A Research Study of Ambulance Operations and Best Practice Considerations for Emergency Medical Services Personnel

First Responders Group

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A Research Study of Ambulance Operations and Best Practice Considerations for Emergency Medical Services Personnel

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Executive Summary

The emergency medical services (EMS) community faces many challenges in providing patient care while maintaining the safety of their patients and themselves. One factor that influences patient care and safety is the ability of the EMS provider operating the ambulance to quickly but safely maneuver to the site of the medical emergency and subsequently transport the patient(s) to the hospital. The Department of Homeland Security (DHS) and the Emergency Medical Services Community identified a need to research best practices for ambulance operators and identify safety gaps. This research report coincides with the DHS Science and Technology Directorate's First Responders Group and the Resilient Systems Division's partnership with the National Institute of Standards and Technology, the National Institute for Occupational Safety and Health, BMT Designers and Planners (D&P), and Carlow International's project to develop ambulance safety and design standards and recommendations. The project provides design guidance for ambulance patient compartments for crashworthiness, patient safety and comfort, and EMS provider safety and performance. This research report summarizes the efforts of this team to identify best practices and considerations for use and consideration by the EMS community.

A team comprised of D&P and Carlow International used human performance requirements analysis, literature reviews and driver (ambulance operator) interviews to identify ambulance operator tasks required in responding to an incident, transporting patients and potential inhibitors to performance and safety. This research report summarizes best practice information received and consolidates it in an appendix for consideration by the EMS community.

Disclaimer: This research report does not establish DHS policy or best practices. The information collected in this research is intended to inform the EMS community of similar practices, vehicle safety and operations that may be considered in the development of standard operating procedures and safety programs.

Table of Contents

List of Tables

1.0 RESEARCH INTRODUCTION

1.1. Background

As part of an on-going effort sponsored by the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) to develop standards, guidelines and concepts for improving ambulance patient compartment design, BMT Designers and Planners (D&P) and Carlow International performed research into ambulance driver (operator) best practices. This research effort focused on behaviors of ambulance drivers that can impact the safety of their crew in the patient compartment, the patient being transported, and the drivers themselves. Identifying and documenting best practices for improved driver performance will further advance DHS' efforts to improve EMS performance and safety. The following report documents the research performed and presents ambulance driver best practices for consideration and use.

One such study of ambulance crashes analyzed 27 fatalities of emergency medical services (EMS) workers contained in the Fatality Analysis Reporting System (FARS) database.[1] The report indicated that the majority of fatalities occurred during favorable weather and environmental conditions: 28 percent of the crashes occurred at an intersection; and 72 percent occurred while operating the ambulance over the posted speed limit or out of its proper lane. In addition, 48 percent of the ambulance operators did not maintain good driving records, with one driver under the influence of alcohol at the time of the crash. Seven of the drivers did not wear seatbelts. These instances represent just a sample of operator behaviors that led to an injury or death of an EMS team member, patient, operator or all occupants.

1.2. Objective

This research sought to document ambulance operator best practices to aid in the reduction and incidence of accidents due to operator error, inadequate skills and abilities, or poor practices.

2.0 RESEARCH TECHNICAL APPROACH

The technical approach consisted of the following activities:

[1] Proudfoot, S.L. (2005). Ambulance crashes: Fatality factors for EMS workers. Emergency Medical Services *34,6,* 71-74.

- Conduct an ambulance operator human performance requirements analysis (HPRA);
- Conduct a literature review; and
- Complete user research, including EMS provider interviews.

2.1. Human Performance Requirements Analysis (HPRA)

The D&P and Carlow International team conducted an HPRA to identify ambulance operator task performance requirements under a range of representative and worst case scenarios. An HPRA decomposes a mission performed by humans into information about functions, tasks, criticality of the tasks to the success of the mission, and requirements for successful task performance. The HPRA sought to analyze the tasks performed by the ambulance operator and factors contributing to success or failure. Each step in the HPRA is described below.

- Define Functions – In performing the HPRA, the team identified 14 overarching ambulance operations functions, including pre-run preparation, receiving a call, driving to the incident location (scene), and conducting operations at the location (Table1).

Table 1 – Primary Ambulance Operations Functions

Ambulance Operator Functions
1. Pre-run preparation
2. Receive a call
3. Depart the station
4. Drive to the scene
5. Arrive at the scene
6. Conduct operations at the scene
7. Prepare to depart from the scene
8. Drive to receiving facility with no one in the passenger seat
9. Arrive at the receiving facility
10. Perform operations at the receiving facility
11. Depart the receiving facility
12. Drive to the station
13. Arrive at the station
14. Conduct post run operations at the station

- Define Sub-functions – The team then derived sub-functions (Table 2) by decomposing ambulance operator functions. For example, from pre-run preparation, the team derived the following sub-functions: inspect vehicle exterior, inspect vehicle interior, verify vehicle readiness and check the inventory of medical equipment and authorized medications.

- Identify Tasks – The team decomposed tasks from the sub-functions to define activities at the lowest level, such as inspect tires, check fuel and check fluids.
- Rate Task Criticality – The criticality of each task was rated, with tasks deemed to be highly critical to operator safety denoted with a checkmark.
- Identify Task Performance Requirements – For highly critical tasks, the team identified performance requirements, including the information needed to conduct the task, decisions required, and the actions needed for the task. For example, while inspecting the vehicle interior, the following task performance requirements would apply:
  - Information – what items should or should not be in the cab?
  - Decision – is everything in place and secured?
  - Actions – are all items in the cab in proper working order?
- Identify Perceptual and Cognitive Skills – The team identified the ambulance operator's perceptual and cognitive skills associated with task performance. For example, the ability to conduct inspections in the dark, make decisions, and control the inspection process were associated with vehicle inspections.
- Identify Training Requirements – The knowledge and skills for task proficiency were identified, e.g., knowledge required to conduct vehicle inspections and skills to accurately perform inspections.
- Identify and Prioritize Performance Risks – Based on the identified tasks, the team identified and prioritized performance risks and determined potential mitigations to resolve these risks. Of the 270 tasks, 235 were classified as being moderately critical. As an example, a risk for performing vehicle inspection would be failing to identify a problem, which was rated as a moderate priority. Mitigations for this risk included developing ambulance operations training and procedures for conducting inspections.
- Identify Ambulance Operator Interface Changes – The team defined an operator interface as either a design modification (e.g., hardware, software and workspace) or standard operating procedures (SOPs). An example is developing an SOP for inspecting the interior of the cab, detailing equipment requirements and specifying their location.

Operator performance tasks, performance risks and potential mitigation actions helped to provide a framework for the subsequent research tasks of conducting a literature review and personal interviews with EMS personnel. Table 2 provides an example of the HPRA form.

2.2. Literature Review

The team conducted literature reviews of periodicals, conference papers and technical reports. This provided an understanding of the challenges ambulance operators face, potential sources of human error, and the associated training and technology to mitigate these challenges. Some of the topics examined included operator fatigue, communications, vehicle inspection, maneuvering through intersections and ambulance operator monitoring systems. The literature review provided a basic understanding of the ambulance operations environment. The team used this information to inform and direct subsequent ambulance operator interviews and formed the foundation for the consolidation of operator best practices for consideration by the EMS community.

2.3. User Research

The team collected input from EMS personnel through interviews. Short informal interviews were conducted with attendees at the 2012 EMS World Expo in New Orleans, Louisiana. This provided the opportunity to discuss EMS ambulance operations policies with operators from various U.S. geographic regions, as well as rural and private industry practices. The team interviewed a total of 16 attendees. They responded to questions on several aspects of ambulance operations including:

- Training;
- Driving procedures;
- Use of restraints;
- Lights and sirens policy;
- Navigation resources;
- Data terminal usage;
- Performance monitoring;
- Accident history and causation;
- EMS ambulance operator distractions; and
- Accident avoidance methods.

Table 2 – Examples from the HPRA

Ambulance Operator Function	Driver Sub-Function	Driver Tasks	Criticality (impact on safety)	Task Performance Requirements			Operator Skill Requirements		Training Requirements		Risk Assessment			Operator Interface Changes	
				Information	Decisions	Actions	Perceptual	Cognitive/ Control	Knowledge	Skills	Risk	Priority	Mitigation	SOP	Design Modifications
	1.2 Inspect the vehicle interior	1.2.1 Inspect the interior of the cab	√	Information on what should be and what should not be in the cab for the next call; are items in the cab secured.	Everything in place and secured and nothing out of place.	Identify what is needed in the cab. Note working order of all items in the cab. Items in the cab are properly secured.	Conduct inspection in the dark.	Control inspection process.	How to conduct inspections. What should be in the cab? What should be secured?	Accuracy of inspections.	Fail to identify a problem.	Moderate	Driver training and procedures for conducting inspections.	Need a standard procedure for inspecting the interior of the cab, knowing what should be where, and what should not be there.	
		1.2.2 Identify maintenance requirements	√	Preventive maintenance activities required - cleaning, replacing. Corrective maintenance activities - remove, replace, repair	Determine what maintenance is required.	Identify what maintenance actions are required, when they should be performed, and by whom.	Visual and auditory indicators.	Control identification of maintenance requirements.	How to identify maintenance requirements?	Accuracy of identifying maintenance requirements.	Fail to identify maintenance requirements.	Moderate	Driver training and procedures to identify maintenance requirements.	Standard procedures to identify maintenance requirements.	

Based on the feedback from the initial interviews, the team reviewed and modified the survey questions. The team then interviewed 20 EMS equipment operators at their stations in Stafford County, Virginia. On average, the operators served as EMS professionals for nine years and possessed more than seven and a half years of ambulance operations experience. The team conducted additional telephone interviews with several providers from various geographical regions in the United States to collect data on ambulance operations safety. Additionally, representatives from the Transportation Research Board and the National Highway Traffic Safety Administration (NHTSA) provided additional insight.

3.0 RESEARCH RESULTS

The team aggregated all of the data from the literature review, HPRA and interviews to create a list of 49 best practice considerations. They were distributed across ambulance operations topics in three general categories: training development, SOPs and communications, and defensive driving. Table 3 lists the best practices in each category.

Table 3 – Ambulance Operator Best Practice Topics

Category	Best Practice Topics
Defensive Driving	Ambulance Handling
	Blind Spot Handling
	Changing Lanes and Passing
	Distraction Management
	Driver Fatique
	Intersection Handling
	Near Miss Recovery
	Patient Compartment Awareness
	Safe Presence
	Safe Speed
	Turning
	Weather
SOPs and Communications	Communication
	Driver Compliance

Category	Best Practice Topics
	Driver Qualification
	Accident Encounters
	Following Distance
	Lights and Siren
	Mirrors
	Navigation
	Parking
	Performance Monitoring
	Right of Way
	Spotter
	Vehicle Readiness
Training Development	Case Studies
	Refresher
	Standardization

The following summarizes the best practices derived from the research for improving ambulance operator performance. A consolidated list of best practices for consideration and implementation by the EMS community can be found in Appendix A.

3.1. Defensive Driving

Ambulance operators must be effective at controlling their vehicles in varying environments and conditions without compromising the safety of ambulance occupants or other road users. The skills needed to achieve this level of effectiveness are subsumed under the concept of defensive driving. Defensive driving includes: an emphasis on awareness of other drivers' potential actions and intentions, driving to avoid collisions and accidents, and reducing the damage from unavoidable accidents, regardless of conditions and the actions of other drivers. Effective defensive driving also requires ambulance operators to maintain an awareness of blind spots, safely change lanes, cross intersections, and maneuver the vehicle. Ambulance operators must also be able to manage fatigue and other distractions, while handling the ambulance in varying weather conditions.

Best practice considerations for Defensive Driving included:

- *Ambulance Handling* – Operators should become familiar with ambulance handling qualities by driving the vehicle in non-emergency situations, while maintaining optimal vehicle handling qualities. This includes ensuring proper vehicle maintenance.
- *Blind Spot Handling* – Operators should ensure that every effort has been made to reduce the risks of blind spots through the use of wide angle mirrors, turning the head to visually check for obstacles, and use spotters when backing up.
- *Changing Lanes and Passing* – Operators should check the side view mirrors to ensure the lane is clear and activate the turn signal when changing lanes or passing.
- *Managing Distractions* – Operators should seek to minimize distractions from cell phones or dispatching systems and avoid tasks such as reading, writing or looking at maps while driving.
- *Management of Driver Fatigue* – Ambulance operators should work to reduce fatigue by getting sufficient rest and following rotating shifts with adequate off-duty time.
- *Maintain a Safe Following Distance* – Ambulance operators must maintain a safe following distance, applying the three-second rule to maintain a safe distance between the ambulance and the vehicle in front of them.
- *Proper Intersection Transverse* – When traversing intersections, ambulance operators should scan the intersection for possible hazards, observe traffic in all four directions, slow down after detecting any potential hazards and avoid using the opposing lane of traffic.
- *Near Miss Recovery* – Following a near miss, a driver should regain control so as not to put himself or herself in position for another accident risk. If a collision is unavoidable, the driver must decide what to do to reduce the risk and resulting collision damage.
- *Patient Compartment Awareness* – Ambulance operators should maintain awareness of patient safety and comfort and EMS provider safety and effectiveness. Operators should warn the EMS provider in the patient compartment of railroad crossings, rough roads or other environmental factors. They should also convey the operation of turn signals and the presence of the driver's foot on the brake even if not fully activated.
- *Safe Presence* – Ambulances should be easily recognizable using features such as retroreflective material, fluorescent colors, contour markings, logos and emblems.
- *Safe Speed* – EMS response vehicles should not exceed posted speed limits by more than 10 miles per hour, and EMS response vehicles should not exceed posted speed limits when proceeding through intersections with or without a signal control device.

