

EXECUTIVE SUMMARY

The delivery of emergency medical services (EMS) is a key functional activity within the safety infrastructure of modern civilization. Responding to emergency incidents and the subsequent transport of injured victims to hospitals and similar health care facilities involve inherent risks. Of particular interest is motor vehicle crashes involving ambulances used for EMS.

Understanding the magnitude and severity of this risk is essential to addressing the overall problem and formulating the necessary policy to address the problem. Data collection for ambulance crashes are typically reported on a local or statewide basis, and a need exists to compile and coordinate this data on a national basis. Crashes involving ambulances are the central focus of this study, with specific attention on the collection of ambulance crash data and the methods used to collect this data.

For this study, a "crash" is recognized as any reportable adverse event that causes vehicular property damage and/or injury to either the EMS crew or civilians. This is intended to include both with and without the transport of patients, and for single or multiple vehicle events such as collisions, rollovers, submersions or fire. It is intended to exclude events independent of the transport function, such as pre-existing life-threatening condition of a civilian victim, or an act of violence like a shooting independent of the transport function. Also excluded are indirect injuries or fatalities beyond the crash scene due to a delayed response of medical care.

The goal of this project is to provide information that will improve the safety of EMS crews and their patients. Objectives to achieve this goal include identifying available data sources, providing limited analysis of the data, recommending optimum data formats, and providing summary data if available.

Certain observations became apparent as a result of this study. For example, every state has a Traffic Records Committee which coordinates crash-related data and serves as a useful point of contact within a particular state, and each state has a lead agency responsible for EMS activities, which once again serves as an important point of contact for ambulance crash data.

Data that are gathered among the available sources needs to be used with significant care, especially when attempting to address trends in the data which may have been collected in ways that could distort an analysis. As an example, in one state (Delaware) an investigation revealed that historical ambulance crash data was based on input that was incorrectly interpreting ambulance "response" as being "involved" in a motor vehicle crash, i.e. the ambulance simply responded to the call and was thus "involved". In another state (New Jersey), data is only captured for licensed providers which do not include private companies.

The deliverables for this project provide a comprehensive overview of existing efforts involving data collection methods at the national, state and local level, along with observations and recommendations relating to the future direction of these data collection efforts. The following are the key observations that have been discussed throughout this report and summarized here:

National Data Collection

- The information collection infrastructure for ambulance crash data is relatively well evolved, but at the same time has room for future enhancements and improvements.
- At the national level, the NEMSIS (National EMS Information System) program provides well established guidelines for the collection of EMS data.
- At the national level, the MMUCC (Model Minimum Uniform Crash Criteria) program provides well established guidelines for the collection of emergency responder vehicle crash data.

State-Based Data Collection

- Ambulance crash data collection at the state level is significant in quantity.
- From a national perspective a lack of uniformity exists among and within the states.
- State-based ambulance crash information collection appears to be occurring on two basic fronts: through the state dept. of public health, often including or in collaboration with the state EMS agency, and also through police accident reports (PARs) that are typically collected through the state dept of transportation.
- In some cases these separate data collection streams are coordinating and sharing information, and in other cases they are effectively independent.
- Efforts to promote and use the MMUCC program guidelines by individual states should continue.

TABLE OF CONTENTS

Executive Summary	1
Table of Contents	3
Summary of Figures and Tables	4
1. Introduction and Background	5
2. Overview of Emergency Responder Data Collection Methods	7
a. Background on Emergency First Responders	8
b. Profile of Emergency Medical Services	10
c. Background on Data Collection Methods	13
d. Information Resources	14
3. Nationally-Based Data Collection Activities	20
a. Federal Government National Data Collection	21
b. Non-Government Based National Data Collection	25
4. State and Local Data Collection Activities	33
5. Summary Observations	57
6. Bibliography	59
a. References Cited	59
b. Additional Reading References from Peer and Non-Peer Publications	63
Annex A: Common Definitions	71
Annex B: Ambulance Crash Data	74
Annex C: Sample State Level EMS Crash Data Form	93

SUMMARY OF FIGURES AND TABLES

Figure 2-1: Overall Safety Infrastructure with Emergency Response Personnel

Figure 2-2: Types of EMS Organizations

Figure 2-3: Combined Fire Services and Emergency Medical Services

Figure 2-3: EMS Provider Levels

Table 2-1: Fire Departments that Provide EMS

Table 2-2: Average Number of Ambulances in Fire Departments

Table 2-3: Selected Summary of Organizations Related to Ambulance Crash Information

Table 3-1: Summary of Ambulance Crash Data from NHTSA FARS and NASS GES, 1990-2009

Table 3-2: Example of Use of Ambulance Crash Data (for U.S. in 2009)

Table 3-3: Summary of Daily News Articles for Motor Vehicle Ambulance Crashes

Table 4-1: Summary of State Ambulance Crash Data Collection

Table 4-2: Summary of Selected State Ambulance Crash Data

1. INTRODUCTION AND BACKGROUND

The delivery of emergency medical services (EMS) is a key functional activity within the safety infrastructure of modern civilization. This involves providing emergency care for injured residents and citizens followed by transport to health care facilities (e.g., hospitals) whose purpose is to provide optimum medical care.

Responding to these emergency incidents and the subsequent transport of injured victims to hospitals and similar health care facilities involve inherent risks. Speed of delivery in both directions is paramount and requires rapid and efficient deployment with ambulances and other transport equipment proceeding rapidly while using emergency lights and sirens.

As a result, motor vehicle crashes involving ambulances used for EMS pose a serious risk to both the crew and the patients. Understanding the magnitude and severity of this risk is essential to addressing the overall problem and formulating the necessary policy to address the problem.

Data collection for ambulance crashes are typically reported on a local or statewide basis, and a need exists to compile and coordinate this data on a national basis. Information such as the number of crashes, cause and contributing factors, and injuries or fatality of personnel and civilians can be found within local emergency service departments and at the state level (e.g., Office of Emergency Medical Services, a.k.a. OEMS), but a comprehensive national report of public and private ambulance crashes including fatalities, injuries, and contributing causes is lacking.

Such data are of interest to multiple groups and organizations. For example, the NFPA Technical Committee on Ambulances is seeking information that describes the existing data collection landscape to support the development of a new proposed document on the safe design of automotive ambulances. Other NFPA committees are also interested in this data, such as the NFPA Technical Committee on Fire Service Training, which is considering the development of a new section for ambulance driving in NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*, and the NFPA Technical Committee on Fire Fighter Professional Qualifications, which is reviewing the requirements for NFPA 1002, *Standard for Fire Apparatus/Operator Professional Qualifications*.

The goal of this project is to provide information on data collection methodologies that will improve the safety of EMS crews and their patients. Objectives to achieve this goal include identifying available data sources, providing limited analysis of the data and data collection methods, recommending optimum data formats, and providing summary data if available.

To achieve this goal and these objectives, this project involves the following tasks:

- 1) *Identify Sources.* Identify and create a list of key resources and points of contact of local, regional, state, and national organizations that have previously collected ambulance crash data or may do so in the future;
- 2) *Compile Formats.* Create a compilation of the formats, approaches, and elements used by the identified organizations collecting data;
- 3) *Analysis.* Analyze the compilation for consistency and harmonization of the formats, approaches, and elements;
- 4) *Recommendations.* Establish a recommended optimum data collection format, approach, and data elements; and
- 5) *Summary Data.* Provide summary data if available.

This study is focused on data collection methods and is not intended to obtain and analyze actual data for the sake of drawing conclusions on ambulance crashes. In cases where actual data are referenced or addressed, the purpose will be to exemplify the methods used to collect data. The overall intent is to clarify the optimum structure or framework for use on a national level for the collection of ambulance crash data.

The geographic area addressed by this study is for ambulance crashes that occur within the United States. The data collection methods of interest are those addressing direct injuries and fatalities; the study scope does not include indirect injuries or fatalities beyond the crash scene due to a delayed response of medical care. Property damage is not excluded from this study, although the primary focus is on those incidents with direct injuries and fatalities.

The research project has been conducted under the auspices of the Fire Protection Research Foundation with guidance provided by a Project Technical Panel of subject-matter experts.

