices beyond what normal traffic laws allow. According to state and local laws and ordinances, practitioners may be allowed to exceed posted speed limits, pass through stop signs and red lights (after stopping for safety concerns), and drive outside of, or around, lane demarcations. Such practices introduce increased risk of collisions, especially when providers are operating under mental or emotional stress and are driving under the pressure of time.

Emergency mode driving safety

Driving in the emergency mode — such as when warning lights and sirens are used — during an emergency response is 1 of the most dangerous aspects of providing emergency services, placing both EMS practitioners and the citizens they serve at risk.

Effectively driving in the emergency mode requires a high level of personal discipline, preparedness and situational awareness on the part of the EMS worker. Appropriate emergency response preparation includes knowing where the call is located. The inherent distractions that occur when responders receive unclear locations or poor directions often contribute to a crash. Even more dangerous is the distracting use of personal data devices, cell phones, mobile data terminals or other equipment while the ambulance is in motion. The driver and their partner should always be on the alert and available to communicate about dangers or threats along the response path.

Factors involved in emergency vehicle crashes

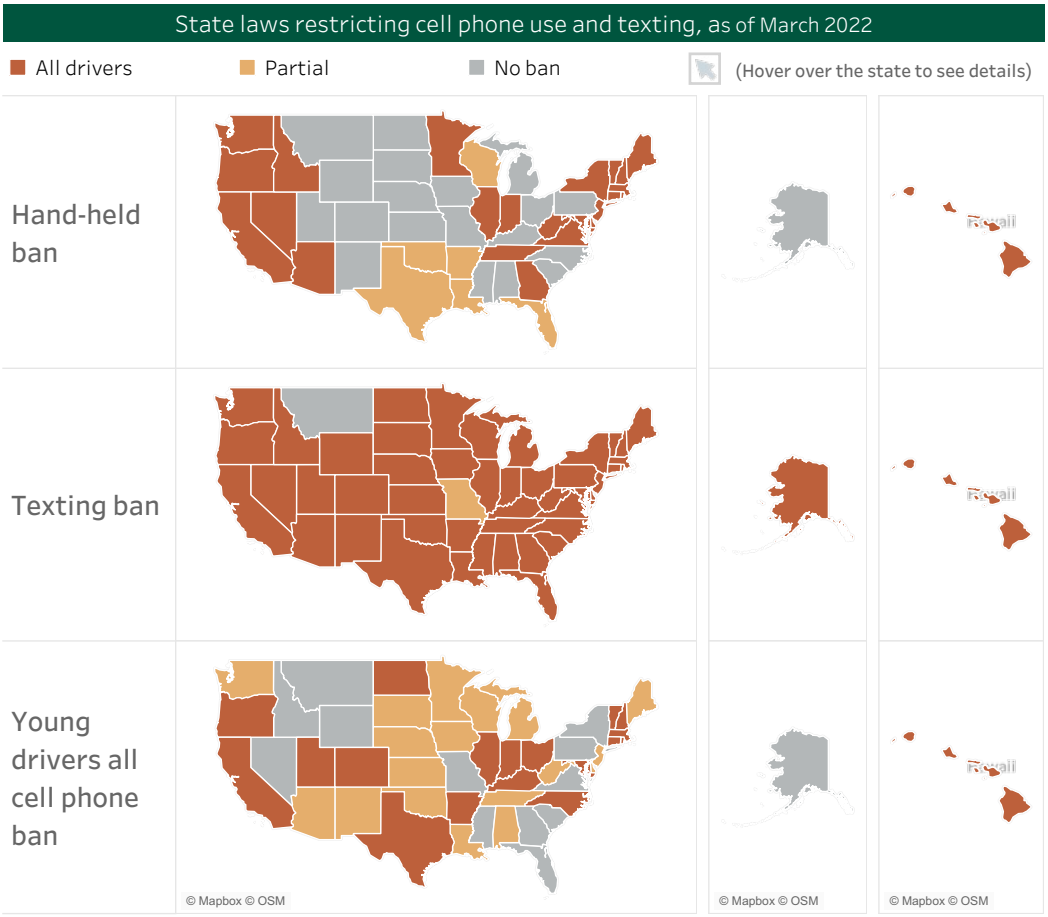
A review of studies has shown that there are 4 major risk factors for emergency vehicle accidents (Hsiao et al., 2018):