- *Vehicle Turning* – When turning the vehicle, operators should engage the turn signal 100 feet before the turn in urban traffic and 300 feet in rural or highway settings. Operators should also keep the turn signal on through the turn and verify that it is off after completing the turn maneuver.
- *Inclement Weather* – When driving the ambulance during inclement weather, operators should keep the windows and windshield clear, turn on low-beam headlights and windshield wipers, reduce speed and maintain a greater distance from the vehicle ahead. Good operators should avoid fast turns and quick stops. Operators should also maintain a cooler with energy bars, water and other snacks, as well as blankets, in the event of becoming stranded or encountering stranded motorists.

3.2. Standard Operating Procedures (SOPs) and Communications

The second category of ambulance operator best practice considerations is SOPs and Communications. An SOP is defined as the approved standard to be followed in carrying out a given operation or in a given situation. SOPs can come in the form of set rules or checklists. This research recommends that all SOPs address procedures for operating in poor weather conditions.

Research found that ambulance driver performance can be significantly enhanced by implementing technology that supports situational awareness while encouraging safe operating practices. At the same time, technology can negatively impact ambulance operator performance by acting as a distractor.

Best practice considerations for SOPs and Communications included:

- *Communication Devices and Protocols* – When the ambulance is in motion, operators should minimize communication with the EMS provider in the patient compartment, as well as radio communications with dispatch or the hospital. Communications between the driver and others should employ a constrained language vocabulary that allows verbal communications to be quickly and accurately performed. Ambulance operators should be in communication (verbal, hand and eye) with EMS providers as well as others at the scene upon departing from a parked position.
- *Operator Compliance* – Ambulance operators are expected to comply with all departmental regulations.
- *Ambulance Operator Qualifications* – Operators must meet all state and departmental qualifications to drive an ambulance. They must maintain a good driving record, be physically fit and obtain certification to operate an emergency vehicle.
- *Encountering an Accident* – Upon encountering an accident en route to a call, ambulance operators should contact dispatch. If the accident involves non-life threatening injuries, the operator should proceed with the response to the original

call. If life-threatening injuries are present, EMS personnel should administer aid and notify dispatch to send another unit to the original call.

- *Lights and Sirens* – Based on the initial information from dispatch or local protocols, the use of lights and sirens may be required. After initial patient care is rendered, the senior EMS professional should assess the patient's severity and level of stabilization to determine if lights and sirens are needed during patient transport. Use of lights and sirens should be upgraded or downgraded as needed over the course of the transport.

- *Mirrors* – At the beginning of the shift, and as necessary, the ambulance operator should adjust side view mirrors. Mirrors and windows should be kept clean as dirty windows and mirrors reduce available light and cause glare from the light of approaching vehicles or streetlights.

- *Navigation* – Operators should learn the geographic and local conditions, individual characteristics of the operations area, and their organization's procedures to map out the most efficient route to emergency locations. They should also maintain awareness of changes to their routes, procedures to identify local information and consideration of height restrictions. A global positioning system (GPS) navigation system can also be used to develop accurate and efficient routes to the incident scene and hospital.

- *Parking* – Operators should always park the ambulance in a hazard-free area to protect the crew, patient and the ambulance. When parking in a parking space or driveway, drivers should back into the parking area for a safe and efficient exit.

- *Performance Monitoring* – Operators should abide by all departmental policies and state laws, to include wearing seatbelts and complying with traffic laws and speed limits. Operators should not disable or turn off video performance or speed regulation monitoring systems.

- *Right of Way* – On a multi-lane highway, the ambulance operator should not enter the opposing traffic lane until it is safe to do so, while ensuring that oncoming vehicles are aware of the ambulance's presence. Similarly, ambulances should not enter a one-way street against traffic until all opposing traffic is aware of its presence and has yielded the right of way.

- *Spotter* – When backing out of a parking space, a spotter should be used. The vehicle should not move until the spotter is positioned in a safe zone and communicated his or her approval to begin moving by way of a hand signal, and voice, when possible.

- *Vehicle Readiness* – Ambulances must be kept fully stocked and in operational condition. EMS personnel should conduct inspections at the beginning of each shift to ensure that they have all of the supplies required to perform patient care. Any maintenance issues should be promptly noted and reported for resolution in a timely manner.

3.3. Training Development

The third category is Training Development. A training program is most effective when best practices guide the development effort. If executed well, a training program should maximize efficiency, safety, job satisfaction and foster a culture of innovation.

The following best practices should be considered for the development and regulation of EMS operator training.

- *Training Requirements* – The Emergency Vehicle Operations Course (EVOC) should be mandated for all drivers. Drivers should also complete supervised on-the-job and annual refresher training. Drivers should be afforded multiple opportunities to learn and practice common driving maneuvers, such as braking, stopping, making lane changes, driving, backing and parking. These driving skills should further be solidified by on-the-job training.
- *Course Development* – Training should be standardized and tailored to the needs of the department. Technology should also be used to supplement the training.
- *Interactivity* – Driver Practice Courses should be interactive, using real world examples, case studies, quizzes and feedback.
- *Training Course Refinement* – Courses should be updated regularly based on feedback from students and subject matter experts.

1. Appendix A

Ambulance Operations Best Practice Considerations

for Emergency Medical Services Personnel

This list of ambulance operations best practice considerations does not establish DHS policy or best practices. The information collected in this research is intended to inform the EMS community of similar practices, vehicle safety and operations that may be considered in the development of standard operating procedures and safety programs.

Table of Contents

List of Figures

List of Tables

List of Acronyms

AED	Automated External Defibrillator
AHA	American Heart Association
AVOC	Ambulance Vehicle Operators Course
CEVO	Coaching the Emergency Vehicle Operator
CPR	Cardiopulmonary Resuscitation
D&P	Designers and Planners
DHS	Department of Homeland Security
EMS	Emergency Medical Services
EMVC	Emergency Medical Vehicle Collisions
ESC	Electronic Stability Control
EVOC	Emergency Vehicle Operations Course
FARS	Fatality Analysis Reporting System
FEMA	Federal Emergency Management Agency
FMCSA	Federal Motor Carrier Safety Administration
GPS	Global Positioning System
HPRA	Human Performance Requirements Analysis
MPH	Miles per Hour
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
O_2	Oxygen
SIPDE	Scan, Identify, Predict, Decide and Execute
SME	Subject Matter Experts
SOP	Standard Operating Procedures
S&T	Science & Technology Directorate

2. Introduction

An Ambulance Operator Performance Best Practice is one in which (1) the described method is an essential contributor toward maintaining ambulance driver performance and safety, (2) the method has been formalized and standardized through replicated and successful application, and (3) the application of the method has been demonstrated to significantly enhance the performance and safety of the ambulance operator. The purpose of this document is to identify performance areas of concern and for each area, describe best practices based on an accepted practice and research findings which can be incorporated into an EMS organization's training and operation. The following three main areas address the best practices:

- *Defensive Driving* – The Defensive Driving section describes practices for handling blind spots, changing lanes and avoiding distractions to reduce the probability of getting into an accident.
- *Standard Operating Procedures and Communications* – The SOPs and Communications section discuss procedures for maintaining safety such as driver qualification, vehicle readiness and communication. It also discusses the technology used to maintain EMS and patient safety, such as mirrors and performance monitoring.
- *Training Development* – The Training Development section discusses practices to ensure EMS drivers receive adequate training to operate the ambulance.

3. Defensive Driving

Operating an ambulance requires above-average driving capabilities. As the lives of patients in critical condition often depend upon immediate medical attention, emergency vehicle operation is time-sensitive work. Thus, an ambulance operator must demonstrate an exhaustive knowledge of the geography of the EMS operations area. The operator must also be able to quickly devise alternate routes should the path be blocked by something such as a train or a construction project. In some cases, the ambulance operator will be required to navigate swiftly through heavy traffic. Although working under a great deal of pressure, the ambulance operator must always seek to preserve the safety of passengers and the other drivers on the road by effectively controlling the vehicle and mitigating environmental hazards in all situations and conditions. The skills needed to achieve this level of effectiveness are subsumed under the concept of defensive driving. Defensive driving includes techniques of safe driving with an emphasis on the awareness of other drivers' potential actions and intentions, driving to avoid collisions and accidents, or reducing the damage if accidents are unavoidable, regardless of conditions or the action or inaction of other drivers.

A good approach to defensive driving is to remember SIPDE: Scan, Identify, Predict, Decide and Execute.

- *Scan:* Moving one's eye point approximately every two seconds and keeping one's head on a swivel. Drivers should not rely on peripheral vision alone to locate potential hazards; they should continually scan the road while driving to react to potential obstructions or incidents.
- *Identify*: Recognizing any potential hazard that might cause peril, from other vehicles to roadway conditions, weather and obstacles.
- *Predict*: Once a potential hazard is identified, drivers should anticipate what could happen and taking action to avoid a crash.
- *Decide*: Based on a prediction, an ambulance operator determines what the best course of action might be, whether it is slowing down, changing lanes, "covering" the brake pedal or some other defensive driving technique.
- *Execute*: If a predicted hazard becomes a reality, an ambulance operator executes a decision to maximize safety and minimize the chances of a crash.

Ambulance operators may also consider numerous SIPDE strategies to address the "if this, then that" factors. SIPDE is simple and it works; all ambulance operators should make it a part of their daily driving protocols.

The following sections describe best practices associated with the elements of defensive driving, namely: safe ambulance handling, blind spot handling, changing lanes and passing other vehicles, managing distractions, managing fatigue, maintaining a safe following distance, safely traversing an intersection, recovering from a near miss, maintaining patient compartment awareness, maintaining a safe speed, safely turning the ambulance, and dealing with adverse weather conditions.

3.4. Ambulance Handling

The Code of Federal Regulations Section 177.816 on driver training (Office of the Federal Register, 2012) requires that commercial drivers be trained in the operation of the vehicle, including maneuvers such as turning, backing, braking, parking, handling and vehicle characteristics. This includes those that affect vehicle stability, such as effects of braking and curves, effects of speed on vehicle control, dangers associated with maneuvering through curves and high center of gravity, and procedures for maneuvering tunnels, bridges, and railroad crossings. The skills associated with safe driving in response to vehicle characteristics, such as those listed above, are collectively described as responding to vehicle handling qualities.

According to a Transportation Research Board simulation study (Swets and Zeitlinger, 1983), three aspects represent the most important handling qualities of the vehicle traversing the road: (1) easily maintaining the vehicle on the centerline of the road in fast straight running, (2) conducting lane-change maneuvers quickly and safely, and (3) making rapid 90-degree turns smoothly at the corners. The first of these aspects primarily focuses on directional stability, and both the second and the third are closely related to the control of the vehicle.

Factors impacting a vehicle's handling qualities include:

- The driver's skills, experience, competency, attitudes and maturity.
- Driver familiarity with the vehicle. A driver learns to control a vehicle through practice and the more the driver operates a vehicle, the better it will handle for him or her. One needs to take extra care for the first few months after beginning to drive a vehicle, especially if it differs in handling qualities from those he or she is used to. Other details that a driver must adjust to include changes in tires, tire pressures and load. That is, handling is not just good or bad; it is also the same or different.
- Weather. Weather affects handling by making the road slippery. Different tires do best in different weather. Deep water is an exception to the rule that wider tires improve road holding.
- Road conditions. Vehicles with relatively soft suspension and with low un-sprung weight are least affected by uneven surfaces; however, on flat smooth surfaces, stiffer suspension systems are better. Unexpected hazards include water, ice, oil, etc.
- Center of gravity height. The center of gravity height, relative to the track (distance between wheels along the same axle), determines load transfer from side-to-side and can cause body lean. Centrifugal force acts at the center of gravity to lean the car toward the outside of the curve, increasing downward force on the outside tires. Height of the center of gravity relative to the wheelbase (distance between axles) determines load transfer between front and rear. The vehicle's momentum acts at its center of gravity to tilt the vehicle forward or backward, respectively, during braking and acceleration. Since it is only the downward force that changes and not the location of the center of gravity, the effect on over/under steer is opposite to that of an actual change in the center of gravity. When a car brakes, the downward load on the front tires increases and that on the rear decreases, with corresponding change in their ability to take sideways load, causing over-steer.
- Center of gravity location. In steady-state cornering, because of the center of gravity, front-heavy cars tend to understeer and rear-heavy cars to over steer, all other things being equal.
- Suspension. Vehicle suspensions feature variable characteristics, which generally differ in the front and rear, all of which affect handling. Characteristics include: spring rate, damping, straight ahead camber angle, camber change with wheel travel, roll center height, and the flexibility and vibration modes of the suspension elements. Suspension also affects un-sprung weight.