2. OVERVIEW OF EMERGENCY RESPONDERS AND DATA COLLECTION METHODS

Emergency Medical Services (EMS) is recognized as providing patient services that might include the provision of assessment, treatments, and other pre-hospital procedures, including ambulance transportation of patients.¹ These services often involve multiple separate organizations with a range of professional personnel that work together in a systematic manner to provide effective implementation.

Various descriptions and definitions of EMS can be found in the literature. For example, EMS is also defined as a national network of services providing aid from the first response to the selected care.² Additional EMS characteristics include a staff trained in emergency care, and being linked into the local and regional emergency communication system.

From an overall perspective, the system that supports EMS involves coordinated activities working in unison providing service to individuals requiring emergency medical care. An EMS system is defined as “a comprehensive, coordinated arrangement of resources and functions which are organized to respond in a timely, staged manner to medical emergencies regardless of their cause.”³

Transportation is a key component of the EMS system, and in most cases this is handled by a motor vehicle such as an ambulance. In some situations, especially those requiring technical rescue, other transport methods might be used (e.g., remote wilderness, hand-carried litters, helicopters, aircraft, boats, and so on). This study is focused on motor vehicle ambulances as the method of transport; other methods of transport are considered outside the study scope.

Similar to other key terms, multiple definitions of ambulance are found in the literature, though they are all relatively similar with only subtle differences. For example, NFPA 450, *Guide for Emergency Medical Services and Systems*, defines an ambulance as “a vehicle designed, equipped, and operated for the treatment of ill or injured persons.”⁴ Another mainstream definition can be found in *Mosby’s Emergency Dictionary* which defines an ambulance as “an emergency vehicle used to take patients to a hospital or other treatment center in cases of accident, injury, or severe illness.”⁵

Crashes involving ambulances are the central focus of this study, with specific attention on the collection of ambulance crash data and the methods used to collect these data. Reliable on-going data, representative of the real-world micro and macro issues, are critical to setting meaningful policy and organizational decision-making.⁶

For this study, a “crash” is recognized as any reportable adverse event that causes vehicular property damage and/or injury to either the EMS crew or civilians. This is intended to include events with or without the transport of patients and single or multiple vehicle events such as collisions, rollovers, submersions, or fire. It is intended to exclude events independent of the

transport function, such as a pre-existing life-threatening condition of a civilian victim or an act of violence such as a shooting independent of the transport function. Also excluded are indirect injuries or fatalities beyond the crash scene due to a delayed response of medical care.

Background on Emergency First Responders

The safety infrastructure comprises all activities that keep us safe from harm. To some extent, safety is proactively designed into almost all products and can range from passive design characteristics, such as the type of materials used in consumer goods (e.g., toys), to active safety features, such as automatic sprinkler systems in buildings.

These passive and active safety characteristics and features are intended to prevent hazards from occurring, or to mitigate them and keep them from escalating. In contrast, other parts of our safety infrastructure provide reactive manual intervention to address these hazards once they are beyond the protection capabilities of built-in passive and active safety measures.

Virtually anywhere in the United States, a person can pick-up the telephone to report an emergency and can expect someone to respond, even in extremely remote wilderness areas where response will take a significant amount of time. The professionals who respond to these emergencies are “emergency first responders,” also referred to as “first responders.”

Emergency first responders are defined as “a group designated by a community as those who will first respond to an incident,” and are usually composed of emergency medical service providers, the fire service, and/or local police.⁷ These personnel are engaged as the front-line resources responding to any given emergency. They are further defined in NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents* as: “those persons, including members of fire departments, police departments, other law enforcement agencies, hazardous materials response teams, emergency medical services, and other organizations that have public safety responsibilities and who would respond to rescue and treat victims, and who would protect the public during an emergency incident.”⁸

Emergency first responders are an important part of our safety infrastructure. They generally operate by responding to initiate action, control, and mitigation of a particular hazard or problem. Emergency first response organizations are arguably reactionary in overall composition, based on a high percentage of staffing and equipment devoted to response operations like EMS, rescue, and fire suppression.⁹ However, certain key line functions are proactive, such as community health and wellness programs that involve inspection, prevention, education, and fire- and crime-mitigation campaigns supporting these programs.

From an overall context, EMS is one of three key groups in the spectrum of emergency first responders, along with fire service and law enforcement. From a traditional perspective these three groups are separate, but in reality there is significant crossover. This is especially the case with EMS and the fire service, which have trended in this direction in recent years with single

organizations in a particular community providing both rescue (EMS) and fire protection services. Figure 2-1 summarizes these three groups within the framework of the traditional safety infrastructure.

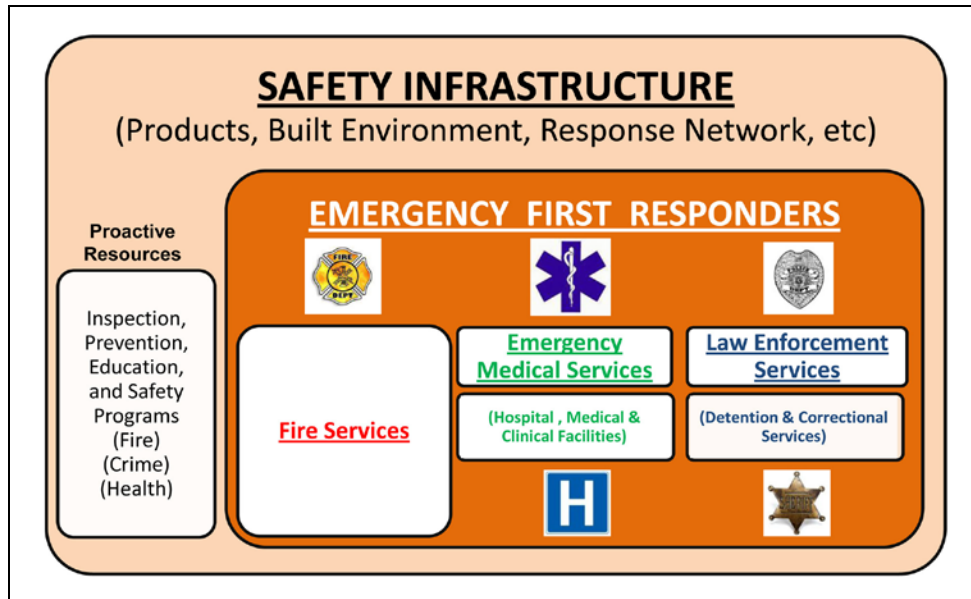


Figure 2-1: Overall Safety Infrastructure with Emergency Response Personnel

Emergency first responders are those professionals providing immediate service to mitigate an emergency event. Others responding to the scene of the emergency as follow-up or secondary support are considered “emergency responders” but not “emergency first responders.” Examples are tow and salvage operators, electric utilities for downed power lines, or fire investigators.

Several other occupational groups are also directly involved with the safety infrastructure, although they don’t normally respond to the scene of an event (except within their own facilities) and thus are one step removed as “first responders.” For example, hospital, clinical and medical personnel are the ultimate recipients of emergency victims. Although they are not normally “responding” directly to the scene of an emergency incident, they are nevertheless a critical part of the emergency response chain.

Federal regulations (29 CFR 1910.120(q)) administered by the U.S. Occupational Health and Safety Administration (OSHA) recognize healthcare workers and hospital employees receiving victims as “first receivers”. Meanwhile, the “first responders” are the emergency medical technicians, fire fighters and police officers responding to an emergency.¹⁰

Profile of Emergency Medical Services

One approach for defining how EMS provides their services for a particular jurisdiction is the manner in which they operate and their primary funding basis. Based on a 2003 survey of state EMS officials, the EMS community operates according to three basic types of EMS organizational approaches (with their approximate percent of the overall total indicated parenthetically) as follows: privately-held or contract organizations (~49%); fire department based (~45%); and municipal based other than fire department (~6%).¹¹

The types of EMS organizations are illustrated in Figure 2-2. In some cases the distinction between the services provided in a particular community has some overlap, such as when the publicly-supported fire department provides basic ambulance service but depends on private-contracted ambulance service for advanced life support. Thus, the values in this breakdown are considered to be approximations.