1. Driver-related factors.
2. Task-related factors.
3. Vehicle-related factors.
4. Environmental-related factors.

Driver-related factors

Training and experience. Emergency vehicle operators are generally required to take emergency vehicle operation courses (EVOC) prior to being certified to drive an ambulance. As a result, studies have shown little association between ambulance collisions and factors such as age or gender. The largest driver-related risk factor was determined to be the level of individual experience and training, with the highest rates of emergency medical vehicle crashes occurring among operators with 3 years of experience or less (Custalow & Gravitz, 2004). These risks can be mitigated through appropriate training and education. Ambulances come in many shapes and sizes, so it is especially important that practitioners are trained and familiar with the particular models they will be operating.

Driver behavior. When a call comes in, emergency practitioners understand the need to respond in rapid fashion. Time can play an important factor in patient treatment and overall outcomes. Responding under the pressure of time can influence driver behavior. The sense of urgency, combined with the use of warning lights and sirens can result in a false sense of invincibility ("siren syndrome") for the operator, which can result in risky driving behavior (USFA, 2014a). Emergency driver training and experience can actually lead to operator overconfidence, which can contribute to dangerous driving and additional risk taking. And studies have shown that once an operator has a crash, it puts them at higher risk of having another crash (Hsiao et al., 2018).



Source: Insurance Institute for Highway Safety. Downloaded in March 2022. https://www.iihs.org/topics/distracted-driving#cellphone-laws

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Additionally, emergency vehicle operators must be aware of the unpredictable driving behavior of the other operators on the road.

Distracted driving. The NHTSA defines distracted driving as when a driver diverts their attention away from driving the vehicle to engage in another task. Distracting tasks can be categorized in 3 different ways:

1. **Visual distraction:** Any task that causes the vehicle operator to look away from the roadway in order to obtain visual information.
2. **Manual distraction:** Any task that may require the vehicle operator to remove their hands from the steering wheel in order to complete a task.
3. **Cognitive distraction:** Any mental workload that shifts the vehicle operator's focus away from driving.

Task-related factors

Time pressure. The response and transport time pressures imposed on emergency medical practitioners is considered one of the most hazardous risks of emergency response vehicle operation (Hsiao et al., 2018). In general, high-speed driving, often exhibited during emergency response, has high correlation rates with both the rate and severity of vehicle collisions. The combination of time pressure and high-speed driving can lead to reduced vehicle stopping time, premature decision-making and increased stress level of vehicle operators. Studies have shown that levels of stress hormones (e.g., cortisol) can be as much as 30% higher during emergency response, which can have deleterious impacts such as impaired cognitive function and increased blood pressure (Lundberg, 2005).

Secondary demands. Emergency vehicle operators are often required to multitask during the course of emergency response. Such multitasking may include (Hsiao et al., 2018):

- Having to operate warning lights and siren devices.
- Interact with navigational systems.
- Interact with vehicle mounted computer dispatch and information systems.
- Engage with passengers.
- Utilize communication devices such as internal speaker systems and external radio systems.

These additional burdens can require the operator to shift focus from the road and can cause slower reaction times. Operators' utilization of vehicle technology was shown to be a contributing factor in 70% of national fatalities involving emergency vehicle response (Yager et al., 2015).

Impact of long shift hours. EMS practitioners are often required to work shifts of 24 hours, which can lead to increased mental stress and overall fatigue. This can manifest in delayed reaction times, reduced ability to recognize hazards, impaired decision-making and reduced visual acuity (USFA, 2014a).