- Tires and wheels. In general, larger tires, softer rubber, higher hysteresis rubber and stiffer cord configurations increase road holding and improve handling. On most types of poor surfaces, large diameter wheels perform better than lower, wider wheels. The fact that larger tires, relative to weight, stick better is the main reason that front heavy cars tend to understeer and rear heavy cars tend to over steer. The depth of tread remaining greatly affects hydroplaning (riding over deep water without reaching the road surface). Increasing tire pressures reduces their slip angle (for given road conditions and loading), but there is an optimum pressure for road holding.

- Track and wheelbase. The track provides the resistance to sideways weight transfer and body lean. The wheelbase provides resistance to front-to-back weight transfer and pitch angular inertia, and provides the torque lever arm to rotate the vehicle when swerving. The wheelbase, however, is less important than angular inertia (polar moment) to the vehicle's ability to swerve quickly.

- Vehicle weight. A Type I ambulance features a cab chassis with modular body and a gross vehicle weight over 10,001 pounds, but less than 14,000 pounds Most heavy duty ambulances feature a truck-style body with a separate driver compartment. A subclass to this ambulance type, the Type I Advanced Duty (AD), features extra cargo capacity and a gross vehicle weight of 14,001 pounds or more. Type II ambulances are a long wheelbase van type with an integral cab design and a gross vehicle weight of 9,201 pounds to 10,000 pounds. Many long-distance transport services use Type II ambulances due to their increased fuel efficiency. In general, Type IIs do not make practical emergency services because of their cramped spaces. Type III ambulances use a van chassis rather than truck chassis. The cab is an integral part of the ambulance and the gross vehicle weight is the same as for Type I ambulances—10,001 pounds to 14,000 pounds. AD ambulance types are also available with gross vehicle weights more than 14,001 pounds.

- Aerodynamics. Aerodynamic forces are generally proportional to the square of the air speed, therefore vehicle aerodynamics become rapidly more important as speed increases.

- Delivery of power to wheels and brakes. Load transfer complicates the effect of braking on handling, which is proportional to the (negative) acceleration times the ratio of the center of gravity height to the wheelbase. Acceleration at the limit of adhesion depends on the road surface, so with the same ratio of front to back braking force, a vehicle will understeer under braking on slick surfaces and over steer under hard braking on solid surfaces. Most modern vehicles combat this by varying the distribution of braking in some way.

- Position and support to the driver. Absorbing "g forces" in his or her arms interferes with a driver's precise steering. In a similar manner, a lack of support for the seating position of the driver may cause them to move around as the vehicle undergoes rapid acceleration (through cornering, taking off or braking). This interferes with precise control inputs, making the vehicle more difficult to control. Reaching the controls easily is also an important consideration, especially when driving a vehicle hard. In certain circumstances, good support may allow a driver to retain some control, even after a minor accident or after the first stage of an accident.

3.4.1. Achieving Familiarity with Ambulance Handling Qualities

Many emergency vehicle products come in a variety of configurations and designs; ambulances are no exception. They can be built or altered to fit single or twin cots depending on the need of the customer. Off-road applications can also be added to ensure the vehicle handles properly at all times. Customization on standard, internal configurations can be optimized to provide the best in operational requirements and proper patient care. Specialized vehicle manufacturers are the most equipped to provide customers with the best in ambulance design and construction. An EMS organization may use multiple varieties of vehicles that an EMS provider will be required to drive.

Spending time driving the vehicle in non-emergency situations offers the best way for a driver to become competent in dealing with an ambulance handling qualities. Through such familiarization, the driver acquires the feel for vehicle handling qualities such as responsiveness, maneuverability, and sensitivity to control inputs.

3.4.2. Maintaining Optimal Vehicle Handling Qualities

Ambulance effectiveness requires ride quality and reliability. The direct result of ambulance handling qualities, ride quality provides a smooth ride for patients and EMS providers in the patient compartment. Both ride quality and ambulance reliability are the direct results of effective ambulance maintenance. The maintenance actions that directly impact ride quality should include:

- Inspecting for damaged, leaking or loose shock absorbers. Ensuring that shocks stabilize the vehicle, as worn shocks can cause vehicle handling to become erratic and hard to control.
- Visually checking and lubricating all steering, suspension and driveline components.
- Checking tires. Visually inspecting tires (including the spare tire). Adjusting tire pressure to specification and recording pressure of all tires. Recording the tread depth of all tires and checking the jack, jack handle and wheel wrench for proper location and operation.
- Checking and adjusting front-end alignment specifications as required.
- Checking for fluid leaks. Visually inspecting under the vehicle for fluid leaks; if fluid leak is noted, investigating the cause and immediately checking all the fluids.

3.4.3. References

Swets and Zeitlinger (1983). *A Simulation Study of Vehicle Maneuverability,* Vehicle System Dynamics, 12, Taylor and Francis.

Office of the Federal Register (2012) Code of Federal Regulations, Title 49: Transportation, Part 177 – Carriage by Public Highway, Subpart A – General Information and Regulations, 177.816 Driver Training. U.S. Government Printing Office, Washington, D.C.

3.5. Blind Spot Handling

Two kinds of ambulance blind spots exist:

- Blind spots in mirrors that obscure the presence of a vehicle; and
- Hidden exits where a vehicle might suddenly emerge in the path of the ambulance.

An ambulance's blind areas typically occur at the sides near the rear of the vehicle; the driver cannot see anything in these areas by looking in the correctly adjusted mirrors. Other vehicles may be blind to anything directly behind them. Ambulance vehicles in which the driver sits very high may have forward-quarter blind spots where they may not be able to see anything low to the ground in front or to the sides near the front. Also, while driving in city traffic, a driver must be on the alert for blind spots such as concealed alleys, side streets or parked cars from which children may dart into traffic.

"Sideswipe" collision, which involves operators who change lanes with a blind spot and do not check or fail to see the other vehicle, serves as another blind spot risk for ambulances. According to the National Highway Traffic Safety Administration, 18 percent of U.S. traffic crashes involve drivers changing lanes who did not see the motor vehicle next to them.

In addition to sideswipe collisions, blind spots can cause back-over accidents. Back-over accidents occur when a vehicle backs over someone, usually a child, due to the rear blind spot on most vehicles. Rear blind spots are directly behind a vehicle and are typically 23 feet wide for a sport utility vehicle.

Blind spots can come in other forms as well. Objects such as large trees, bus stops, signs and other stationary objects in the visual field as a driver approaches an intersection can create blind spots. The blind spot created by a stationary object actually shifts as the motorist continues down the road and creates a dangerous condition that drivers must be aware of and must always check in order to be safe, especially at intersections and cross walks.

The following best practices discuss handling blind spots.

3.5.1. Enhancing the Field of View

The mirrors on the driver's side of every modern car have a field of view of approximately 15 to 17 degrees wide, the angle between two adjacent numbers on a clock face, offering a narrow slice of events occurring behind the car. Curved mirrors offer a wider field of view, but the curve distorts the image, e.g., curved passenger side mirrors always warn riders that objects are closer than they appear.

The practices for reducing blind spot hazards include enhancing the driver’s field of view by:

- Turning one's head briefly (risking rear-end collisions).
- Installing mirrors with larger fields-of-view.
- Reducing overlap between side- and rear-view mirrors by adjusting side mirrors:
    - Right-side mirror: The side of the car should be barely visible when the operator’s head is between the front seats.
    - Left-side mirror: The side of the car should be barely visible when the operator’s head is almost touching the driver’s side window
    - Check to ensure that the operator can see cars approaching from behind on either side when on the road.

3.5.2. Use of Spotters

The risk of striking something or someone in the rear blind spot while reversing the ambulance can be reduced through the use of a spotter positioned at the rear of the vehicle to monitor the safety of the back-up maneuver. The driver and spotter need to use unambiguous communication that may be based on verbal interaction or, at greater distances, on hand signals. The driver and spotter must agree on the meaning of hand signals (see paragraph 3.1.3) or voice commands before initiating the back-up maneuver. The steps required for a safe back-up maneuver include:

- Performing a visual inventory of the area;
- Locating the relevant landmarks;
- Adjusting mirrors properly;
- Rolling the window down to hear spotter;
- Using emergency lights;
- Using the back-up alarm;
- Positioning the wheels before stopping completely in the direction of the exit;
- Do not start moving if unsure of the area;

- Maintaining awareness of the location of the rear tires as they are considered the pivotal reference point to begin the turn; and
- Remembering the vehicle height when backing up.

3.5.3. Maintain Vigilance for Hazards Associated with Forward Blind Spots

The ambulance operator should drive through city traffic expecting that a vehicle, pedestrian or child will suddenly appear directly in the path of the ambulance. The distinguishing feature of defensive driving is to remain alert for unexpected responses or behaviors of other drivers and pedestrians, and maintain readiness to effectively respond to the unexpected.

3.6. Changing Lanes and Passing

An ambulance on the way to the scene or transporting a critically injured patient to a hospital may be required to execute frequent lane changes and passing maneuvers. With lights and siren on, the driver will need to be extra vigilant as to how other drivers will respond since that response is not always predictable. Clawson et al. (1997) describe an emergency roadway accident phenomenon that might redefine the actual scope of effects caused by lights and siren responses and transports as the wake-effect accident. This appears to be caused by the passage of an emergency vehicle, but does not actually involve the emergency vehicle. The authors surveyed paramedics in the Salt Lake City area about their experience with emergency medical vehicle collisions (EMVCs). Of the 73 respondents, 78 percent reported either personal involvement in an EMVC or witnessing at least one wake-effect collision. Of that group, 55 percent reported wake-effect collisions as occurring more frequently than actual EMVCs; 4 percent reported that wake-effect collisions occurred in equal numbers to EMVCs; 19 percent indicated that these collisions occurred less often than actual EMVCs; and 22 percent did not report either.

The results validate the occurrence of wake-effect collisions and report their frequency relative to actual EMVCs. The subsequent finding that wake-effect collisions may occur five times more than actual EMVCs is the antithesis of the most basic premise of medical care: "First, do no harm." Although the study did not determine the seriousness of wake-effect collisions, even small collisions without injuries pose community and economic repercussions that should be considered when evaluating the costs and benefits of a lights and siren policy. Levick (2008) also reported that wake-effect crashes occur with a frequency of five times greater than accidents involving the ambulance itself.

3.6.1. Lane Change Safety

Sanddal et al. (2010) recommend checking the side-view mirrors to ensure the lane is clear, and activating the turn signal at least 100 feet prior to the lane change in the city and 300 feet on a highway, maintaining the turn signal activation through the lane change maneuver.

3.6.2. Passing Safety

Sanddal et al. (2010) recommend checking the side-view mirrors to ensure the lane is clear and activating the turn signal at least 300 feet before passing, maintaining the turn signal activation through the passing maneuvers.

3.6.3. References

Clawson, J.J., Martin, R.L., Cady, G.L. and Maio, R.F., (1997).The Wake Effect: Emergency Vehicle Related Collisions. *Prehospital and Disaster Medicine, 12,* No 4.

Levick, N., (2008). *Emergency Medical Services: A Unique Transportation Safety Challenge.* Transportation Research Board Annual Meeting.

Sanddal, T., Ward, N., and Stanley, L., (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist.* U.S. Department of Transportation, Research and Innovative Technology Administration.

3.7. Distraction Management

According to the NHTSA's website Distraction.Gov, in 2011 crashes involving a distracted driver killed 3,331 people, compared to 3,267 in 2010. In 2011, an additional 387,000 people were injured in motor vehicle crashes involving a distracted driver. A total of 18 percent of injury crashes in 2010 were reported as distraction-affected crashes. Drivers using hand-held devices are four times more likely to get into crashes serious enough to injure themselves. Text messaging creates a crash risk 23 times worse than driving while not distracted. Sending or receiving a text removes a driver's eyes from the road for an average of 4.6 seconds, the equivalent of driving the length of an entire football field blind at 55 miles per hour (mph). Headset cell phone use is not substantially safer than hand-held use.

The Federal Motor Carrier Safety Administration (FMCSA) conducted a study of the impact of distractions on commercial vehicle drivers, which is applicable to ambulance drivers. This study (Olson et al., 2009) described driver distraction as occurring when inattention leads to a delay in recognition of information necessary to accomplish the driving task. The FMCSA study recorded a total of 4,452 safety critical events (i.e., crashes, near-crashes, crash-relevant conflicts and unintentional lane deviations) in the data set, along with 19,888 baseline (uneventful, routine driving) non-safety critical events.