A further breakdown of the types of EMS includes whether the professionals involved are career, volunteer, or a combination of both. The types of EMS indicated by the National Registry of Emergency Medical Technicians are: (1) government EMS; (2) fire and police linked service; (3) voluntary EMS; (4) private ambulance service; (5) combined emergency services; and (6) hospital based service.¹²

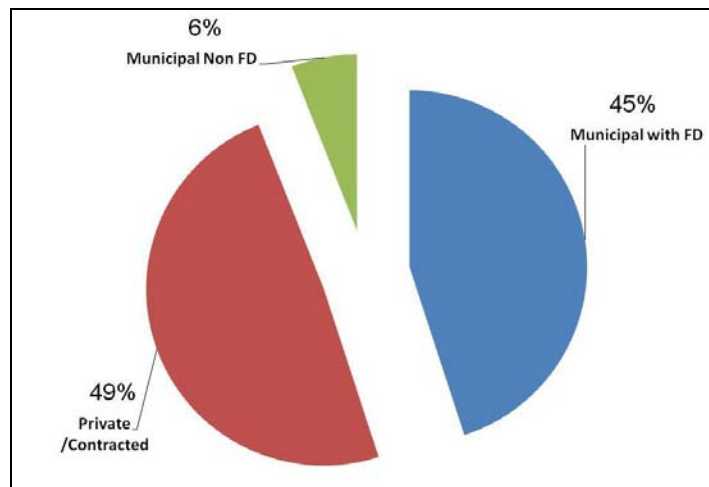


Figure 2-2: Types of EMS Organizations

In many jurisdictions, fire and rescue response services operate as distinctly separate organizational entities. Conversely, it is also common for them to be combined into a single organization. Based on data collected for the period between 2005 and 2007, 59% of the fire departments in the United States also provide emergency medical services. This is subdivided as 44% of fire departments handle EMS and another 15% provide EMS and advanced life support. This is shown in Figure 2-3, which illustrates the percent of departments that have combined fire services and emergency medical services.¹³

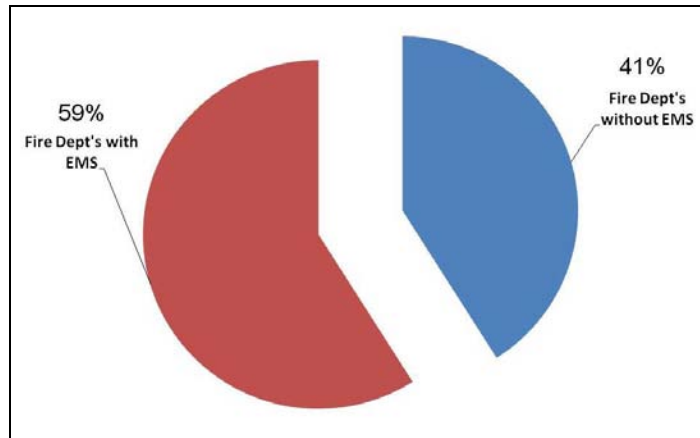


Figure 2-3: Combined Fire Services and Emergency Medical Services¹⁴

Ambulances operating under emergency conditions are exposed to greater risks than conventional traffic due to the nature of their operation. The rate of ambulance collisions per miles driven is perceived to be several times that of civilian drivers. Based on information provided by the American Ambulance Association that was collected through insurance organizations protecting ambulance services, it is estimated that over 10,000 ambulance-related collisions occur annually, with many of these resulting in injury or death.¹⁵

For EMS operations integral with fire department operations, data are available that provide additional useful profile information describing the EMS function. Based on the “Third Needs Assessment of the U.S Fire Service,” roughly two-thirds (~69%) of all fire departments indicate that that EMS is a role that they perform.¹⁶ Table 2-1 provides summary data on the percentage of fire departments that provide EMS, by community. The percentage of the fire departments that provide EMS has been steadily increasing in recent years, based on similar Needs Assessments completed in 2001 and 2005.¹⁷ The most likely community size to have a fire department that does not perform EMS is in small rural communities with less than 2500 population, but even for these small fire departments a majority, or 60%, now provide EMS.

Table 2-1: Fire Departments that Provide EMS¹⁸

Community Population	Fire Depts. without EMS		Fire Depts. with EMS		Total	
	Number of Depts.	Percent	Number of Depts.	Percent	Number of Depts.	Percent
500,000 or more	2	3.8%	51	96.2%	53	100%
250,000 to 499,999	2	3.2%	60	96.8%	62	100%
100,000 to 249,000	2	1.3%	235	98.7%	238	100%
50,000 to 99,999	26	5.8%	421	94.2%	447	100%
25,000 to 49,999	107	9.9%	978	90.1%	1,085	100%
10,000 to 24,999	524	17.8%	2,427	82.2%	2,951	100%
5,000 to 9,999	1,032	27.5%	2,723	72.5%	3,755	100%
2,500 to 4,999	1,466	30.1%	3,409	69.9%	4,875	100%
Under 2,500	5,148	39.7%	7,816	60.3%	12,964	100%
Total	8,310	31.4%	18,120	68.6%	26,430	100%

Additional data are available through the latest Needs Assessment on the number of ambulances used by fire departments in each community, based on responses to their survey from 4,237 fire departments.¹⁹ Table 2-2 illustrates the average number of ambulances or other patient transport vehicles per fire department, according to the population of the community. These averages are calculated over all departments in the particular community size category, and since a larger percentage of fire departments in smaller communities do not provide EMS (up to 40% in communities under 2,500), understandably they have a lower average number of ambulances per fire department.

Table 2-2: Average Number of Ambulances in Fire Departments²⁰

Community Population	Average Number of Ambulances
500,000 or more	33.67
250,000 to 499,999	11.50
100,000 to 249,000	4.23
50,000 to 99,999	2.47
25,000 to 49,999	2.01
10,000 to 24,999	1.23
5,000 to 9,999	0.77
2,500 to 4,999	0.49
Under 2,500	0.32
Overall Average Total	0.75

The professional qualifications of EMS personnel and their organizations are generally well-established. From a categorical standpoint this is referred to as “level of care provided” and “service levels.” These concepts define the provision of patient care services as determined by provider certification and licensure.²¹

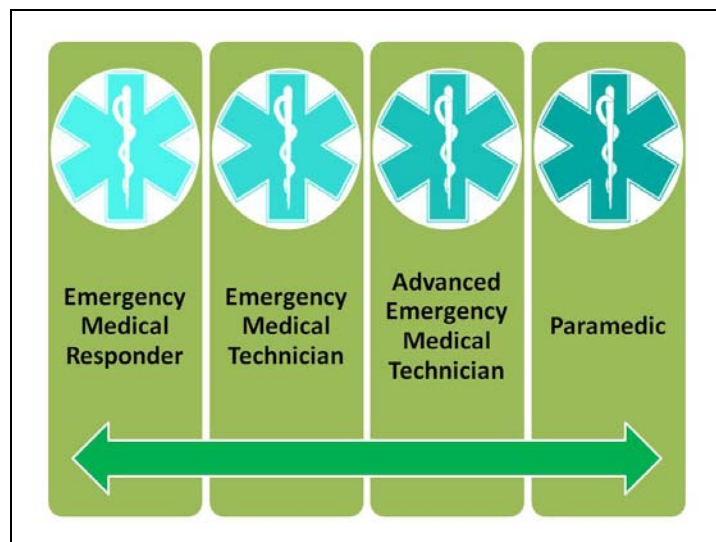


Figure 2-3: EMS Provider Levels²⁵

State and local jurisdictional authorities normally provide the programmatic oversight for certification and licensure of personnel to perform within their specific scope of practice levels.