Vehicle-related factors

Vehicle characteristics. Ambulances come in a variety of shapes and sizes. Typically, ambulances vary from traditional passenger vehicles in numerous ways, including having

higher gross vehicle weights, higher center of gravity, lower acceleration and deceleration as a result of their mass, and reduced visibility. These characteristics can make ambulances harder to control, increase the chance for traffic collisions, increase the risk of rollovers and result in more severe injuries and fatalities when collisions occur (Hsiao et al., 2018).

Visibility. Ambulances are generally required to be painted in highly visible colors and display retroreflective or fluorescent materials (USFA, 2014a). However, identifying emergency vehicles may still be challenging for other drivers depending on the prevailing environmental conditions. For instance, light-colored vehicles are more visible in daylight and during clear weather, reflective markings are most effective at night but only when there is an external light source, and fluorescent colors are most effective during daylight hours because they rely on ultraviolet light (USFA, 2014b).

Environment-related factors

Roadway design. Intersections have been demonstrated to pose increased risk of crashes during emergency response, and the larger an intersection is (e.g., the more lanes or junctions) further increases the risk of traffic conflicts (Polders et al., 2015). Ambulances, due to their size and weight, may not be as maneuverable as a passenger vehicle and face additional challenges when having to navigate intersections. While traffic signals are designed to increase safety and allow for orderly passage through an intersection, it is impossible for an emergency vehicle operator to predict if other drivers will comply with these signals or if they will allow for emergency vehicle right of way use through the intersection. The sheer weight and inertia of an ambulance increases stopping times, making it difficult for an emergency vehicle operator to make sudden adjustments based on the actions of other motorists. Speed limits also play a factor, as a 2013 study found that more severe collisions occur at intersections on roads with higher speed limits (Abdelwanis, 2013).

Driving in inclement weather. Having to operate a vehicle in any environmental condition that reduces the emergency operator's visibility or the vehicle's traction with the road may be among the most dangerous condition in which emergency vehicle operators must operate. Due to the nature of the services they deliver, EMS practitioners have little choice but to respond, even during the worst of conditions. In fact, it is likely that call volume may actually increase during inclement weather conditions. EMS agencies may see a greater demand for service as civilians are unwilling to drive themselves to seek medical treatment regardless of the acuity of illness or injury (IAFF, 2010).

Numerous studies have demonstrated the effect of adverse weather on vehicle crashes. Research has shown that snow increases crash rates by as much as 84% and corresponding injury rates by approximately 75%, while rain increases crash rates by as much as 71% and corresponding injury rates by approximately 49% (Qiu & Nixon, 2008). However, it should be noted that the majority of emergency vehicle crashes actually have been shown to occur on dry roads and in clear weather (Custalow & Gravitz, 2004; NHTSA, 2011).

"Wake effect" crashes. A "wake effect" crash pertains to secondary incidents occurring as a result, and in the wake, of an active emergency response. These collisions occur as a result of an emergency response vehicle's transit but does not directly involve the emergency vehicle itself. Very little is known about the exact number of EMS vehicle crashes involved in wake effect crashes (Clawson et al., 2012).

Often a wake effect crash involves a vehicle that stops to give an EMS vehicle the right of way and is hit by another vehicle. Sometimes, a wake effect crash happens when a vehicle is being pushed or forced into the traffic at a crowded intersection by an ambulance engaging warning lights and sirens.

Little is known about non-crash incidents involving EMS vehicular operations. These types of incidents include when an EMT in the back of the ambulance is injured by the ambulance's sudden stop or sharp turn. High-profile risks for EMS responders, patients and the public should be identified and prioritized (Clawson et al., 1997).