Key findings noted that drivers engaged in non-driving related tasks in 71 percent of crashes, 46 percent of near-crashes and 60 percent of all safety-critical events. Furthermore, the study found performing highly complex tasks while driving led to a significant increase in risk. Eye glance analyses examined driver eye location while simultaneously performing tasks and operating a commercial motor vehicle. Tasks that were associated with an increased risk or high odds ratio were also associated with a high number of glances from the road in front of the vehicle. This suggests that tasks drawing the driver's visual attention away from the forward roadway should be minimized or avoided. Based on the results of the analyses, FMCSA offers a number of recommendations to address the issue of driver distraction in ambulance operations; these include:

- Fleet safety managers engage and educate their ambulance operators, and discuss the importance of being attentive and not engaging in distracting tasks or behaviors. Even routine behaviors (e.g., reaching for an object, putting on sunglasses, or adjusting the instrument panel) can distract and may lead to a safety-critical event.
- Fleet safety managers develop policies to minimize or eliminate the use of in-vehicle devices while driving. The authors also urge fleet safety managers to be cognizant of devices that drivers bring into the truck cab and use while driving. These may seem innocuous (e.g., calculator), but may increase crash risk if used while driving.
- Ambulance operators should not use the radio while driving and fleet safety managers should educate drivers on the danger of interacting with these devices while driving. Similar to manually dialing a cell phone, if operators must interact with a radio, the authors recommend that they do so only when the ambulance is stopped.
- Ambulance operators should not manually dial cell phones while driving. If a call must be made, they should pull off the road to a safe area. Another option, requiring further study, is the use of voice-activated, hands-free dialing, which would allow the operator to maintain eyes on the roadway. This approach may cause “cognitive distraction” (though visual distraction would be expected to be reduced).
- Ambulance operators should not read, write or look at maps while driving. Commonly performed tasks, such as reading, writing and looking at maps, significantly draw visual attention away from the forward roadway. These activities, which may be integral to the driver’s job, are not integral to operating the vehicle and the authors recommend that such tasks never be performed while the vehicle is in motion.
- Designers of radios and other communication devices should consider the increased risk associated with using their devices and work to develop more human-factor designed interfaces that do not draw the driver’s eyes from the roadway. Possible solutions include a hands-free interface or blocking manual use while the vehicle is in motion.
- Designers of ambulance operator compartment instrument panels should consider the increased risk of adjusting panel controls. The designs should be intuitive, user-friendly and require only brief glances away from the forward roadway.

3.7.1. References

Olson, R.L., Hanowski, R.J., Hickman, J.S., and Bocanegra, J., (2009). *Driver distraction in commercial vehicle operations*.

3.8. Management of Ambulance Driver Fatigue

Approximately 6,500 ambulance crashes occur each year, injuring an estimated 10 people per day and killing almost two people each month. Some of these accidents can be attributed to unnecessary speeding, insufficient driver training, driver exhaustion from long work hours, and inadequate dispatch procedures. Many EMS operations allow workers to perform duties in two or three long shifts, similar to fire departments. Working multiple shifts can be effective for firehouse operations due to the reduced number of fire calls which allows time for rest. Nonemergency transports and patient transports to appointments often occupy EMS providers for entire shifts, reducing the opportunity to obtain appropriate levels of rest and sleep.

As stated by Aimee (2004), little data exists on the role of fatigue in ambulance accidents or its impact on medical service delivery. The anecdotal accounts of ambulance drivers falling asleep at the wheel and employee complaints about excessive overtime appearing in newspapers across the country should serve as a warning to the industry to look at the effects of fatigue on EMS employees' health and safety (Zagaroli, 2003).

The National Transportation Safety Board (NTSB) estimates that driver fatigue causes 100,000 crashes and approximately 1,500 fatalities annually. The Board's "Most Wanted" list of safety improvements includes the development of effective fatigue countermeasures (Ellingstad, 1998).

Fatigue is a shorthand reference to a general state of decreased mental and physical capacity resulting from a lack of sufficient restorative sleep or a disruption of the circadian rhythm, the natural biological clock that drives the body's cycle of sleeping at night and waking at daylight. This can be exacerbated by on-the-job stress and poor personal habits. Working night shifts, running double shifts, and "sleeping with one eye open" while anticipating the next emergency call are part of the normal work environment of EMS professionals. Such conditions place them at high risk for suffering from fatigue and detrimentally impacting their job performance and personal health.

The following best practices can reduce the impact of fatigue on driver performance.

3.8.1. Provide Education

Education is the first step taken in each program developed to address job-related fatigue. Knowledgeable employees will more likely embrace change, especially change that affects off-duty behavior, if they understand and appreciate the effect of fatigue on their work and in their lives. Training programs prove most effective when proposed countermeasures specifically address the workplace and can demonstrate how they will provide relief from specific aspects of fatigue. Most education programs are mandatory for all employees, including management, and include lectures by experts, brochures and other reference materials such as websites, informational videos and an employee hotline.

3.8.2. Design Rotating Shifts to Reduce Fatigue

Consideration should be given to developing rotating shifts to avoid a permanent night-shift workforce and providing adequate recovery time for employees between shift changes. Although many workers prefer a fixed shift schedule due to family responsibilities, research indicates that most permanent night shift workers rarely grow accustomed to their schedule. Daytime sleep has been found to be less restorative than nighttime sleep, so regular night shift workers never catch up on deep sleep. In addition, most companies report that night shift workers return to a day schedule on their days off, disrupting their sleep patterns. Rotational shifts can help solve the problems caused by permanent shifts if the shifts are rotated forward, from a day to an evening to a night shift. A comparison of shifts of 6, 8 and 12 hours found that 12-hour shifts offer the best compromise between productive work and providing employees sufficient time to rest.

3.8.3. Avoid Quick Shift Changes

To maximize the amount of restorative sleep employees can obtain, quick shift changes, long work shifts and overtime should be avoided when possible. Night shifts should be kept to a minimum of two to four consecutive nights and allow a minimum of 24 hours before reporting to the next shift.

3.8.4. Provide Appropriate Length Off-Duty Shifts

Additionally, providing off-duty shifts of more than eight hours will offer employees time to obtain the full 6-10 hours of sleep they need. The FMCSA standard for long-haul drivers extended off-duty shifts to 10 hours to provide operators time to travel to their homes, eat and unwind before sleeping.

3.8.5. Provide Appropriate Workplace

Maintaining a comfortable temperature, controlling excessive noise, and providing well-lit duty areas and dark, quiet sleeping facilities are steps companies take to reduce employee fatigue and make the workplace more comfortable. Some companies provide recreational areas with comfortable furniture, televisions and other leisure pursuits to provide temporary relief to employees. Exercise equipment encourages a break from work and physical activity on the job, which has been shown to help enhance alertness and efficiency temporarily.

3.8.6. Provide Appropriate Fatigue Preventive Strategies

The only cure for fatigue is sleep. EMS operators should sleep as much as possible before or between duty days to avoid beginning a shift already tired. Developing a regular sleep routine by going to bed and waking up at the same time each day has been found to make it easier to fall asleep. Relaxing prior to going to sleep will improve the quality of sleep on a regular basis.

Techniques for helping someone sleep include reading or taking a warm bath before bedtime and keeping room temperatures cooler in order to promote restful sleep. Other preventive strategies for reducing fatigue include:

- Taking naps can provide a temporary boost to alertness and relief from fatigue, but do not compensate for long-term sleep loss, so they are best used in addition to sufficient sleep. Naps should last about 20 minutes. Napping longer than 45 minutes allows one to enter a deep sleep that usually results in grogginess and disorientation when interrupted by a duty call and should be avoided.
- Conversely, sleeping for two hours is usually enough to permit one complete cycle through the different stages of sleep and can be beneficial.
- Eating too much, too little or certain kinds of food can interfere with the ability to fall and remain asleep. Caffeine, alcohol and nicotine all stimulate the nervous system and can provide some measure of temporary relief from the effects of fatigue. All of the stimulants also impair the ability to fall asleep and maintain the deep level of sleep necessary to provide restorative benefits, and are best used early in a shift and not at all three hours before bedtime. To avoid headaches, irritability and other symptoms that affect heavy caffeine consumers who try to reduce their intake, cut down on caffeine by one-half or one cup every few days.
- Avoid using alcoholic drinks to unwind after work. Although alcohol promotes relaxation and drowsiness, it suppresses the deeper levels of sleep needed to restore the body. It is best to avoid drinking two to three hours before bedtime. Heavy drinking will impair alertness the following day and possibly contribute to long-term health problems.
- Participating in a regular exercise routine of approximately 30 minutes daily helps to maintain health and fight the effects of fatigue. Overall physical fitness helps the body cope with stress and resist illness and disease, and promotes a deeper, more restful sleep. Exercising before the start of a shift, if not overdone, can invigorate one and could provide a healthy way to stimulate oneself for work. Because of this stimulating effect, studies recommend avoiding strenuous exercise three to six hours prior to bedtime.

3.8.7. Incorporate the Components of a Successful Program

Adopting a fatigue countermeasure program will not ensure that employees receive sufficient sleep and develop healthful personal habits. Employees are likely to resent suggestions that affect their off-duty personal time, particularly those who juggle family demands while recovering from long shifts. Furthermore, many people suffer from sleep disorders and require individualized interventions to help them avoid sleep disruptions. Successful fatigue countermeasure programs include the following:

- Commitment by management to address workplace practices that most contribute to fatigue.

- Employee participation in the development of strategies and programs were the most frequently cited elements of successful alertness programs. Employees supported workplace changes when a strong fatigue education and training component was included as part of the program, and when employees at all levels participated.
- Family participation in education and training programs on the effects of shift work and fatigue. This was found to reduce stress at home and contributed to employees' ability to obtain sufficient uninterrupted sleep while off duty. If family members know what the work and sleep schedule will be, and the importance of sufficient undisturbed sleep, activities can be scheduled accordingly.

3.8.8. References

Aimee, F.J. (2004). *Fatigue Management,* EMS World.

Antone R. *Ambulance crews piling up overtime.* Star Bulletin, July 11, 2001, at http://starbulletin.com/2001/07/11/news/story1.html.

Collins E. *Paramedics: Long shifts put public at risk.* The Capital, June 8, 2003.

Ellingstad, V.S., Director, Office of Research and Engineering, National Transportation Safety Board. "Testimony regarding Fatigue in the Trucking and Rail Industry," September 16, 1998 before the Surface Transportation and Merchant Marine Subcommittee, Senate Commerce Committee, U.S. House of Representatives at www.ntsb.gov/speeches/s980916.htm; Chairman Marion Blakey. *Remarks for the United Transportation Union,* Washington, D.C., July 30, 2002, at www.bmwe.org/nw/2002/04APR/24.htm; "NTSB Chairman Highlights Fatigue as Major Cause of Transportation Accidents" at www.ntsb.gov/speeches/blakey/mcb020730.htm. (note: link is no longer available)

Frank, A.J. (2003). Two-Hatter Controversy Revisited in Hartford, *Best Practices in Emergency Services,* 6, August, p. 2.

Zagaroli, L., and Taylor A. (2003). *Ambulance driver fatigue a danger.* Detroit News, Retrieved January 27, from www.detnews.com/2003/specialreport/0301/27/a01-69705.htm. (note: link is no longer available)

3.9. Maintaining a Safe Following Distance

Maintaining a safe following distance helps prevent accidents. Based on the weight of the ambulance and the speed at which it travels, the vehicle requires a minimum amount of distance to stop. By maintaining a safe following distance, the ambulance operator will be able to safely stop the ambulance without rear-ending another vehicle, or possibly swerving into another lane and colliding with another vehicle.

3.9.1. Follow the Three-Second Rule

The ambulance operator should watch the vehicle in front pass an object (bridge, pole, etc.) then start counting. It should take three seconds for the ambulance to pass the same object. This period should extend to six seconds in inclement weather.

3.9.2. Keep Separation from the Vehicle in Front when Stopped

When stopped at an intersection, the operator should leave enough space between the ambulance and the vehicle in front for an escape route. If the driver receives a call, the ambulance can be maneuvered out of the traffic line. A good rule of thumb is the ability of the driver to see the bottom of the rear tires of the vehicle in front.

Based on the ambulance's speed, the operator should plan to safely brake at the specified distances below should the preceding vehicle abruptly stop (Table 1).

Table 1 – Vehicle Speed and Stopping Distance

Vehicle Speed	Stopping Distance
10 mph	18 feet
20 mph	52 feet
30 mph	100 feet
40 mph	169 feet
50 mph	280 feet
60 mph	426 feet

3.9.3. References

Buncombe County EMS. (2008). Defensive Driving Course. Retrieved March 5, 2013 from http://emsstaff.buncombecounty.org/inhousetraining/drivingpart1/driving_overview3.htm.

Pro EMS. Policy and Procedure Manual. (2008). Retrieved March 15, 2013 from http://www.proems.com/v2/employment_pnp2.cfm?title=38&titleName=Introduction. (note: link is no longer available)

Widmeier, K. (2011). Driving Procedures Keep Providers Safe on the Road. JEMS. Retrieved March 13, 2013 from http://m.jems.com/article/vehicle-ops/driving-procedures-keep-providers-safe-r.