Consequently, in the United States the certification and licensure of EMS delivery varies from state to state.²² However, they all generally consider the following four basic categories of provider levels: Emergency Medical Responder; Emergency Medical Technician; Advanced Emergency Medical Technician; and Paramedic.²³ These are illustrated in Figure 2-3, EMS Provider Levels. These latest category titles were recently updated, and some may be more familiar with the previous titles: First Responder; Basic Emergency Medical Technician (EMT-B); Intermediate Emergency Medical Technician (EMT-I); and Paramedic (EMT-P).²⁴

Although not necessarily indicative of the number of overall EMS professionals, one interesting indicator of the magnitude of each of these provider levels is through the widely recognized certifications provided by the National Registry of Emergency Medical Technicians. Their data indicate in 2010 there were the following certified professionals at each of these provider levels:²⁶

- Emergency Medical Responder – 9,666
- Emergency Medical Technician – 220,547
- Advanced Emergency Medical Technician – 18,708
- Paramedic – 72,544

Background on Data Collection Methods

Reliable representative data and their analysis provide clarification of the problem at-hand, but data recorded over time also provide clarification of trends. Once a problem is identified (e.g. ambulance crashes are higher in certain states during certain seasons), an obvious question is whether the situation is getting better or worse over time.

Information collected over time must have a consistent base of comparison during the years covered. The sampling techniques used to create the database need to, as much as possible, avoid shifts and modifications over time that could compromise trend analysis. The better and more comprehensive the data collection methods are designed from the outset, the better will be the ability to analyze trends.²⁷

The general approach being taken with the national collection of ambulance crash data is top-down, or top-driven. The analysis of data involving a top-down approach begins with a summary of big numbers and then subdivides the totals into their major parts.²⁸ This type of approach provides the broadest perspective on the overall problem. Accordingly, this study is based on a review of existing national data collection efforts supplemented by existing efforts that are on-going on a state or local level.

For any subject, there are inherent challenges in designing an approach for collecting national data that maintains its effectiveness over time. Addressing subtle yet critical details up front is paramount, since the passage of time will continually test the efficacy of the overall approach.²⁹ Details that are not obvious during the initial stages can become magnified in subsequent collection periods and possibly introduce questions on the data being used for policy decisions.

In subsequent years after the launch of the data collection effort, fundamental revisions may not be an attractive option, since they could possibly compromise the year-to-year comparisons that are essential for on-going analysis.

Definitions of the information being collected provide an example of the details addressed up front within the design of a particular data collection effort. In the case of ambulance crashes, the definition of an “ambulance” and “crash” are important. For the definition of ambulance, we had earlier indicated that it is “a vehicle designed, equipped, and operated for the treatment of ill or injured persons.”³⁰

For this study, we are further defining “ambulance” as a motor vehicle approved for travel on public roadways. On this basis it excludes, for example, vehicles not intended for motorized transport over public roadways such as farm equipment, construction equipment, or all-terrain off-road vehicles. Further, this excludes motor vehicles not intended for this purpose, such as private passenger cars. In certain historic large-scale disasters, a wide spectrum of non-ambulance vehicles have been used to transport injured victims, such as the 1942 Coconut Grove disaster which also utilized taxis and newspaper delivery trucks.³¹

The term “crash” as used with a motor vehicle is intended to indicate a collision that disrupts the functionality of the unit. The data collection methods of interest in this study are crashes that result in direct injuries and fatalities. Here, “direct injuries and fatalities” is intended to include only the injuries and fatalities caused by the crash itself, and not those resulting away from the crash scene due to a delayed response of medical care for the original emergency incident.

Activity among existing national data collection efforts indicates a growing interest on placing more emphasis on “serious injury crashes.” Justification for this approach is based on very little difference between a fatal crash and a serious injury crash, and considering both would substantially increase the robustness of most crash analyses. At this time a standard definition of “serious injury crashes” in use across the country is lacking.

One additional factor that is altering the overall data collection landscape is technological innovation. Enhancements that promote more efficient individual data collection efforts will likewise enhance broad data collection efforts. For example, the on-going and future digitization of electronic communications and dispatch data allows for noteworthy efficiencies with broad data collection efforts. The continued evolution of computer hardware and software is allowing improved automated linkage of data involving topics such as vehicle crash reports, hospital activity, medical claims and other data-rich resources.³²

Information Resources

Numerous organizations provide either direct or indirect support for the EMS community by addressing ambulance crash related information. These have been established and have

evolved over the years to fulfill certain express needs. The organizational types are quite varied and include private non-profit membership associations, trade groups, state or federal government agencies, collective bargaining bodies, commercial enterprises, and so on.

In addition to entities with a national orientation, there are multiple groups and organizations that are active on a state or local level. For example, an ambulance-based association for EMS professionals can be found in a variety of states. Their purpose is to represent the interests of their constituents and provide a forum for additional networking and dialogue. More specifically, the following states have active ambulance/EMS association: Arizona, Arkansas, California, Colorado, Iowa, Kentucky, Maine, Michigan, Minnesota, Missouri, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Vermont, Wisconsin, and Wyoming.³³

Table 2-3 provides a brief summary of selected national organizations that provide noteworthy direct support for today's EMS activities and ambulance crash related information in the United States. In addition, most of these organizations provide a website that includes links to other related organizations, some of which may be worthy of further possible consideration.³⁴

Table 2-3: Selected Summary of Organizations Related to Ambulance Crash Information

<p><u>American Ambulance Association (AAA)</u> (www.the-aaa.org) A membership association representing ambulance services in the United States. Established in 1979, the association serves more than 75% of the U.S. population, with its representative membership consisting of emergency and nonemergency care and medical transportation services. It has developed the Commission on Accreditation of Ambulance Services (CAAS), which became an independent entity in 1990.</p>
<p><u>American Association of State Highway and Transportation Officials (AASHTO)</u> (www.transportation.org) A nonprofit U.S.-based association of state and federal transportation agencies with a primary goal to foster the development, operation, and maintenance of an integrated national transportation system. It develops technical standards and addresses transportation involving air, highways, public transportation, rail, and water.</p>
<p><u>American Automobile Association Foundation for Traffic Safety (AAAFTS)</u> (www.aaafoundation.org) Established in 1947, the foundation is a not-for-profit, publicly-supported charitable educational and research organization, dedicated to saving lives and reducing injuries on the roads.</p>
<p><u>American College of Emergency Physicians (ACEP)</u> (www.acep.org) A national membership organization founded in 1968 that promotes the interests of emergency physicians, based on a membership of more than 28,000 emergency physicians, residents and medical students.</p>
<p><u>American Heart Association (AHA)</u> (www.americanheart.org) A national voluntary health agency founded in 1924 whose mission is to reduce disability and death from cardiovascular diseases and stroke. It offers programs addressing cardiac care in the pre-hospital environment, provides published peer-reviewed scientific journals, and recommends changes to cardiac care based on scientific research.</p>
<p><u>American Medical Association (AMA)</u> (www.ama-assn.org) Founded in 1847 and among the oldest medical related organizations in North America. Their mission is to promote the art and science of medicine and the betterment of public health.</p>

American Public Health Association (APHA) (www.apha.org) Founded in 1872, they are among the oldest and most diverse organizations of public health professionals. Its focus is to assist U.S. residents, families, and their communities from preventable, serious health threats. It pushes for universal accessibility of community-based health promotion and disease prevention activities and preventive health services.

Association of Transportation Safety Information Professionals (ATSIP) (www.atsip.org) A membership organization for professionals working within the areas of traffic safety data collection, management, and analysis, to further the development and sharing of traffic records system procedures, tools, and professionalism. Founded in 2009, it had previously existed as a subcommittee under the National Safety Council.

ASTM International (American Society of Testing and Materials) (www.astm.org) A membership society that is one of the world's largest voluntary standards developing organizations. With a membership of approximately 30,000, it administratively supports more than 130 technical committees responsible for more than 12,000 standards.

Center for Disease Control and Prevention (CDC) (www.cdc.gov) An agency within the U.S. Department of Health and Human Services that promotes issues of interest to EMS professionals.

Commission on Accreditation of Ambulance Services (CAAS) (www.caas.org) An independent accreditation commission that provides indication of an organization's compliance with various standards and performance measures. It was created in 1984 under the American Ambulance Association and became a separate organization in 1990.

Consumer Product Safety Commission (CPSC) (www.cpsc.gov) A commission within the U.S. federal government whose mission is to protect the public from unreasonable risks of injury or death from the types of consumer products under the agency's jurisdiction, which include products that pose a fire, electrical, chemical, or mechanical hazard. The CPSC collaborates with NIOSH to collect non-fatal work-related injury data through the National Electronic Injury Surveillance System (NEISS).