Reducing the risks of ground transportation

Through proper education and training, the risk of emergency vehicle collision, and the resultant injuries, can be reduced. When operating an emergency response vehicle, EMS practitioners should (Clawson, 2017; Hsiao et al., 2018):

- Ensure proper use of seatbelts and patient restraint systems for all occupants in the vehicle.
- Always operate emergency vehicles with due regard for the safety of the other drivers on the road, as well as for the safety of the community at large.
- Always follow state and local laws and SOPs dictating the operation of emergency vehicles during non emergency response, emergency response and patient transport.
- Exercise responsible judgment and judicial use of warning lights and sirens. The mode of response (e.g., lights and sirens) should be dictated by the level of appropriate response. Emergency response should only be initiated when the patient's condition warrants it.

- Use all equipped warning lights and sirens throughout the duration of emergency response.
- Employ defensive driving techniques and visually confirm that all approaching vehicles have come to a complete stop prior to passing through an intersection.
- Recognize that, even when operators are allowed exemption from standard traffic laws during emergency response, it does not give them the absolute right of way.
- All ambulance crashes involving EMS vehicles should be investigated. EMS leaders should also report a summary of the incident and any lessons learned.
- Internal policies should be reviewed and revised to reflect and mitigate any identified risks.

Technology support

Traffic control devices. These devices provide emergency vehicle operators, or even dispatchers, control over traffic signals. This allows for the preemption of traffic lights (e.g., changing a green light to red) to ensure emergency vehicles safe passage through intersections during emergency response.

Automatic vehicle location (AVL) and computer-aided dispatch (CAD). AVL and CAD systems can reduce response times by identifying the safest and fastest response routes.

Driving simulators. Studies have shown that driving simulators can increase an operator's ability to detect and identify potential hazards (Underwood et al., 2011). One study involving EMS students showed that 82% were in favor of the use of the simulator and said they were beneficial to their training (Lindsey, 2004). Driving simulators can benefit the EMS community in a number of ways:

- An ambulance does not have to be taken out of service in order to complete driver training.
- An instructor is not required for simulator training, while conducting an actual field-driving course requires at least 2 fully credentialed driving instructors.
- Simulators may help reduce damage to ambulances and/or the course props (e.g., traffic cones) that can incur through practical driver training.
- Simulators can safely be used at any time of the day and in any type of weather.

It is important to note that driver simulators should be used in conjunction with other practical training, such as an EVOC.

Air transportation

Determining the need for a medical helicopter

EMS field providers must evaluate potential risks and benefits when considering an air medical services request. The risk-benefit profile of summoning an aircrew involves an appreciation of the dangers during takeoff and landing and current weather conditions. When considering the use of a helicopter air ambulance, responders should ask themselves the following questions:

- Will the use of the helicopter bring unique and specialized skills that are not available to a life-threatened patient by ground ambulance personnel or a closer hospital?
- Do the weather conditions and/or the terrain present an unnecessary risk to the medical aviation crew?
- Is there a safe landing zone within a reasonable distance from the scene?
- Are sufficient personnel on scene to secure a safe landing zone?
- Are there multiple patients and/or insufficient transport resources at the emergency scene?
- Will prolonged transport times threaten the patient's outcome?

Reducing the risks of air transportation

Approaching the helicopter

EMS practitioners should only approach a helicopter when the helicopter personnel have signaled it is safe to do so. It is also important for responders to become familiar with the make and model of the helicopter that is being used by the responding agency (if unknown, many EMS helicopter providers will conduct familiarization classes on request).

In some circumstances, helicopters are loaded from the rear of the aircraft near the fuselage. This loading site presents some danger for EMS practitioners during hot load operations as a distracted provider or bystander may be unaware of the danger zone near the tail rotor. In other circumstances, patients are loaded at a right angle into the side of the helicopter. Depending on the pitch of the blades, the direction and strength of the wind, and the slope of the landing zone, rescuers may be vulnerable to the danger zone by the main rotor.

Emergency personnel and bystanders

The responsibility for securing a safe landing zone rests on the incident commander and the EMS practitioner who have summoned the helicopter. Therefore, emergency personnel should be concerned about bystanders' safety during medical helicopter take-off and landing. Pedestrians and/or vehicles that encroach upon the landing site or enter the approach patterns can compromise takeoff or landing safety. Numerous events have been recorded where an ambulance vehicle strikes the rotor blades of a medical helicopter and disables the aircraft. Bystanders or unaffiliated vehicles that approach an improperly secured landing zone may force the medical helicopter pilot to make an evasive maneuver that might result in an aviation mishap or crash.