3.9.4. Intersection Handling

According to Levick (2008), extensive studies identified that many ambulance crash fatalities and injuries occur in intersections. Additionally, it has been demonstrated that for each ambulance occupant killed, three bystanders—either pedestrians or passengers in an unrelated vehicle—are killed. The rear patient compartment has been identified as the most dangerous part of the ambulance for its occupants, yet this part of the vehicle is currently not regulated by the Federal Motor Vehicle Standards. Unfortunately, no existing reporting system or database specifically identifies ambulance crash related injuries and their nature, making specific details on these injuries and their causes extremely scarce. Research indicates that although some crashes may not have been preventable, risky ambulance operations are the cause of many fatal and injurious crashes. One research paper cites that 20 percent of the ambulance drivers determined to be high risk, caused 80 percent of the crashes. Failure to stop at intersections has been identified as an extremely high-risk behavior. A number of EMS services have implemented policies requiring ambulances to completely stop at a red light or stop sign. No national requirement or safety policy currently exists.

3.9.5. Proper Intersection Traverse

According to Sanddal et al. (2010), the procedure for traversing an intersection is to take the foot off of the accelerator pedal and position it over the brake upon approaching the intersection. If the light is green, slow the vehicle to the normal or less than the posted speed, visually scan all directions and proceed. If the light is red, slow down when approaching the intersection, bring the vehicle to a complete stop, visually scan in all directions and proceed with caution.

Guidelines for traversing an intersection should include:

- EMS response vehicles should not exceed posted speed limits when proceeding through green signal or no control device intersections.
- When an EMS response vehicle approaches an intersection, with or without a control device, the vehicle should be operated in a manner as to permit the driver to make a safe, controlled stop if necessary.
- When an EMS response vehicle approaches a red light, stop sign, stopped school bus or a non-controlled railroad crossing, the vehicle should come to a complete stop.
- The driver of an EMS response vehicle should account for all lanes of traffic prior to proceeding through an intersection and should treat each lane of traffic as a separate intersection.

According to Patrick (2012), any intersection controlled by a stop sign, yield sign, yellow traffic light or red traffic light requires a complete stop by the emergency vehicle driver if the driver cannot account for all visible traffic in all lanes. In addition, drivers should follow these steps:

- Do not rely on warning devices to clear traffic.
- Scan the intersection for possible hazards (right turns on red, pedestrians, vehicles traveling fast, etc.) as well as driver options.

- Begin to slow down well before reaching the intersection, cover the brake pedal with the driver's foot, and continue to scan in four directions (left, right, front and back).
- Change the siren cadence not less than 200 feet from an intersection.
- Scan the intersection for possible passing options (pass on right, left, wait, etc.).
- Observe traffic in all four directions (left, right, front, rear).
- Avoid using the opposing lane of traffic if at all possible.
- Complete an incident report if the driver proceeds past a control device with a negative right-of-way without coming to a complete stop; both the driver and partner should explain the circumstances that permitted them to do so.
- Establish eye contact with other vehicle drivers. The EMS partner should communicate that all is clear then reconfirm all other vehicles are stopped.
- Slow down if any potential hazards are detected, in addition to covering the brake pedal with the operator's foot when approaching an intersection that does not have a control device (stop sign, yield or traffic signal) or where the traffic control signal is green as approached.

3.9.6. References

Levick, N., (2008). *Emergency Medical Services: A Unique Transportation Safety Challenge*. Transportation Research Board Annual Meeting.

Patrick, R.W., (2012). *Safe Intersection Practices*. EMS World.

Sanddal, T., Ward, N., and Stanley, L., (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist*. U.S. Department of Transportation, Research and Innovative Technology Administration.

3.10. Near Miss Recovery

Near miss recovery is the effectiveness with which the driver recovers control of the ambulance after a near miss.

3.10.1. Regaining Control

In making a split second response to avoid an accident, the ambulance operator's familiarity with the handling qualities of the ambulance, including its capabilities and limitations, is critical. In addition, operators can more easily regain control after a near miss if the speed is not excessive and allows for weather, traffic and roadway conditions.

Although a near miss implies accident avoidance, in recovering from a close call, the operator must not put him or herself in a position for another accident risk. Accident avoidance training must stress not only avoiding a collision, but also ensuring that the actions to avoid the initial accident do not lead to a second accident situation.

3.10.2. Dealing with an Unavoidable Collision

If, in avoiding a collision, the operator is placed in a position where impact with a second vehicle or fixed obstacle is inevitable, the driver must be aware of the impending collision and decide how to avoid it or reduce the risk and damage resulting from the collision. Ambulance operators should receive training on procedures to avoid or mitigate the damage associated with a collision.

3.11. Operator Actions for Safe Patient Care

Patient care and safety can be significantly impacted by an ambulance operator's action or inaction. To facilitate quality patient care, the operator should:

- Accelerate at a gradual rate avoiding jack rabbit starts.
- Change speed as gradually as possible.
- Ease into turns to reduce forces on personnel in the patient compartment.
- Avoid sudden directional changes.
- Avoid high rates of speed to the extent possible consistent with patient medical needs.
- Warn the EMS provider in the patient's compartment of railroad crossing, rough roads or other factors that will disrupt patient comfort and EMS provider effectiveness.
- Identify bumps in the road or potholes visually or from a leading vehicle and adjusting steering and speed accordingly.
- Convey to the EMS provider in the patient compartment the operation of turn signals and presence of the driver's foot on the brake even if not fully activated.

3.12. Safe Presence

In 2009, the Federal Emergency Management Agency (FEMA) assessed the requirements for color coding and marking emergency vehicles. The report found that previous studies conducted across the United States and in other countries suggest that steps to improve emergency vehicle visibility and conspicuity hold promise for enhancing first responders' safety when exposed to traffic, both inside and outside their response vehicles (e.g., patrol cars, motorcycles, fire apparatus and ambulances). A major finding from the report was an urgent need for additional research specific to emergency vehicle visibility. The report also discussed a number of other key findings with implications for deploying existing conspicuity treatments, and developing future technologies, standards and safe operating procedures.

3.12.1. Enhancing Ambulance Conspicuity

Ambulance conspicuity can be enhanced by the following:

- *Retroreflective Materials* – Properly applied and maintained retroreflective sheeting materials can effectively increase the nighttime visibility and conspicuity of treated objects, as frequently used across the United States in a wide range of traffic control applications. Research performed by NHTSA suggests retroreflective conspicuity treatments applied to U.S. heavy truck trailers since 1992, with a retrofit requirement in 1999, have been "quite effective" at reducing side- and rear-impact crashes at night.

- *Visibility and Recognition* – A wide range of factors affect the visibility and recognition of emergency vehicles, including the presence or operation of active warning devices such as lights and sirens, retroreflective conspicuity treatments (at night), lettering and graphics; and color scheme(s).

- *Contrast* – The use of contrasting colors can positively affect conspicuity by assisting drivers with locating a hazard amid the visual clutter of the roadway. The two basic types of contrast include: 1) luminance contrast— the degree to which an object is brighter than its background, and 2) color contrast—the difference in an object's color(s) and those found in its background. Contrast is enhanced by using colors not normally found in the environment, including fluorescents.

- *Fluorescent Colors* – The specific color choice may or may not be important with respect to fluorescents, depending on background characteristics. Studies indicate that fluorescent yellow was best detected and fluorescent orange was best recognized against a number of backgrounds. A recent study of traffic safety garments showed no statistical difference in the daytime conspicuity of fluorescent red-orange and fluorescent yellow-green, although fluorescent yellow-green produced a significantly higher luminance value, compared to the background, than the fluorescent red-orange.

- *Contour Markings* – Outlining vehicle boundaries with "contour" or "edge" markings by using retroreflective material can enhance emergency vehicle visibility and conspicuity. A Canadian study of large truck trailers identified continuous contour markings, made with white retroreflective tape, on the sides and rear of trailers to be more visible under varied weather conditions than the Federal Motor Vehicle Safety Standard 108 (Office of the Federal Register, 2012) conspicuity treatment required by U.S. regulations.

- *Placement* – Studies of recent changes in headlamp illumination suggest it might be efficacious to concentrate retroreflective material lower on emergency vehicles to optimize interaction with approaching vehicles' headlamps. This opportunity does not replace, but rather complements, the anticipated positive effects of contour markings outlining an emergency vehicle's overall size and shape.

- *Logos and Emblems* – Applying distinctive logos or emblems made with retroreflective material could improve emergency vehicle visibility and recognition. European studies on the use of retroreflectorized logos and graphics found the application of simple designs made from retroreflective sheeting markedly improved the visibility and conspicuity of heavy trucks. The use of clearly identifiable logos or graphics specifying the affiliation, and therefore function, of an emergency vehicle can be reasonably expected to aid recognition and help surrounding drivers better anticipate its behavior.

3.12.2. References

FEMA, (2009) "Emergency Vehicle Visibility and Conspicuity Study," FA-323.

Office of the Federal Register (2012) Code of Federal Regulations, Title 49: Transportation, Part 571 – Federal Motor Safety Standards, 571.108 Lamps, Reflective Devices, and Associated Equipment. U.S. Government Printing Office, Washington, D.C.

3.13. Safe Speed

The theory of the golden hour proposes that patients with serious trauma who arrive at the hospital within 60 minutes of injury are far more likely to survive. On its face value, this rule makes sense: if someone is bleeding internally, surgeons can stop the hemorrhage as long as they can get to the source of the bleeding quickly. Although the golden hour has become dogma, it may not be backed by science.

A recent study reported by Newgard et al. (2010) in the Annals of Emergency Medicine casts further doubt on the concept of the golden hour for patients with severe injury. The authors studied more than 3,000 trauma patients with low blood pressures from bleeding, head injuries and difficulty breathing, and examined various time intervals after a call to 9-1-1. The authors compared the times with outcomes for patients in the hospital. The result: shorter intervals did not appear to improve survival.

How important is speed in the care of trauma patients before they arrive at the hospital? Previous efforts to measure the effectiveness of patient time in an ambulance have struggled with longer patient care times versus speed to the patient treatment facility. Patient condition and other factors make it nearly impossible to point to an effect of time spent in the ambulance versus survival rates. Although some of these biases remain, the authors of this study used sophisticated methods to account for many of these problems, allowing the reader to reasonably conclude that for ambulance care, a few minutes either way neither saves nor costs lives for patients with severe trauma.

Meisel and Pines (2010) state that it would be wrong and irresponsible to claim that time does not impact the delivery of emergency care. Time-sensitive medical conditions, such as choking episodes requiring the Heimlich maneuver and cardiac arrest that could require medics to shock and restart a heart, depend upon timely action. New and better evidence suggests that very small differences in time may not be as important as other factors in the delivery of care for seriously ill patients. Policies should be examined in relation to risk, value and consequences—policies that may save minutes but not lives.

This is important, because many ambulance services are benchmarked for the quality of their response time, which in turn may encourage ambulance operators to speed.

3.13.1. Ambulance Speed Guidelines

Best practice guidelines for ambulance speed include the following:

- Ambulances should not exceed the posted speed limit by more than 10 mph.
- Speed should be moderated to avoid roll over in a turn or curve.
- Speed should be reduced when the curbside tires leave the paved or elevated surface of a road to reduce the likelihood of improperly returning the vehicle to the paved surface.

3.13.2. 2.11.2References

Meisel, Z., and Pines, J., (2010), “High Speed Care: How Fast Should Ambulances Go?,” Slate magazine, May 2010.

Newgard, C.D., Schmicker, R.H., Hedges, J.R., Trickett, J.P., Davis, D.P., Bulger, E.M., Aufderheide, T.P., Minel, J.P., Hata, J.S., Gubler, K.D., Brown, T.B., Yelle, J.D., Bardarson, B., Nichol, G., (2010), “Emergency Medical Services Intervals and Survival in Trauma: Assessment of the Golden Hour in a North American Prospective Cohort,” *Annals of Emergency Medicine*, Mar, 55(3), 235-246.

3.14. Turning Vehicles

When turning an ambulance, the operator should check the side-view mirrors to determine if it is safe to do so. The turn signal should be engaged 100 feet before the turn in urban traffic and 300 feet in rural or highway settings and remain on throughout the turn. The driver should verify that it is off after completing the turn maneuver.

Hard turns at high speeds will cause the ambulance to push outward, onto the shoulder or into the oncoming lane.

3.15. Weather

Today’s EMS vehicles include a tremendous amount of technology in the chassis and drive system to keep the ambulance safely on the road during adverse weather conditions. The ambulance operator should take time to understand the ambulance’s capabilities and driving characteristics in order to take advantage of this technology. If the vehicle offers traction control, operators should become acquainted with this feature prior to using it during an emergency response. Additional features may include four-wheel or all-wheel drive systems. Additional questions the ambulance operator should consider include:

- If the ambulance offers four-wheel drive, does it have a full transfer case allowing 4-HI and 4-LOW operation, and does it have manual, automatic or center-locking differential modes?
- What does each mode do and why?
- Is the vehicle full-time or part-time four-wheel drive?
- Does it have a limited slip?
- Have the various operating modes been tested and experienced by ambulance driver prior to operating in winter conditions?
- What is the best operating mode for a given traction condition?

EMS vehicles are subject to the same physical constraints as other production vehicles, including the opportunity to become stuck or stranded. The driver faces a real possibility of becoming stranded for hours until rescued by a plow or tow truck. In addition to checking the vehicle for the usual medical and technical supplies, the operator should consider a cooler of energy bars, water and other supplies in case he or she gets stranded during inclement weather. The driver should ensure the ambulance includes space for warming blankets, keeping in mind that other stranded motorists may seek refuge in the ambulance. Also, operators should consider keeping a spare set of windshield wipers in the ambulance to replace damaged or faulty wipers.