EMS Coalition ([www.emsworld.com/print/EMS-World/EMS-Coalition-Breaks-Ground/1\\$5994](http://www.emsworld.com/print/EMS-World/EMS-Coalition-Breaks-Ground/1$5994)) A quasi-formal organization of EMS professionals that first started meeting in 2010 for the purpose of prioritizing the recommendations made in the 2006 report, *Emergency Medical Services at the Crossroads*, issued by the Institute of Medicine's Committee on the Future of Emergency Care in the United States Health System. EMS Magazine and EMSWorld assist with organizational administration.

Federal Communications Commission (FCC) (www.fcc.gov) The Public Safety and Homeland Security Bureau is a division of the FCC involved with EMS, and their primary mission is to ensure continuous operations and restore critical communications systems and services in the event of an emergency.

Federal Emergency Management Agency (FEMA) www.fema.gov An agency within the U.S. Department of Homeland Security whose initial beginnings can be traced back to the Congressional Act of 1803, and whose primary mission is to reduce the loss of life and property and protect the United States from all hazards, including natural disasters, acts of terrorism, and other man-made disasters.

Federal Highway Administration (FHA) (www.fhwa.dot.gov) A division of the United States Department of Transportation addressing highway transportation, the FHA serves as the custodian for the nation's highway transportation system.

Federal Interagency Committee on Emergency Medical Services (FICEMS) (www.ems.gov/ficems) Established in 2005 by the U.S. Department of Transportation Reauthorization, Public Law 109-59 (Section 10202), its purpose is to ensure coordination

among U.S. federal agencies involved with state, local, tribal, and regional emergency medical services and 9-1-1 systems.

Fire and Emergency Manufacturers and Services Association (FEMSA) (www.femsa.org) A trade association representing more than 130 companies, FEMSA provides products to EMS and fire professionals worldwide.

General Services Administration (GSA) (www.gsa.gov) Operating under the Department of Commerce, it serves as the landlord for the U.S. federal government. GSA purchases ambulances for the U.S. federal government, and its ambulance purchase specification has become widely recognized as de-facto design requirements for these vehicles.

Governors Highway Safety Association (GHSA) (www.statehighwaysafety.org) A U.S.-based non-profit organization whose members are the state highway safety offices of the 50 states, U.S. territories, and Indian nations. GHSA implements programs to address behavioral highway safety issues (e.g., occupant protection, impaired driving, speeding, etc.) and provides leadership and advocacy to improve traffic safety, influence national policy, enhance program management and promote best practices.

Health Resources and Services Administration (HRSA) (www.hrsa.gov) An agency within the U.S. Department of Health and Human Services responsible for improving access to health care services for people who are uninsured, isolated, or medically vulnerable. HRSA is comprised of six bureaus and 13 offices, providing leadership and financial support to health care providers in every state and U.S. territory.

Highway Loss Data Institute (HLDI) (www.iihs.org/about_hldi.html) A nonprofit research organization organized in 1972 that is an affiliate of the Insurance Institute for Highway Safety. HLDI publishes insurance loss statistics on most passenger vehicles on US roads and administers a database of more than 150 million individual passenger vehicles representing about 80% of all privately insured road vehicles, which is considered one of the largest repositories of such information in the world.

Indian Health Services (IHS) (www.ihs.gov) An agency within the U.S. Department of Health and Human Services responsible for providing federal health services to American Indians and Alaska natives.

Insurance Institute for Highway Safety (IIHS) (www.iihs.org) An independent, nonprofit, scientific, and educational organization dedicated to reducing deaths, injuries, and property damage from crashes on the nation's highways. IIHS supports its mission through scientific studies of insurance data representing the human and economic losses resulting from the operation of different types of vehicles.

International Association of Emergency Medical Services Chiefs (IAEMSC) (www.iaemsc.org) A professional membership and advocacy organization serving the chief officers of the EMS community, with a focus on career and volunteer EMS constituents worldwide.

International Association of Fire Chiefs (IAFC) (www.iafc.org) A membership association of approximately 13,000 members established in 1873, representing the fire service leadership, serving career and volunteer chiefs, chief fire officers, company officers and managers of emergency service organizations throughout the international community. The EMS section was established in 1985 and is one of the largest membership sections within IAFC. The IAFC also sponsors the Commission on Fire Accreditation International (CFAI), which provides performance measures for the evaluation of fire and emergency services organizations.

International Association of Fire Fighters (IAFF) (www.iaff.org) A membership organization established in 1918, representing the interests of more than 298,000 full-time professional fire fighters and paramedics protecting the majority of North America's population.

National Association of Emergency Medical Service Physicians (NAEMSP) (www.naemsp.org)

An organization established in 1984 of physicians and other professionals partnering to provide leadership and foster excellence in and out of hospital emergency medical services.

National Association of Emergency Medical Technicians (NAEMT) (www.naemt.org)

A membership association of 32,000 EMS professionals founded in 1975 and dedicated to representing the professional interests of all EMS practitioners, including paramedics, emergency medical technicians, first responders, and other professionals working in pre-hospital emergency medicine.

National Association of State Emergency Medical Service Officials (NASEMSO)

(www.nasemsd.org)

A nonprofit organization founded in 1980 representing state and territorial EMS agencies and their officials in 56 jurisdictions, including state directors, medical directors, and training coordinators. Prior to 2006 the organization was known as the National Association of State EMS Directors.

National EMS Advisory Council (NEMSAC) (www.ems.gov/nemsac)

A nationally recognized council established in April 2007, composed of EMS representatives and consumers providing EMS oriented advice and recommendations to NHTSA, its host organization. NEMSAC provides a forum for the development, consideration, and communication of information from a knowledgeable and independent perspective for advancing EMS systems nationwide.

National EMS Information System (NEMSIS) (www.nemsis.org)

A data collection initiative created to promote the unification of EMS data. Administration is provided through a technical assistance center jointly hosted by the University of Utah and the University of North Carolina. The genesis of its origin can be traced prior to 2001, but at that time the effort appeared under the NEMSIS banner through the combined efforts of a public private partnership involving the National Association of State EMS Officials, National Highway Traffic Safety Administration (NHTSA), and the Trauma/EMS Systems program of the Health Resources and Services Administration's (HRSA) Maternal Child Health Bureau.

National Fire Protection Association (NFPA) (www.nfpa.org)

A nonprofit membership association established in 1896 with about 85,000 members, dedicated to the mission of making the world safe from fire and explosions through public education, research, and consensus-based model codes and standards. NFPA's nearly 300 technical committees provide more than 300 codes and standards, of which about 80 are directly focused on the needs of the emergency response community.

National Highway Traffic Safety Administration (NHTSA) (www.nhtsa.gov)

Operating within the Department of Transportation, the NHTSA Office of EMS (OEMS, at www.ems.gov) and its predecessor agency has pursued its mission since 1966, to reduce death and disability by providing leadership and coordination to the EMS community through assessing, planning, developing, and promoting comprehensive, evidence-based emergency medical services and 9-1-1 systems.

National Institute for Occupational Safety and Health (NIOSH) (www.cdc.gov/NIOSH)

An agency of CDC whose purpose is to generate new knowledge in the field of occupational safety and health and to transfer that knowledge into practice for the betterment of workers. NIOSH accomplishes its mission through scientific research, developing guidance and authoritative recommendations, disseminating information, and responding to requests for workplace health hazard evaluations. NIOSH collaborates with CPSC to collect non-fatal work-related injury data through the National Electronic Injury Surveillance System (NEISS).

National Registry of Emergency Medical Technicians (NREMT) (www.nremt.org)

A widely recognized certifying organization formed in 1970, NREMT provides a standardized framework for the certification of professional EMS providers.

National Volunteer Fire Council (NVFC) (www.nvfc.org) A non-profit membership association comprised of 49 state volunteer fire fighter organizations and other affiliated members, representing the interests of the volunteer fire, EMS and rescue services. The EMS/Rescue Section provides volunteers in an EMS delivery system with information, education, services, and representation to enhance their professionalism.

Transportation Research Board (TRB) (www.trb.org) A major division of the U.S. National Research Council serving as an independent adviser to the federal government and others on scientific and technical questions of national importance. The TRB is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Its mission is to provide leadership in transportation innovation and progress through research and information exchange. It is the administrative host for the Transportation Research Information Services (TRIS), which provides transportation-related library and data information.