Landing zone

Local ground ambulance personnel, police and firefighters are often the best source for finding or recommending a suitable landing zone for an emergency medical helicopter. If they are not predesignated, there may be a park, parking lot, field or, in extreme cases, a highway where the emergency landing can safely occur. For nighttime landings, the dangers of strobes or pointed spotlights should be considered. When directed at the aircraft's cockpit, these lights could potentially obscure or temporarily blind the pilot's night vision, especially if they are using night vision goggles. Helicopter landing zones for most aircraft require a minimum of 60 feet by 60 feet during daylight operations in clear weather and 100 feet by 100 feet during nighttime operations. The landing zone should be clear of obstructions including overhead wires, trees and debris that may get caught in the rotor.

Additionally, the slope on which the helicopter will land should generally be no more than 4% to 6% as the pitch of the rotor blades may put a rescuer into the danger zone of the main rotor. Areas that make excellent landing zones for medical helicopters are:

- Sports fields, preferably with fencing to prevent bystanders from accessing the action area.
- Predesignated landing spots that have been evaluated using GPS and cleared by the air medical service.
- Approved helipads with fencing, properly lighted markings and a hard surface.

To ensure safe helicopter operations during landing and takeoff, a landing zone coordinator or the heli-spot manager should oversee the site safety and security access. They should also ensure the presence of proper markings for the incoming helicopter so the pilot can locate the landing site.

Communication and coordination with the arriving pilots and flight team are vital to increase safety on scene. This is conducted by utilizing a separate radio channel. Personnel facilitating the helicopter's landing on the ground should also be properly equipped using eye protection and a helmet, protective clothing with reflective markings, and ideally a flashlight with an aviation attachment that does not compromise the pilot's vision. OSHA requires agencies to conduct annual refresher courses on helicopter safety.

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Section VI: Tying it all Together

EMS practitioners are taught on day 1 of EMT and paramedic school that safety is the core tenet of their profession. Ensuring scene safety and personal safety is paramount to preserving the lives of personnel and patients. While it is important to abide by safety regulations and guidelines set forth by organizations like OSHA, IAFF, CCOHS, NFPA, NIOSH and NHTSA for operating in the field, it is equally important to develop a culture of safety within fire and EMS departments.

Understanding how to complete thorough risk assessments for the purpose of risk management is an important first step of this process.

From an operational standpoint, the development of a successful safety culture is fostered by support from senior management, lack of barriers to performing safety behaviors, orderliness of the workplace, minimal conflict, frequent safety-related training and feedback, and PPE availability. From a cultural standpoint, developing a "just culture" requires department leadership to foster an environment of shared accountability. Employees should be encouraged to report medical errors so they can learn how to be better practitioners, and employers should provide guidance based on those mistakes rather than issue punishment.

Misunderstandings caused by lack of communication lead to more errors and lack of efficiency. Thus, communication between leadership and practitioners is a critical component to building a strong culture of safety, shared decision-making, minimizing incidents and ensuring crew member safety.

Developing a safety program is another critical component of ensuring safe practices within a department. An effective program will reduce injuries, incidents, damage to facilities and equipment, and hazardous materials exposures. NFPA 1500 provides guidance on developing a robust safety program. Guidelines for these programs include implementing occupational safety practices and a safety training program for employees, maintenance of equipment and PPE, establishing member assistance programs, and implementing an incident management system. NFPA 1500 also requires each department to have a safety officer who is responsible for meeting OSHA standards, conducting safety training, reporting accidents and approving safety apparatuses and PPE.