3.15.1. Guidelines for Driving in Adverse Weather

Adverse weather conditions include rain, snow, wind, fog and dust.

- When operating on ice or conditions with a reduced coefficient of friction, or when snow, rain or smoke impairs visibility, the ambulance operator should slow to a speed that will allow for safe response or transport.
- If the vehicle begins to skid, the driver should ease up on the accelerator and turn the front wheels in the direction of the skid.
- In purchasing an ambulance, departments should consider the use of electronic stability control (ESC) systems, a computerized technology to detect and mitigate skids. When an ESC system identifies a loss of steering control, it automatically applies the brakes and may cut engine power to help control and direct the vehicle. According to NHTSA and the Insurance Institute for Highway Safety, up to one-third of fatal accidents might be prevented this way. ESC is increasingly featured in EMS apparatus, particularly modern van-type units, and could be especially beneficial in rural areas where single-vehicle crashes produce many ambulance-related injuries.

- If the operator feels that the tires have lost traction with the surface of the road and the vehicle is hydroplaning, he or she should take their foot off the accelerator and let the vehicle slow down. The driver should not try to stop until the tires grip the road again. To reduce the chances of hydroplaning, tires with adequate water-channeling treads should be used and checked often. The operator should always slow down on wet roads.
- The operator should make sure he or she is able to see and be seen. If driving in rain or snow, the ambulance operator should stop occasionally to wipe mud or snow off the windshield, headlights and taillights. Even in excellent weather, the headlights should be on so as to be seen by other drivers.
- The operator should slow down at the first sign of rain, drizzle or snow on the road. Many road surfaces are most slippery at this time because moisture mixes with oil and dust that has not been washed away. If not already on, the driver should turn on low-beam headlights. Heavy rainfall can reduce visibility to zero; therefore, if the call allows the operator should pull over and wait for the rain to subside or until visibility improves.
- Ambulance operators should slow down when driving in fog as fog makes it very difficult to judge speed.
- Drivers should increase the following distance in fog and be prepared to stop within the space that can be seen in front of the vehicle. Operators should also watch for slow moving vehicles, check rearview mirrors for vehicles approaching from behind, reduce speed in patchy fog conditions and turn on the vehicle's low-beams.
- The operator should pull safely and completely off the road if the fog becomes so thick that he or she can barely see. They should not continue driving until the fog lifts and visibility improves.
- Adverse weather conditions such as rain, fog, ice, snow and dust can limit visibility. Operators should reduce speed, drive at speeds safe for the weather or delay departure until conditions improve.
- Streets and highways covered with snow, snow pack or ice are extremely hazardous. When the snow or ice begins to melt, roads are most hazardous as the slush or wet surface acts as a lubricant and reduces traction.
- Wind creates additional problems for ambulance operators. It can be especially dangerous for high-profile vehicles like ambulances. The best defensive driving technique one can use for high wind is driving at slower speeds. Wind generally reduces steering control: tail winds push a vehicle, increasing speed; head winds slow a vehicle down; and crosswinds may cause the ambulance to swerve. Operators should be prepared to make adjustments in speed and steering to compensate for wind conditions or safely pull over to allow gusty winds to subside. The ambulance operator should be prepared for gusts of wind when crossing a culvert or bridge, or passing through a mountain pass or ravine. Wind

gusts occur suddenly and may cause a total loss of vehicle control, requiring adjustments in speed and steering. The operator should be alert when being passed by a large truck or bus since these may create a small gust.

3.15.2. Extreme Weather Condition Equipment

Extreme weather conditions may require special equipment (e.g., tire chains) or special skills by the driver (e.g., slow starts and stops). Guidelines for driving in snow or icy conditions include:

- Keeping the windows and windshield clear;
- Obtaining maximum visibility by turning on low-beam headlights and windshield wipers;
- Driving slowly and staying farther behind the vehicle ahead;
- Slowing to a crawl on ice and decreasing speed when approaching curves and intersections;
- Avoiding fast turns; and
- Avoiding quick stops.

4.0 Standard Operating Procedures and Technology

This section presents ambulance operations best practices that address the use of SOPs and performance aiding technology.

An SOP, for the purposes of this research, is defined as the approved standard to be followed in carrying out a given operation or in a given situation. SOPs can come in the form of set rules or checklists. All SOPs should address procedures for dealing with poor weather conditions.

Ambulance operator performance can be significantly enhanced by the appropriate implementation of technology that supports situational awareness and encourages safe driving practices. At the same time, technology can negatively impact driver performance by acting as a distractor.

4.1. Communication Devices and Protocols

Communications between the ambulance operator and others inside or outside of the ambulance is critical, but can become a significant source of distraction, leading to a higher likelihood of an accident. Communication mechanisms that might be used by the operator include radios, company cell phone, personal cell phone, intercom between the cab and the patient compartments, laptops, and the pass-through window or patient compartment walkthrough. In addition, the patient compartment might include a visual display to communicate the operator's use of brakes and turn signals. The following presents best practices associated with communications devices and protocols.

4.1.1. Communications While Moving

The use of communications devices, such as cell phones and radios, represents a potential key distraction for an ambulance operator. Reaching for, activating and using a communications device can cause the driver to remove his or her eyes from the road and reduce attention to the primary task of driving. This can be minimized by:

- Designating the ambulance operator's partner as the primary communications contact between ambulance and other stakeholders, such as the dispatcher and hospital; and
- Limiting the ambulance operator's communications to only that which is essential, can be performed with one hand, and requires only minimal eye diversion from the road when the ambulance is in motion.

4.1.2. Use of Constrained Language

Communications between the operator and others should employ a constrained language vocabulary that allows verbal communications to be quickly and accurately performed. Constrained language consists of concise, well-defined phrases or terms that convey a specific meaning to others. This allows for more effective communication between two or more individuals in noisy or stressful environments and reduces the chances of miscommunications or misinterpretations. Training should be conducted between all those involved in communications to ensure that they understand the constrained language vocabulary.

4.1.3. Communications Prior to Departure and During Transport

As the ambulance departs a location, specific critical communications need to occur to ensure that the departure and subsequent travel is as risk free as possible. Departing a parked location can be risky due to poor visibility and high levels of activity. These include backing into objects, colliding with other vehicles or people at the scene, or injury to EMS providers or patients in the patient compartment. To reduce risk, the driver should adhere to the following:

- Prior to departing a parked position, regardless of where it is (accident scene, hospital, station), the driver should communicate with others at the scene to ensure that it is safe to pull out into the roadway. Communication can be facilitated by speaking directly through an open window, by using a device, or by using hand signals. Hand signals should be consistent with industry standards as illustrated in Figure 1.

Figure 1 – Typical Hand Signals

(From Alton Fire and Rescue Department Standard Operating Guidelines
http://www.altonfire.org/SOG_1.3.4_Backing-Up_Apparatus.pdf)

- Prior to moving, the ambulance operator should verify that those in the patient compartment are ready to leave, which includes being seated and restrained.
- The ambulance should include a device that communicates to the driver when EMS providers in the patient compartment are not restrained during patient transport.
- Communication between the operator and those in the patient compartment should follow all of the best practices cited above.

4.1.4. Ambulance Operator Compliance

Ambulance operators are expected to comply with all regulations of their department including:

- All EMS personnel and passengers are to be seated and restrained while the vehicle is in motion.

- Ambulance operators are to follow minimum rest requirements for shifts to reduce fatigue as discussed in Section 2.4.
- EMS personnel are to ensure that vehicle, staff and equipment are ready to respond to calls at the beginning of each shift.
- Operators are to follow all vehicle operation regulations regarding backing, turning, passing other vehicles, following the speed limit, etc.
- Operators are to comply with all required training and retraining.
- Driver impairment due to elongated shifts, medications, alcohol, drugs, illness or fatigue should be promptly reported to the supervisor.

4.1.5. Ambulance Operator Qualification

Ambulance operators should be adequately trained and qualified to drive. They must make vital and timely decisions while responding to an emergency call or transporting patients to a hospital without risking the lives of the medic team and other civilians, or causing further injury to their patient. They must possess knowledge of driving rules and regulations as well as the skills and ability to implement those rules appropriately. Failure to be properly trained and qualified can lead to injury or death to themselves, their passengers and other motorists. Studnek and Fernandez (2007) analyzed 27 fatalities of EMS workers from the FARS database and found that the majority occurred during favorable weather and environmental conditions. Forty-eight percent of the ambulance drivers involved in the crashes had a poor driving record prior to the crash. Several practices should be implemented to ensure that drivers exhibit proper qualifications, including maintaining a good driving record, maintaining proper physical health and obtaining emergency vehicle certification.

4.1.6. Maintain a Good Driving Record

Ambulance operators should have no recorded incidence of driving under the influence, suspended license, vehicular manslaughter or other infractions that could jeopardize the public's welfare**.** Driving records should be examined for the number of accidents or infractions for the three years prior to being permitted to operate the ambulance.

4.1.7. Maintain Proper Physical Fitness

All EMS personnel should complete a physical exam prior to being hired. Medical conditions such as loss of consciousness, cardiovascular disease, neurological/neurovascular disorder, mental illness, substance abuse/dependency, insulin-dependent diabetes, or any other rheumatic, arthritic, orthopedic, muscular, neuromuscular, or vascular disease that interferes with driving a vehicle must be noted in the exam. The presence of a medical condition alone may not disqualify an EMS provider from driving an ambulance; however, it can identify an area for consideration in determining their medical fitness. Once hired, several practices should be followed to maintain physical fitness:

- Ambulance operators should complete a physical annually.
- A standardized physical fitness program should be provided.
- A physical fitness assessment should be implemented to monitor the level of fitness at least biannually.
- At least one hour per duty day should be allotted for physical fitness.

4.1.8. Complete Emergency Vehicle Certification

All ambulance operators should be required to obtain certification from an Ambulance Vehicle Operators Course (AVOC), Emergency Vehicle Operator Course (EVOC) or Coaching the Emergency Vehicle Operator (CEVO) course. In addition, drivers should:

- Pass visual acuity, glare recovery and reaction time tests.
- Demonstrate proficiency on the regulations and procedures addressed during classroom training.
- Demonstrate proficiency in driving skills such as braking, backing up, turning, parking and crash avoidance through the hands on portions of the class (see Training 4.0 for additional information).

4.1.9. Complete Emergency Vehicle Operations Check-off

All new hires should complete a vehicle operations checklist to ensure that they are familiar with ambulance controls and equipment.

4.1.10. Complete Ambulance Operations Qualification Card

An ambulance operator qualification card (Table 2) should be completed for each EMS equipment operator and placed in his or her record before they are allowed to operate the vehicle.

Table 2 – Example Driver Qualification Card

Ambulance Operator Qualification Card	**Sign Off:** **Name/Date:**
I. Prerequisites	
A. Candidate must complete one of the following:	

Ambulance Operator Qualification Card	**Sign Off:** **Name/Date:**
1. AVOC Course 2. CEVO Course 3. EVOC Course	
B. Candidate should complete one of the following: 1. Red Cross CPR (cardiopulmonary resuscitation) for the Professional Rescuer 2. American Heart Association (AHA) Healthcare Provider (CPR and AED (Automated External Defibrillator)) 3. AHA Heartsaver AED (CPR and AED)	
II. Knowledge Requirements	
A. Candidate must possess general knowledge of the roads and house numbering system within the ambulance district.	
B. Candidate must possess a working knowledge of routes to all local hospitals (including alternative routes).	
C. Candidate must possess knowledge of emergency driving SOPs.	
D. Candidate must possess knowledge of all gauges, switches and controls in the cab and in the patient compartment.	
III. Knowledge and Location Requirements	
A. Candidate must demonstrate knowledge and location of the following equipment: 1. Main oxygen tank and valve 2. Helmet and fire coat 3. Portable radio 4. Spotlight 5. Fire extinguisher 6. Hazmat Response Guidebook 7. Injury report clipboard 8. Winter weather equipment	

Ambulance Operator Qualification Card	**Sign Off:** **Name/Date:**
9. Multiple casualty incident kit 10. Extrication equipment (splints, hare traction splint) 11. Backboards, headblocks and collars 12. Portable suction 13. Portable oxygen tanks 14. Basic life support medic's bag	
IV. Skill Requirements	
A. Candidate must demonstrate ability to complete the following ambulance driver operations: 1. Start the engine 2. Stop the engine 3. Engage the parking break 4. Disengage the parking break 5. Properly use lights, sirens and public address system 6. Operate both high-band and low-band radios (in cab and box) 7. Turn on/off main oxygen tank 8. Read pressure in main oxygen tank 9. Operate the gurney (demo all adjustments) 10. Operate the stair chair (demo all adjustments) 11. Operate the GPS units (demonstrate address searches)	
B. Candidate must complete the driving course with ambulance: 1. Straight line driving forward 2. Straight line driving reverse 3. Alley dock 4. Serpentine 5. Confined space	

Ambulance Operator Qualification Card	**Sign Off:** **Name/Date:**
6. Offset 7. Diminishing clearance 8. Stop	
V. Practice	
A. Candidate should practice driving non-emergency return from the hospital 2-3 times (with a driver trainer).	
B. Candidate should practice driving emergency mode to the scene 3-4 times (with a driver trainer).	
VI. Approval	
Instructor's signature and date:	

4.1.11. References

Sanddal, T.L., Sanddal, N. D., Ward, N. & Stanley, L. (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist (D1).* Washington, D.C.: U.S. Department of Transportation.