U.S. Fire Administration (USFA) (www.usfa.dhs.gov) An entity of the U.S. Department of Homeland Security's Federal Emergency Management Agency, with a mission to foster a solid foundation in prevention, preparedness, and response by providing national leadership to local fire and emergency services.

3. NATIONALLY BASED DATA COLLECTION ACTIVITIES

There are currently several existing data collection programs that relate to the topic of ambulance crashes. A significant portion of this activity exists at the state and local level, although there are various data collection activities at the national level that address crashes involving motor vehicular ambulances. Data collection efforts for EMS with a state-based focus have evolved partly because of the general characteristics of the governmental framework in the United States. This is part of the challenge of coordinating data and similar information on a national level, for all emergency first responders including EMS.

From an international perspective, there are often inquiries about the genesis of the emergency responder infrastructure within the United States. As background, the general arrangement of U.S. governance has the federal government at the top, followed by state government (excluding territories), then county government, and finally local government involving cities, towns, or villages. This overall approach was established in 1789 as a federal republic under a strong democratic tradition, and is based on a legal system using English Common Law.³⁵

After the federal level, the next level of government is with the states, which includes each of the fifty states and the government of the District of Columbia (and excludes territories for sake of this discussion). While the federal government provides certain centralized functions such as foreign relations, currency regulation, and defense, state government has significant autonomy and addresses issues such as public safety, industry, business, public utilities, state criminal code, property regulations, and so on. The local government entities within each state provide direct support to their residents with services such as fire/rescue protection, law enforcement, education, public health, sanitary regulations, and housing.

The interaction between these levels of government depends of the constitutions and charters of the respective governing bodies. In the United States, the Tenth Amendment of the U.S. Constitution allows the states to exercise their reserved powers, including police powers. Consequently, topics of public safety, such as EMS and other emergency responders (e.g., law enforcement and fire service), receive primary attention at the state level (based on the state constitution) and local level as delegated by the particular state.³⁶

In summary, the focus on public safety activities like EMS is more generally rooted at the state and local level, and not the federal level. Yet important tasks still remain at the federal level, such as coordinating national data. Collecting data for EMS on a national level faces the natural obstacle of individual states handling this function directly themselves, usually with significant diversity.

Even with the inherent challenges of on-going data collection efforts occurring at the state level, a strong need to coordinate this data on a national basis is readily obvious. Several

national EMS data collection efforts exist based on both public and private sector arrangements. A review of some of these national data collection efforts follow here.

Federal Government National Data Collection

There are several noteworthy national data collection efforts that relate to the topic of ambulance crashes. The most robust and transparent of these have been developed and administered by a federal government agency. However, despite the clear strengths of these various efforts, they each have certain unique characteristics that at this time include various limitations.

Fatality Analysis Reporting System (FARS) and National Automotive Sampling System General Estimates System (NASS GES)

The Fatality Analysis Reporting System (FARS) and the National Automotive Sampling System General Estimates System (NASS GES) are perhaps among the most recognized national data collection activities in the United States addressing adverse motor vehicular traffic events. These systems are administered by the National Highway Traffic Safety Administration (NHTSA)

NHTSA is the agency within the U.S. Department of Transportation whose mission is to save lives, prevent injuries, and reduce vehicle-related crashes on U.S. highways and roads.³⁷ The agency has been a leader for issues relating to vehicular safety, and its data collection activities have been similarly noteworthy. For the topic of EMS, the NHTSA Office of EMS (OEMS) and its predecessor agency has pursued its mission since 1966, to reduce death and disability by providing leadership and coordination to the EMS community in assessing, planning, developing, and promoting comprehensive, evidence-based emergency medical services and 9-1-1 systems.³⁸

The FARS and NASS GES are both publicly available and widely utilized database programs. For more than three decades, FARS has been among the most referenced sources for U.S. vehicular fatal crash data; and since 1988, NASS GES has been a key source for non-fatal injury crash data.

Both the FARS and NASS GES systems have used fairly similar sets of data elements, but they have each evolved with different coding details, which required separate coding, software, documentation, and analysis. Starting in 2006, NHTSA began working with the Federal Motor Carrier Safety Administration (FMCSA) and the Federal Highway Administration (FHWA) to establish similar data standardization for the two systems. This work is on-going.³⁹

The guideline used by almost all states for their crash report forms and databases is the Model Minimum Uniform Crash Criteria (MMUCC).⁴⁰ The current work to synchronize the FARS and NASS GES is being done so that both systems will align with the MMUCC. The first phase of this coordination effort was completed in 2009 and involved 45 common data elements.⁴¹

The FARS data (focusing on fatalities) and the NASS GES data (focusing on injuries) are arguably the most comprehensive national data being collected today. Despite its breadth and depth on particular subjects such as ambulance crashes, there are statistical details that are not available. The total number of fatal crashes involving ambulances can be ascertained by FARS. More work is needed to establish a complete national count of fatality, injury and property-damage only crashes.⁴² Thus, while fatality and injury data can be retrieved or estimated, the exact number of incidents remains elusive.

Table 3-1: Summary of Ambulance Crash Data from NHTSA FARS and NASS GES, 1990-2009

Use Type	Single Vehicle Ambulance Crash				Multi Vehicle Ambulance Crash				TOTAL			
	Fatal	Injury *	\$ Loss Only*	Total	Fatal	Injury *	\$ Loss Only*	Total	Fatal	Injury *	\$ Loss Only*	Total
Not in Emergency Use	70	794	2,638	3,502	195	8,560	15,614	24,269	265	9,355	18,252	27,871
In Emergency Use	51	1,653	3,265	4,970	273	16,235	27,915	44,423	324	17,889	31,180	49,393
Unknown	---	471	2,299	2,770	1	1,255	3,520	4,776	1	1,726	5,819	7,546
TOTAL	121	2,919	8,202	11,242	469	26,051	47,049	73,568	590	28,969	55,251	84,810

* Note: "Injury" and "\$ Loss Only" are estimates.

An important characteristic of the FARS and NASS GES data collected through U.S. federal agencies like NHTSA is its transparency. Unlike data collected through private channels (e.g. manufacturers, insurance, etc.), private or personal information is removed and data summaries are generally accessible. Table 3-1 provides a summary of ambulance crash data from NHTSA FARS and NASS GES for the twenty-year period from 1990 to 2009. This data information is reflected in greater detail in Annex B.

Table 3-2: Example of Use of Ambulance Crash Data (for U.S. in 2009)⁴⁴

	Incidents Using Lights/Sirens	Total Incidents
Ambulance Crashes with Fatalities	16	29
Ambulance Crashes with Injuries	488	959
Ambulances in All Crashes	1,404	3,029
Ambulance Driver Fatality	1	3
Ambulance Crew Other Than Driver Fatality	5	10
Other Ambulance Passenger Fatality	9	17
Non-Motorist Fatality	3	5
Total Ambulance Crash Fatalities	16	35
Total Ambulance Crash Injuries	918	1,579

The FARS and NASS GES data from NHTSA are widely used. For example, summary data provided by the National Safety Council directly uses this summary information in their literature. Table 3-1, Example of Use of Ambulance Crash Data (in U.S. in 2009), provides a summary for National Safety Council literature, based on data from NHTSA FARS and NASS GES.⁴³

National EMS Information System (NEMSIS)

The National EMS Information System (NEMSIS) was established to promote the unification on EMS data. Their focus is on establishing a framework for the evolution of effective national EMS data that includes coordination with state-based data collection efforts. It is estimated that more than three-quarters of the states have some type of data system in place right now at various levels of sophistication. Many states are currently working to revise data elements, improve data capture, and ensure compliance with the future NEMSIS dataset.⁴⁵

The genesis of its origin can be traced prior to 2001, but at that time the effort appeared under the NEMSIS banner through the combined efforts of a public private partnership involving the National Association of State EMS Officials, National Highway Traffic Safety Administration (NHTSA), and the Trauma/EMS Systems program of the Health Resources and Services Administration's (HRSA) Maternal Child Health Bureau. Today, administration is provided through a technical assistance center jointly hosted by the University of Utah and the University of North Carolina. Funding is provided through NHTSA, HRSA, and the CDC to support each state's efforts to collect, retain, and send data to the national database. A wide range of professional organization and federal agency partners also participate with NEMSIS.⁴⁶