To ensure EMS practitioners are utilizing the most optimal safety practices, it is critical to monitor safety trends through data collection and analysis. The most frequently utilized systems are the NFFNMRS, FIRST, E.V.E.N.T. and NEMSIS. These reporting systems help scientifically evaluate current safety practices and whether changes need to be made to optimize those practices.

Upholding safety practices also encompasses maintaining physical and mental health. Situational awareness, using proper lifting and maneuvering techniques, and training

on the response to and de-escalation of violent patient scenarios will help reduce risk of common physical injuries and lost days of work among EMS practitioners. It is also imperative that practitioners wear seatbelts and secure patients with shoulder straps and lap belts to reduce the risk of injury or death to all occupants in the event of an ambulance crash. Additionally, having peer support programs, EAPs and CISM in place is necessary to ensure practitioners have avenues to improve and maintain their mental health. PTS, PTSD, depression and suicide are common issues among EMS practitioners due to the stressful nature of their work. Without intervention, employees may need to take leave, resign or work less hours, so it is imperative that departments provide sufficient supportive systems to ensure their mental wellness. Resilience training has also proven to be a protective factor in preventing mental health issues.

Infection control is another critical component to practitioner safety as infectious diseases pose a significant threat in the field, as observed during the COVID-19 pandemic. Infection control best practices involve frequent hand-washing, equipment and ambulance disinfection, proper PPE usage, and knowledge of microbial transmission. Similarly, education on handling hazardous materials incidents is necessary to protect EMS practitioners on hazardous materials scenes. They should be well-versed in preventing exposure to hazardous materials with PPE, knowing decontamination procedures and treating exposure to these materials. In the same vein of protective wear, the EMS practitioner should follow NFPA 1999's guidelines on proper uniforms, footwear and head protection in environments during rescue operations or environments where falling debris is a hazard. It is also important for practitioners to wear high-visibility safety vests for highway incident response to prevent being struck by vehicles. Lastly, body armor and ballistic armor should be considered for fire and EMS crews that frequently face violent patients, shootings or crime scenes.

Outdoor operations require heightened situational awareness. Arrival to the scene should involve ensuring scene safety, the correct address, assessing potentially aggressive bystanders, dangerous animals on scene and preparing to call for law enforcement as soon as they are needed. Building a rapport with patients and bystanders upon arrival through welcoming body language, tone and facial expressions helps diffuse heightened emotions and builds trust. Practitioners should be aware of points of egress in the event they must escape a violent situation. Larger-scale outdoor operations require additional skill sets. For example, traffic incidents require knowledge of appropriate apparatus positioning and managing roadway risks, and mass gathering events require preparation for the response to and management of MCIs or civil unrest.

EMS practitioners often walk onto scenes with little knowledge of what they will encounter. Because it is common for them to experience violent patients or situations, being mentally

and physically prepared for a potentially hostile situation will reduce the risk of injury to the practitioner. However, the preparation should begin at the workplace, then translate to the field. EMS agencies must adopt zero-tolerance policies for workplace violence. SOPs/standard operating guidelines should include objectives that acknowledge the issue of workplace violence, identify internal and external risks to practitioners, and obtain buy-in from management and human resources staff who can arrange programs to train employees in identifying potentially violent scenarios, how to de-escalate or avoid them, and how to protect themselves. NIOSH also serves as a resource for online training programs on workplace violence against health care workers.

As active shooter events, civil unrest and other MCIs become more frequent, it is crucial to train EMS practitioners on how to respond to such events. Conducting multidisciplinary, multijurisdictional exercises is beneficial to all stakeholders who would be involved were a hostile event to occur. Exercises should cover common terminology to use between stakeholders, establishing unified command, RTFs, triage and transport, medical care in the Warm Zone, victim evacuation, and communicating with receiving hospitals.

Learning safe driving practices for emergency medical vehicles is paramount to practitioner and patient safety. If possible, ambulance simulator training is preferred over practicing using an ambulance. In either case, students should learn how to safely drive in emergency mode to avoid wake effect crashes and be alert to other threats on the road. In the event a medical helicopter is considered for patient transport, EMS practitioners should evaluate the risks and benefits before requesting air medical services. They should also be trained in determining the best landing zone nearby an incident scene, ensuring bystander and emergency personnel safety during landing, and how to properly approach helicopters upon their landing.