Studnek, J.R., and Ferketich, A. (2007). Organizational policy and other factors associated with emergency medical technician seat belt use. *Journal of Safety Research, 38,* 1-8.

Walworth Ambulance Inc. (2009). *Driver Qualification Card.* Retrieved March 22, 2013 from www.walworthfire-ems.org.

4.2. Encountering an Accident When En Route to an Emergency

In the course of responding to a call, EMS personnel may encounter another emergency. Responders should take several steps to achieve the best outcome. These include:

- Stopping and investigating immediately, unless responding to a life-threatening call;
- Checking for injuries;
- Notifying dispatch of the location, number, type and extent of injuries as well as any need for additional units and police;
- Protecting the incident scene with warning devices (e.g., cones) to prevent additional damages or injuries;
- Maintaining the vehicles in place until the police arrive;

- Proceeding with response to the original call if the accident involves non-life-threatening injuries. If possible, one person from the medic team should remain at the accident site; and
- Administering aid and notifying dispatch to send another unit to the original call if life-threatening injuries are present.

4.2.1. Reference

McNeil and Company (n.d.). *Ambulance Driving Policy Guidelines.* Retrieved March 3, 2013 from http://www.mcneilandcompany.com/?s=sample+policy.

4.3. Lights and Sirens

Reports indicate that most emergency vehicle accidents occur when ambulances operate with lights and sirens. Sanddal et al. (2008) examined 112 rural crashes involving ambulances and found that 86 occurred while the ambulance was operating with lights and sirens. All 86 accidents resulted in injuries and 23 resulted in fatalities. Although studies such as Addario, et al. (2000) and Kupas et al. (1984) confirmed that response times are slightly faster when ambulances operate with lights and sirens, there are indicators that the faster response time did not significantly impact patient recovery with the exception of cardiac arrest and obstructed airway patients.

The decision to run lights and sirens must be made cautiously. Depending on the nature of the patient emergency, running lights and sirens may not significantly affect patient outcome and could result in higher risk of EMS personnel injury or death. The following guidelines should be followed when making the determination to operate with lights and sirens.

4.3.1. Perform Risk Assessment

Dispatch should conduct a risk assessment using a risk matrix similar to the one presented in Figure 2. Based on information received from the caller, dispatch should determine the frequency and severity level of the incident. For incidents determined to be of high frequency and severity, lights and sirens should be run. For incidents with low frequency but high severity, lights and sirens should also be run. For incidents with low frequency and severity, no lights and sirens should be run.

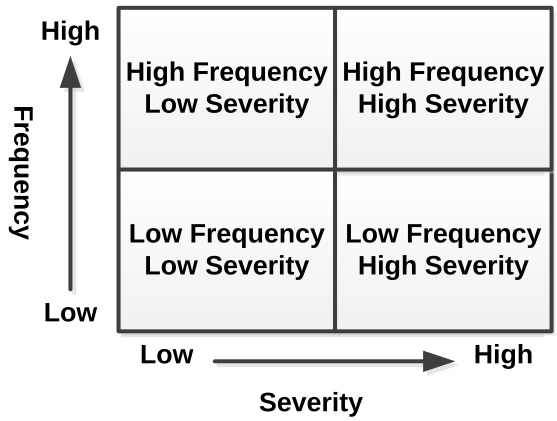

Figure 2 – Risk Level Matrix

4.3.2. Respond Cautiously to Patient Call

The ambulance operator should:

- Read back dispatch information to ensure understanding.
- Downgrade as needed upon receipt of additional information from first responders at the scene.
- Proceed no more than 10 mph above posted speed limit.

4.3.3. Cautiously Conduct Patient Transport

The EMS equipment operator should:

- Determine if lights and sirens are needed based on severity of patient's symptoms and the risk matrix above; lights and sirens should only be used when the required patient care is greater than the ability of the ambulance to provide.
- Upgrade or downgrade as needed over the course of the transport.
- Proceed no more than 10 mph above posted speed limit.

4.3.4. 3.3.4 References

Addario, M., Brown, L., Hogue, T., Hunt R. C., & Whitney, C. L. (2000). Do warning lights and sirens reduce ambulance response times? Prehospital Emergency Care, 4, 70-74.

Federal Emergency Management Agency. (2004). *Emergency Vehicle Safety Initiative* (FA-272). Department of Homeland Security: Washington, D.C.

Hunt, R.C., Brown, L.H., Cabinum, E.S., Whitley, T.W., Prasad, H., Owens, C.F., & Mayo, C.E. (1995). Is ambulance transport time with lights and siren faster than that without? *Annals of Emergency Medicine, 25,* 507-511.

Kupas, D., Dula, D., & Pino, B. (1994). Patient outcome using medical protocol to limit "lights and siren" transport. *Prehospital and Disaster Medicine, 9,* 226-229.

Sanddal, N.D., Albert, S., Hansen, J.D. & Kupas, D.F. (2008). Contributing factors and issues associated with rural ambulance crashes. *Prehospital Emergency Care, 12*, 257-267.

4.4. Mirrors

Mirrors serve as an important tool to ensure the driver can accurately view his or her surroundings and use that information to make safe decisions.

4.4.1. Mirror Maintenance and Alignment

Mirrors should be properly aligned and maintained using the following guidelines:

- At the beginning of a shift, and as necessary, the side view mirrors should be adjusted to support the equipment operator.
- Mirrors should be kept clean as dirty mirrors will reduce available light and cause glare when approaching vehicles or streetlights.
- Mirrors should not be located and mounted where door pillars or other obstructions block the view.
- The location and mounting of the mirrors should prevent warning lights from reflecting in the mirror and blinding the driver's view.

4.4.2. Mirror Purchase Considerations

The following guidelines should be considered when determining the type of mirrors to include in new apparatus purchases:

- Remote-controlled mirrors should be considered, especially on the curb side.
- Convex and other secondary mirrors should be considered to eliminate blind spots not covered by primary mirrors.
- Where necessary, heated mirrors should also be considered.

4.5. Navigation

When responding to an EMS call, the ambulance operator must determine the most direct route while avoiding potential hazards or delays. Effective route selection considerations include route planning and operator familiarization.

4.5.1. Route Planning

Route planning involves learning the geographic and local conditions, individual characteristics of the area and organizational procedures to map out the most efficient route to the emergency scene.

- Primary and alternate routes should be identified.
- Alternate routes should be available in case of bad road conditions, weather or other situations that effect primary routes.
- Navigation at night can be difficult, especially as street signs, hazards or other problems are difficult to see.
- The EMS operator and partner should communicate as a team and follow the organization's standard procedure for giving direction.
- A map of the local operations area should be assembled and referred to when deciding upon a route to the scene.
- When planning a route, drivers should think about the geographic and local conditions affecting the roads along the planned route.
- Operators should add useful information that is not included on the map, such as dirt roads, dangerous intersections, very steep grades, roads or lanes on roads that change direction according to the time of day.
- Operators should be aware of and prepare for the conditions in the area to which the ambulance will be driving.
- When heading out to the emergency scene, the operator should communicate with dispatch or directly with the first responder.
- Operators should choose routes that minimize stops and turns, avoid intersections and avoid residential streets to the extent possible.
- Routes should be developed and maintained by the EMS organization or coordinated with other emergency services in the area.
- Operators should practice communicating navigating directions with the team during a practice run or when returning to the station.

4.5.2. Operator Familiarization

Operator familiarization involves awareness of changes to the route, procedures to identify local information and consideration of height restrictions. Drivers should:

- Consider any special events that may occur on the primary and alternate routes (e.g., parades).
- Find out if new developments or buildings are under construction on the primary and alternate routes.

- Be aware of changing weather and road conditions, typically congested traffic times such as the beginning and end of the work or school day and shift change times at large employers; determine if an alternative route needs to be taken when responding to an emergency.
- Be familiar with local reference points, such as buildings, farms, gas stations, etc., when operating in an area with limited road and street signs.
- Keep the ambulance height posted in the vehicle where it is easily visible; the dashboard or visor should be considered.
- Be aware of height restrictions when planning routes that include passage through bridges, tunnels and parking ramps.

4.5.3. Navigation Systems

Depending on the EMS department, a GPS navigation system may be provided. GPS can be an effective and easy to use tool to further assist the driver in quickly and safely transporting the patient. It can quickly calculate step-by-step directions that provide routes to multiple destinations. If the driver deviates from the planned route, the navigation system will automatically recalculate the route to determine a new one from the current location. Some GPS systems even include a mode for emergency vehicles. The following guidelines describe ways to maximize the effectiveness of this tool:

- Prior to using the system on a response call, the ambulance operator should ensure that he or she is familiar with the features and know how to operate the system.
- If the vehicle is in motion, only a passenger should program the unit. The operator should not program the unit unless the vehicle is stationary and in a safe location.
- Depending on the capabilities of the navigation system, it may provide information on suggested routes without regard to factors that may affect the driving experience or the time required to arrive at the destination, such as congestion or road closure.
- The navigation system is not a substitute for good judgment. The route suggestions should never supersede any local traffic regulation, personal judgment or knowledge of safe driving practices.
- Up-to-date maps or map books should still be consulted to ensure the driver follows an appropriate route.

4.6. Parking

When EMS equipment operators position emergency vehicles on any street, road, highway or expressway, they should park in a manner that best protects the incident scene and the work area. All EMS providers should understand and appreciate the high risk that personnel are exposed to when operating in or near moving vehicle traffic. Moving vehicles should always be considered a threat to safety. The following guidelines should be followed when parking the ambulance:

- Drivers should always park the ambulance in a hazard-free area to protect the crew, patient and the ambulance (e.g., at a motor vehicle accident, pull past the accident to avoid fuel spills and park the vehicle off the road on the shoulder).
- A spotter should assist when parking to the driver's blind side.
- When parking in a parking space or driveway, the driver should back into the parking area to allow the ambulance a safe and efficient exit.

4.7. Performance Monitoring

New and pending standards or state laws may require the use of video data recording device (called a black box) on all apparatus. Variables such as vehicle speed, acceleration, deceleration, engine throttle position, anti-lock braking system, seat occupation and if the occupant is seat belted will be monitored. Software to produce reports on these behaviors is also required. A commonly used electronic device, the black box monitors driving factors such as speed, acceleration, braking and cornering. It provides auditory warnings when the driver breaches the threshold for these behaviors and records them for performance reports. The following guidelines should be followed for compliance with performance monitoring:

- All EMS providers in the ambulance should comply with all required behaviors within the vehicle (wearing seatbelts and complying with traffic laws regarding speeding).
- No attempts should be made to turn off or disable the performance monitoring system.
- Any member of the EMS provider team who observes dangerous driver behavior (e.g., reckless or erratic driving) or attempts to disable the performance monitoring system should promptly report the incident to his or her supervisor.

4.8. Right of Way

It is important to determine which vehicle has the right of way to minimize potential injury to the medic team and civilians.

4.8.1. Right of Way Guidance

Ambulance operators should abide by the following guidance to handle right of way situations:

- Do not assume civilians see or hear the ambulance. If they do see and hear the ambulance, do not assume they will give it the right of way.

- Use warning lights to inform civilians of the presence of the ambulance. Civilians are more likely to realize the ambulance's proximity, decide upon an action to take and carry out that decision with sufficient time and space.
- On a multilane highway, do not enter an opposing traffic lane until it is safe to do so and all other oncoming vehicles are aware of the ambulance's presence.
- Similarly, do not enter a one-way street against traffic until all opposing traffic is aware of the ambulance's presence and yields the right of way.

4.8.2. Reference

U.S. Department of Transportation. (1995). Emergency Vehicle Operator's Course Manual. National Highway Traffic Safety Administration: Washington, D.C.

4.9. Spotter

Ambulance operators should use the support of a spotter when performing backing or other obstructed view maneuvers. A spotter guides the operator and ensures the avoidance or identification of any potential hazards. The spotter should direct the operator to stop at any time the backing maneuver cannot be completed safely. There are several guidelines that should be followed to ensure safety of the EMS providers and reduce damage to the vehicle.

4.9.1. Backing the Ambulance

Where backing is unavoidable:

- A spotter or an assistant outside the vehicle should be used.
- A spotter should be used when vehicles must negotiate forward turns with restrictive side clearances and uncertain height clearances. The spotter expands the driver's sense for the right, left, front and rear space cushions.
- Under circumstances in which the ambulance is staffed by only the operator (e.g., all other personnel are inside the residence with the patient), the driver should attempt to utilize any available emergency services personnel to act as spotters. If no personnel are available to assist, the operator should park the vehicle, get out and make a complete survey of the space cushion around all four sides of the vehicle to determine the presence of any obstructions before proceeding to back the ambulance.
- Spotters must never ride the tailboard or running boards while the vehicle is in motion. The spotter should be in a visible safe zone positioning him or herself 10 to 15 feet at the left rear of the ambulance.