Work through NEMSIS is on-going, and the latest available information is the version 3 Data Dictionary, XML Schema, and supporting documentation.⁴⁷ This has included the creation of a detailed data dictionary, development of schemas, recommended software arrangements, and other details supporting an EMS Pre-hospital Dataset.⁴⁸

In the meantime, vehicular crashes involving ambulances is one detail in the complex overall data collection effort involving EMS. NEMSIS has a focus on these other aspects of EMS activity, such as patient care and condition, and less on vehicular crashes. For example, two major federally sponsored data definitions that describe data points for collection on patient encounters are the Uniform Prehospital Data Elements developed by NHTSA87 and the Data Elements for Emergency Department Systems (DEEDS) developed by the Centers for Disease Control.⁴⁹

National Electronic Injury Surveillance System (NEISS)

The National Electronic Injury Surveillance System (NEISS) is a national probability sample that uses patient injury information from participating NEISS hospitals in the U.S. and its territories.⁵⁰ The Consumer Product Safety Commission administers and provides oversight for the NEISS and collaborates with the National Institute for Occupational Safety and Health on a supplement to NEISS to collect surveillance data on nonfatal work-related injuries and illnesses treated in U.S. hospital emergency departments. The occupational supplement is referred to as NEISS-Work, or Work-Related Injury Statistics Query System (Work-RISQS).⁵¹

Specifically, NEISS-Work is a national stratified probability sample of 67 hospitals in the U.S. and its territories that have a minimum of six beds and that operate a 24-hour emergency

department. Hospitals in the sample were selected from approximately 5,300 rural and urban U.S. hospitals after stratification by total annual emergency department visits. The occupational injury hospital sample is a subset (2/3) of the hospital sample used by CPSC for capture of product-related injuries. Work-related cases are identified from admissions information and emergency department chart review by hospital coders. A workers' compensation claim is not required for inclusion.⁵²

NEISS-Work is designed to produce national estimates. A national estimate is obtained by extrapolating the number of cases seen in the 67 hospitals by using the statistical weight of each case. The statistical weight varies depending upon the size of the hospital and the number of patients typically treated in their emergency department. In other words, each case captured in a sample hospital may represent 20 to more than 100 cases seen in other U.S. hospitals. By summing the weights for similar cases, a national estimate is obtained for a specific demographic group, type of injury, injury circumstances, or all injuries and illnesses.

In its current arrangement, NEISS-Work has limitations with regard to how the surveillance system captures ambulance transport related incidents. The "transportation" incident numbers per year are generally too small to be reported or are "barely" reportable. Further, ambulance crash data are part of the larger event category of "transportation incidents," which is not exclusive to ambulances, even though for EMS worker injuries they are probably mostly due to ambulance related incidents. Nevertheless, NEISS-Work provides another basic approach for capturing ambulance crash data, and presents a future opportunity for data collection through an alternative hospital-based framework.

National Fire Incident Reporting System (NFIRS)

The National Fire Incident Reporting System (NFIRS) is administered through the U.S. Fire Administration, which operates within the Federal Emergency Management Agency under the U.S. Department of Homeland Security. NFIRS is the standard national reporting system used by fire departments in the U.S. to report fires and other incidents to which they respond and to maintain records of these incidents in a uniform manner.⁵³

NFIRS is considered the world's largest national annual database of fire incident information. State participation in NFIRS is voluntary, and each year approximately 23,000 fire departments input data. On average these participating fire departments report an annual average of 19 million incidents and one million fires each year, accounting for an estimated 75% of all reported fires.⁵⁴ Because a majority of fire departments also provide EMS, some data is captured on EMS events in addition to fire events. However, despite the extensive nature of the NFIRS tool, it is lacking the necessary detail to provide value on the topic of ambulance crashes.

The latest version for NFIRS is 5.0, and this includes an EMS component. The initial foundation for NFIRS was laid by the Federal Fire Prevention and Control Act of 1974 (P.L. 93-498) and authorizes the National Fire Data Center in the United States Fire Administration (USFA) to

gather and analyze information on the magnitude of the Nation's fire problem, as well as its detailed characteristics and trends.⁵⁵

In its infancy, fire department activity reporting was limited to fires only, at least on a national level, yet the need to justify all activities and expenditures grew over time. Many local fire departments began to collect data on their own, using the NFIRS program to attempt to gather management information in ways that had not been anticipated.⁵⁶

Recognizing that EMS activities represent a significant portion of what fire departments are currently doing, an EMS reporting module was included in NFIRS 5.0. The starting point for development of the EMS module was the Final Report of the 1993 Uniform Pre-Hospital EMS Data Conference sponsored by the NHTSA.⁵⁷ The essential data elements indicated in this and other earlier activity have been retained as much as practicable in the latest version. The current NFIRS EMS module is not intended to replace or otherwise interfere with state or local EMS patient care reporting requirements, nor is it intended to be a comprehensive EMS patient care report. Instead the module should be considered as a core element around which a complete patient care report can be built.

Bureau of Labor Statistics (BLS)

The Bureau of Labor Statistics (BLS) of the U.S. Department of Labor is the principal federal agency addressing the broad field of labor economics and statistics. As an independent statistical agency, it is responsible for measuring working conditions, labor market activity, and economic price changes. BLS accomplishes its mission by collecting, analyzing, and disseminating essential economic information to support public and private decision-making.⁵⁸

BLS provides statistical data on the pool of professionals available in the workplace. It maintains multiple databases, which can be of assistance on some aspects of certain national data collection efforts. However, typically the databases are relatively high-level and provide limited details on a particular sub-category such as EMS workers. Nevertheless, data collection approaches may want to consider this resource.

Non-Government Based National Data Collection

There are a number of EMS data collection efforts that exist or are proposed outside the federal government. Some of these are relatively rigorous with the intent of providing full statistical analysis, while other data collection efforts are much more informal and proceed on the basis of providing on-going case studies. Several examples are offered here.

Highway Loss Data Institute (HLDI)

The Highway Loss Data Institute (HLDI) is a nonprofit research organization organized in 1972 that is an affiliate of the Insurance Institute for Highway Safety. HLDI publishes insurance loss statistics on most passenger vehicles on U.S. roads and administers a database of more than

150 million individual passenger vehicles representing about 80% of all privately insured road vehicles.⁵⁹

The HLDI database is considered one of the largest repositories of such information in the world. The institute addresses a wide range of topics of interest to its supporting insurance companies, including auto-theft and other non-safety oriented concerns. Although HLDI maintains a database with a significant number of data elements, access to this information is limited since it is meant for the supporting constituents. Further, the relationship to EMS and ambulance crash data appears to be peripheral to their primary focus.⁶⁰

International Association of Emergency Medical Service Chiefs (IAEMSC)

A new EMS data collection initiative called the National EMS Health Surveillance System was recently launched under the administrative leadership of the International Association of Emergency Medical Service Chiefs (IAEMSC). IAEMSC has partnered with a private organization specializing in data collection to develop a national EMS health surveillance system.⁶¹

The purpose of this initiative is to create a national repository of data related to occupational illnesses, injuries, or deaths from all EMS providers in the United States. This project will enable EMS organizations from the United States to voluntarily report occupational illnesses, injuries, and deaths using a common web-based tool. This is intended to fill the gap by providing the opportunity for all EMS organizations of all system configurations a framework for reporting occupational illnesses, injuries, and deaths.⁶²

On-Line Information Collection

Various publication organizations have taken advantage of the World Wide Web to capture and post information relating to ambulance crashes. This includes on-line publications such as EMTCity.com, EMSWorld.com, and EMSNetwork.org. They provide an interactive forum for on-going data on crashes involving ambulances. These on-line publications likewise provide summary articles that reveal additional data points.⁶³

In general, this information only indirectly lends itself to efforts to conduct any manner of statistical analysis. There have been, however, efforts to more formally use this data through more conventional analysis. In particular, one study has provided a retrospective analysis of ambulance crash characteristics in the U.S. as defined by the popular press.⁶⁴ This not only provides an analysis of certain data relating to ambulance crashes, but it also reflects on the efficacy of the use of data gathered through the popular press and on-line information collection.