Lastly, this “EMS Safety Practices” manual is intended to provide information to enhance the health and safety of the EMS practitioner to support the reduction of occupational illness and on-duty injuries and fatalities.

Acronyms

ACEP	American College of Emergency Physicians
ACF	All Clear Foundation
ADA	Americans with Disabilities Act
AIS	American Institute of Stress
ANSI	American National Standards Institute
ANSI/ISEA	American National Standards Institute/International Safety Equipment Association
APA	American Psychological Association
ASD	acute stress disorder
ASHER	Active Shooter/Hostile Event Response
ASPR TRACIE	Assistant Secretary for Preparedness and Response Technical Resources, Assistance Center, and Information Exchange
AVL	automatic vehicle location
BGL	blood glucose level
BLS	Bureau of Labor Statistics
BPE	ballistic protection equipment
C. diff	Clostridium difficile
CAD	computer-aided dispatch
CBT	cognitive behavioral therapy
CCOHS	Canadian Centre for Occupational Health and Safety
CDC	Centers for Disease Control and Prevention
CISM	critical incident stress management
CLIR	Center for Leadership, Innovation, and Research in EMS
CRM	crew resource management
CVD	cardiovascular disease
DICO	Designated Infection Control Officer
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
E.V.E.N.T.	EMS Voluntary Event Notification Tool

EAP	employee assistance program
ED	emergency department
EMR	emergency medical responder
EMS	emergency medical services
EMT	emergency medical technician
EPA	Environmental Protection Agency
ERSI	Emergency Responder Safety Institute
EVOC	emergency vehicle operation courses
FDNY	Fire Department of New York
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRST	Center for Firefighter Injury Research and Safety Trends
FSTAR	Firefighter Safety Through Advanced Research
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRSA	Health Resources and Services Administration
HVSA	high-visibility safety apparel
IAFC	International Association of Fire Chiefs
IAFF	International Association of Fire Fighters
IHP	improved hydrogen peroxide
MCI	mass casualty incident
MHFA	Mental Health First Aid
MRSA	methicillin-resistant Staphylococcus aureus
MUTCD	Manual on Uniform Traffic Control Devices
MVC	motor vehicle collision
NAEMSP	National Association of EMS Physicians
NAEMT	National Association of Emergency Medical Technicians
NASEMSO	National Association of State EMS Officials
NEMSAC	National EMS Advisory Council
NEMSIS	National EMS Information System
NEMSQA	National EMS Quality Alliance

NFFF	National Fallen Firefighters Foundation
NFFNMRS	National Fire Fighter Near-Miss Reporting System
NFPA	National Fire Protection Association
NHTSA	National Highway Traffic Safety Administration
NIFC	National Interagency Fire Center
NIJ	National Institute of Justice
NIMH	National Institute of Mental Health
NIOSH	National Institute for Occupational Safety and Health
NREMT	National Registry of Emergency Medical Technicians
NVFC	National Volunteer Fire Council
OB	obstetrical
OPIM	other potentially infectious materials
OSHA	Occupational Safety and Health Administration
PAPR	powered air purifying respirator
PEL	permissible exposure limit
PFA	psychological first aid
PPE	personal protective equipment
PSP	peer support provider
PTS	post-traumatic stress
PTSD	post-traumatic stress disorder
RCA	root cause analysis
REACT	Recognize, Evaluate, Advocate, Coordinate and Track
REMM	Radiation Emergency Medical Management
RTF	rescue task force
SCBA	self-contained breathing apparatus
SOP	standard operating procedure
TB	tuberculosis
TIM	traffic incident management
TTC	temporary traffic control
USFA	U.S. Fire Administration

VRE	vancomycin-resistant enterococcus
WHO	World Health Organization

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