- The vehicle should not be backed until the spotter is in the safe zone and communicated his or her approval to begin backing by way of a hand signal, and voice, when possible.
- Spotters should remain visible to the driver in the safe zone. Anytime the driver loses sight of the spotter, the vehicle should be stopped immediately until the spotter is again visible and the communication to continue backing is processed. Backing the ambulance should be done very slowly and cautiously.
- The operator should make sure the window is down and audio systems are off during backing.

4.9.2. Standard Signals

The standard signals for spotters (see paragraph 3.1.3 and Figure 1) are as follows:

- *Straight Back* – One hand above the head with palm toward face, waving back. Other hand at the side.
- *Turn* – Both arms pointing the same direction with index fingers extended.
- *Stop* – Both arms crossed with hands in fists. The signal should be reinforced by yelling the "stop" order loud enough for the operator to hear.
- *Night Backing* – Signals are the same. The spotter should assure that the rear-ambulance spotlights are turned on before allowing the vehicle to be backed. A flashlight, wand type is useful, may be carried but at no time should it be directed towards the mirrors.

4.10. Vehicle Readiness

Ambulances must be kept fully stocked and in operating condition. EMS providers should conduct inspections of the ambulance at the beginning of each shift to ensure it contains all of the supplies required to respond to calls and perform patient care. Any maintenance issues should be promptly noted and reported so they can be resolved in a timely manner. EMS providers should also keep track of supply levels and any vehicle operations issues that occur over the course of their shift; any items needing to be resupplied can be ordered and restocked and nonemergency vehicle repairs scheduled. Table 3 provides a sample of a vehicle readiness checklist.

Table 3 – Example Vehicle Readiness Checklist

Vehicle Readiness Checklist If the category meets expectations, place a check mark in the box unless otherwise noted. If the category does not meet expectations, the crewmembers will immediately correct the problem if possible. If the crewmembers are unable to correct the problem, a minus will be

placed in the column. If a crewmember feels the truck needs to be taken out of service due to the deficiencies, a supervisor will be notified immediately.	
1. Mileage Obtain the mileage from the odometer.	
2. Fuel Place a check mark in the box if fuel level is above ¾ of a tank. If level is below ¾ mark the designated level with ¼, ½, or ¾. If below ¾ fuel it up.	
3. Tire Checks Visually check all tires for defects. Thump the tires to ensure proper inflation. If tires pass the inspection, place check mark in the box. If tires do not pass inspection, call a supervisor and place the truck out of service.	
4. No Fluid Leaks Visually inspect under the vehicle for fluid leaks. If fluid leak is noted, investigate cause and immediately check all the fluids. Call supervisor or base maintenance person. If no fluid leaks are noted, or if a leak was noted and the fluids are in safe range, place a check mark in the box.	
5. Exterior Clean Examine exterior of the ambulance. If the exterior passes the inspection, place a checkmark in the box.	
6. Exterior Equipment Check all exterior cabinets for appropriate equipment levels. If cabinets pass inspection, place a check mark in the box.	
7. Radio/Cell Phone Power up all cell phones and radios. Key up the mic and listen to the repeater activate. If radio and cell phones pass inspection, place a check mark in the box.	
8. All Lights With the ambulance running, check all interior, exterior and emergency lights. If any lights are out, put note on the maintenance board. If the lights pass inspection, place a check mark in the box.	
9. Interior Clean Examine interior of the ambulance. If the interior passes inspection, place a check mark in the box.	
10. Suction Inspect portable and in-house suction units for any defects. Turn suction on and kink suction hose and watch gauge. The unit should reach 300 mmHg quickly. If the suction units pass the inspection, place a check mark in the box. If the unit fails, notify a supervisor.	

11. Cardiac Monitor Inspect the monitor and cables for any defects. If the monitor passes inspections, place a check mark in the box. If the unit fails, notify the supervisor.	
12. Portable Oxygen (O_2) Record O_2 level. If below 500 psi, change the tank and record the new level.	
13. Main O_2 Record O_2 level. If below 500 psi, change the tank and record the new level.	
14. Interior Equipment Check all interior cabinets for appropriate equipment. If the cabinets pass inspection, place a check mark in the box.	
15. First in Bag Inspect bag for proper equipment. If bag passes inspection, place a check mark in the box.	
16. Paperwork Check clipboards for adequate amount of paperwork. If adequate amount of paperwork noted, place a check mark in the box.	
Crew Member's Signature and Date:	

4.11. Reference

Hunter Ambulance (2007). *Driver Training Review*. North Star Emergency Medical Services. (n.d.) Daily Ambulance Checklist. Retrieved March 25, 2013 from http://www.fchn.org/docs/northstar/Daily%20Checklist%20Instructions.pdf.

4.12. Training Development

This category is reserved for parties with authority to create and regulate EMS driver training. A training program is most effective when best practices guide the development effort. If executed well, a training program should maximize efficiency, safety, job satisfaction and foster a culture of innovation. The following best practices should be considered for the development and regulation of EMS driver training.

4.13. Training Requirements

Although training should embody teaching of the SOPs mentioned in Section 3, the following SOPs should be considered for training requirements.

4.13.1. Mandated Ambulance Operator Training

All EMS organizations should adopt and mandate training procedures concerning vehicle operations. Courses such as EVOC provide training and skill building opportunities; however, only 31 of 50 states, as illustrated in Table 4, require EVOC prior to operating an ambulance.

Table 4 – States Requiring EVOC

State	EVOC Required?	State	EVOC Required?
Alabama	Yes	Montana	No
Alaska	No	Nebraska	Yes
Arizona	No	Nevada	No
Arkansas	No	New Hampshire	No
California	No	New Jersey	No
Colorado	No	N. Mariana Islands	Yes
Connecticut	Yes	New Mexico	Yes
Delaware	Yes	New York	No
District of Columbia	Yes	North Carolina	No
Florida	Yes	North Dakota	No
Georgia	No	Ohio	No
Hawaii	Yes	Oklahoma	Yes
Idaho	No	Oregon	Yes
Illinois	No	Pennsylvania	Yes
Indiana	No	Rhode Island	No
Iowa	Yes	South Carolina	No
Kansas	No	South Dakota	No
Kentucky	Yes	Tennessee	No
Louisiana	No	Texas	No
Maine	No	Utah	No
Maryland	No	Vermont	No
Massachusetts	No	Virginia	Yes
Michigan	No	Washington	No
Minnesota	Yes	West Virginia	Yes

State	EVOC Required?	State	EVOC Required?
Mississippi	Yes	Wisconsin	No
Missouri	Yes	Wyoming	Yes

4.13.2. Mandated Behind-the-Wheel Training

Ambulances tend to be larger and more difficult to maneuver than other conventional vehicles. Ambulance operators need in-depth training and practice to obtain the skills needed to operate these vehicles safely. EMS personnel should be offered multiple opportunities to learn and practice braking, stopping, making lane changes, driving, backing and parking. These driving skills should further be solidified by on-the-job training.

4.13.3. Mandated On-the-Job Driver Training

Students should be mandated to complete a certain number of on-the-job training hours before he or she can drive without a supervisor. Training students by making them perform real tasks while on the job is important. After completing training, students should maintain new skills and knowledge.

4.13.4. Mandated Refresher Training

Refresher training should be mandatory for all ambulance operators at a minimum of once per year. The same best practices for training should be applied to refresher training.

4.13.5. Training Course Development

Learning objectives, class skill level and the teaching organization’s technology and logistics resources heavily drive the course design and technology selection. All of the following course elements should be considered when developing a training course.

4.13.6. Standardize Training

Training courses should be standardized as much as possible. Currently, three primary EVOC training programs exist across the United States. These training programs are built upon documents produced by the U.S. Department of Transportation (DOT), the United States Fire Administration (USFA) and the National Safety Council (NSC). All three courses vary in content and approach to training.

Based on training documentation, the USFA places more emphasis on the consequences of unsafe driving, incident report reviews, the motivation to drive safely, and the legal regulations in place, while it gives a cursory overview of vehicle maintenance and operation. The DOT course discusses the legal aspects of safe driving as well; however, more of its modules deal with the actual aspects of driving the vehicle, including vehicle inspection, navigation, route planning and vehicle handling during emergency situations. The NSC focuses on general vehicle handling as well as defensive driving.

Thus, ambulance drivers receive emphasis on different aspects of ambulance operation depending on which course they completed. Training needs to be standardized so all drivers nationwide are not only aware of the legal aspects of operating an ambulance safely, but also aware of the mechanical techniques involved in operating the vehicle and avoiding accidents. Table 5 below illustrates the course differences.

Table 5 – EVOC Curriculum Content and Time Allocation Comparison

Lesson #	DOT	Hrs	USFA	Hrs	NSC	Hrs
1	Introduction	1	Introduction	.5	Self-Appraisal	NS
2	Legal Aspects	1.5	The Problem	1.5	Inspection	NS
3	Communication	1.5	Motivation	.5	Safety Cushion	NS
4	Ambulance Ops	.5	Personnel	1	On the Road	NS
5	Inspection	2	Legal Aspects	1	Specific Considerations	NS
6	Navigation	2	Physical Forces	2	Emergency Driving	NS
7	Maneuvers	3	Maintenance	.5	Final Test	NS
8	Special Issues	3	SOP	1		
9	Safety	1.5				
10	The Run	1				
Total Hrs.	(Estimated)	17	(Estimated)	8	(Estimated)	4

NS = Not Specified

4.13.7. Tailor Courses

Training should be tailored to cover topics of particular importance to certain regions (i.e., driving in the snow for the north, or driving amongst many pedestrians in cities) or EMS providers. This may include guidance for how to determine training time allocation (i.e., if a driver is especially poor at backing up, more time should be spent on that portion of training). For example, all course content on weather should be standardized, but more time may be spent on training within a certain topic per regional needs (i.e., real world driver training in the snow for a northern region).

4.13.8. Develop Meaningful Learning Objectives

Learning objectives should be documented and reviewed, ensuring the student clearly understands them. Trainers should develop clear, meaningful, performance-based objectives that can be achieved in the allotted time. Trainers should make sure the class understands these objectives.

4.13.9. Organize Course Content Logically

Well-designed courses should include a timed agenda, learning objectives, instructional content and examples. Thoughtfully chosen graphics and animation convey learning points, further detail content and help enhance recall.

4.13.10. Use Tested Teaching Methods

Training courses should implement tested processes. Implementation of tested processes leads to high-quality training that minimizes challenges and maximizes success.

4.13.11. Choose Appropriate Technology to Supplement Training

Technology and its features can be engaging to some learners, but frustrating to others. Therefore, selecting technology that is suitable for the intended audience is critical and should be done carefully. Selection of the appropriate technology supports the learner's ability to demonstrate repeated successful integration of the training information into their knowledge base, improve their relevant skills and positively change in their attitudes.

4.14. Interactivity

Effective “interactive” learning uses various methods to engage the learner with the content, while decreasing passive reception of information from an instructor. Additionally, careful design of content layout, overviews, summaries and information sequence can improve learner engagement.

4.14.1. Make Course Interactive

Training should help students retain information and make learning enjoyable and interactive. Group work, quizzes and other activities can help make training programs less lecture-based and more interactive.

4.14.2. Provide Real World Training

Real world training opportunities, such as supervised driving, should be provided to students. One of the most important elements of training development is its easy transference back to the work environment. This method of training is much more effective than teaching theory and expecting students to apply it in the real world. It also provides a safe environment for students to make mistakes and be provided feedback.

4.14.3. Use Case Studies to Teach Decision Making

Training should incorporate teaching via case studies, scenarios and lessons learned training. This type of teaching is much more effective at increasing learner attention and critical thinking than standard multiple-choice questions.

4.14.4. Ask Interim Quiz Questions

Interim quiz questions should be offered throughout the course to create a method for providing immediate, detailed feedback to the learner on his or her performance. Objective questions (i.e., those with one correct answer that minimizes use of forced choice, e.g., true/false) are most effective. Varying the types of questions also enhances interactivity.

4.14.5. Provide Students with Feedback

Feedback should be provided in real time as often as possible. Make sure to clearly explain why the answer given was right or wrong. If the wrong answer is given, encourage the learner to try again or provide the correct answer with an explanation for why the correct answer is more appropriate.

4.14.6. Continuously Refine Training Course

To maximize the effectiveness of new information and technologies, training courses should be continuously refined.

4.14.7. Update Course Content Regularly

Courses should be reviewed at least annually to ensure that the most current information is presented. A group of subject matter experts should review learning objectives and course content for technical accuracy and relevance.

4.14.8. Evaluate Training Course Effectiveness/Seek Student Satisfaction with Course

Student course evaluation should be taken into consideration for course refinement. Timely and accurate learner feedback serves as an essential component of training development. For maximum accuracy, feedback should be obtained at the completion of each course session. Immediate learner feedback improves the overall course because instructors can integrate quality suggestions into future editions of the training.

4.15. References

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