As a case study example of the information available through on-line information collection, the on-line news publication EMSNetwork has been active since 2001. This internet-based publication includes an active web log and news wire service that provides a convenient public bulletin board for news articles that address crashes involving ambulances.⁶⁵

Although the information they gather does not appear to be undergoing automatic filtering and synthesis, it does provide interesting and informative summaries and case studies of identified events. Of course, this particular statistical sample set is relatively undefined and therefore does not readily lend itself to formal statistical analysis. However, as a minimum it can be utilized for purposes of cross-reference to clarify or trace additional data through other more institutional collection programs.

An example of the implied value of the EMSNetwork news information is further exemplified in Table 3-3.⁶⁶ This information was collected over a one year period by an individual EMS/fire department based on a daily review of the on-line articles addressing incidents in the United States. For the one-year period of November 2009 through October 2010, this information yields additional details for 242 crash events involving motor vehicle ambulances, with 40 civilian deaths and 222 civilian injuries, and 14 EMS staff deaths and 188 EMS staff injuries.

Table 3-3: Summary of Daily News Articles for Motor Vehicle Ambulance Crashes⁶⁷

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
2-Nov-2009	Boston, MA	1				
3-Nov-2009	Jacksonville, AK		1			
4-Nov-2009	San Carlos, AZ			2		
4-Nov-2009	Winchester, MA	1				
6-Nov-2009	Victorville, CA					No Injuries
6-Nov-2009	Villa Rica, GA		1			
6-Nov-2009	Tacoma, WA	1		1		
6-Nov-2009	Topeka, KS			1		
6-Nov-2009	Bessemer, AL					Unknown Injuries
10-Nov-2009	Jacksonville, FL	4				
10-Nov-2009	East Grand Forks, ND	2				
14-Nov-2009	Woodland, WA	1				
16-Nov-2009	Manchester, OH			1		
16-Nov-2009	Silver Springs, Wash DC					No Injuries
16-Nov-2009	Cape County, MO					No Injuries
19-Nov-2009	Libertyville, IL			1		
19-Nov-2009	N. Rochester, MN					Unknown injuries
19-Nov-2009	Harrison Township, OH			2		
19-Nov-2009	Quincy, IL					No Injuries
21-Nov-2009	Port Arthur, TX	1				
21-Nov-2009	N. Hampton County, PA	1				3 crew evaluated
21-Nov-2009	Huntington, WV	1		2		
26-Nov-2009	Aurora, CO					No Injuries
2-Dec-2009	Jacksonville, FL	3	1	1		
3-Dec-2009	Washington Township, OH	3	1	1		
7-Dec-2009	Syracuse, NY	1		4		
8-Dec-2009	Ellicott City, MD					No Injuries
8-Dec-2009	South Londonderry, PA	6		1		

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
10-Dec-2009	Toms River, NJ					No Injuries
10-Dec-2009	Joliet, IL	1		2		
11-Dec-2009	DeKalb, IL					No Injuries
11-Dec-2009	Allegan County, MI					Unknown Injuries
11-Dec-2009	Missouri	4		2		
15-Dec-2009	Brooklyn, NY		1			
17-Dec-2009	North Austin, TX					Unknown Injuries
21-Dec-2009	Ridgewood, NJ	1		1		
21-Dec-2009	Basking Ridge, NJ					No Injuries
24-Dec-2009	Dixon, MO					No Injuries
24-Dec-2009	Milaca, MN					Unknown Injuries
26-Dec-2009	Indianapolis, IN					No Injuries
26-Dec-2009	Johnson County, NC	3		3		
28-Dec-2009	Kettering, OH					No Injuries
28-Dec-2009	Schuylkill County, PA		1	1		
28-Dec-2009	Greenburgh, NY					No Injuries
28-Dec-2009	Douglas County, GA	3			1	
29-Dec-2009	Tennessee		1		1	
31-Dec-2009	El Paso County, CO					No Injuries
31-Dec-2009	Las Vegas, NV					No Injuries
4-Jan-2010	Maplewood, NY					No Injuries
4-Jan-2010	Piqua, OH					No Injuries
5-Jan-2010	Georgetown Township, MI					No Injuries
6-Jan-2010	Fairplay, AR	3		2		
9-Jan-2010	Jackson County, MI	1		1		
9-Jan-2010	Morgan County, KY	1		2		
9-Jan-2010	South Park, CO	3		2		
9-Jan-2010	Iron River, MN	1		2		
9-Jan-2010	Egg Harbor, NJ			2		
13-Jan-2010	Lakewood Ranch, FL	1		2		
14-Jan-2010	Des Moines, IA					No Injuries
14-Jan-2010	White Township, NJ		1	2		
16-Jan-2010	Muskogee, OK			1		
18-Jan-2009	Nashua, NH	1		2		
20-Jan-2009	Keene, NH			1		
20-Jan-2010	Louisville, KY			2		
20-Jan-2010	Prince George, MD	2		2		
21-Jan-2010	Nederland, TX			1		
21-Jan-2010	Augusta, GA					Unknown Injuries
21-Jan-2010	Blissfield, MI					No Injuries
21-Jan-2010	Utica, NY	2		1		
21-Jan-2010	Tulare, CA	1		1		
22-Jan-2010	Genoa Kingston, IL			3		
22-Jan-2010	Brockton, MA					No Injuries

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
25-Jan-2010	Burlington, CT					Unknown Injuries
26-Jan-2010	Portland, OR			2		
31-Jan-2010	Elkview, WV					No Injuries
31-Jan-2010	Laporte, IA					No Injuries
31-Jan-2010	New Britain, CT					No Injuries
31-Jan-2010	Lexington, KY	1				
1-Feb-2010	Fall River, MA	1		2		
2-Feb-2010	Halifax, FL			1		
2-Feb-2010	Westmoreland, NY	1				
9-Feb-2010	Fargo, ND	1		2		
7-Feb-2010	Washington DC					No Injuries
7-Feb-2010	Middle Township, NJ	1				
7-Feb-2010	Natick, MA	2		2		
7-Feb-2010	Unknown Location					No Injuries
7-Feb-2010	Daytona Beach, FL					No Injuries
12-Feb-2010	Milton, MA	4		2		
13-Feb-2010	Dunn, NC		2	2		
16-Feb-2010	Illinois	2				
16-Feb-2010	Kettering, OH					Unknown Injuries
16-Feb-2010	North Carolina					No Injuries
16-Feb-2010	Gladstone, MI	1		1		
16-Feb-2010	Chicago, IL	4				
16-Feb-2010	Chicago, IL	6				
17-Feb-2010	Gallatin County, OH	1		1		
17-Feb-2010	Houston, TX			1		
17-Feb-2010	New York					Unknown Injuries
19-Feb-2010	Broward, FL	1		3		
21-Feb-2010	Jamestown, ND					No Injuries
21-Feb-2010	Illinois	1				
22-Feb-2010	Columbus, OH					No Injuries
22-Feb-2010	Somers, CT			1		
23-Feb-2010	Nephi, UT			4		
25-Feb-2010	Westmoreland, NY					Unknown Injuries
28-Feb-2010	Prosser, WA	1				
1-Mar-2010	Bethlehem, PA	2				
3-Mar-2010	Fort Pierce, FL		1	1		
6-Mar-2010	Upper Cleveland, NC			1		
7-Mar-2010	Florida			1		
7-Mar-2010	Huron Valley, MI	1		1		
18-Mar-2010	Horry County, SC		1			
18-Mar-2010	Richmond, VA					Unknown Injuries
18-Mar-2010	Lawton, OK	1	1			
18-Mar-2010	Montgomery County, NC			2		
18-Mar-2010	Fairbanks, AK					No Injuries

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
18-Mar-2010	Maumee, OH	2		2		
18-Mar-2010	Rainbow, AL	1		2		
18-Mar-2010	Louisville, KY	2		2		
22-Mar-2010	Dallas, OR	3		3		
23-Mar-2010	Virginia Beach, WV	1		2		
25-Mar-2010	Liberty, KY	1				
25-Mar-2010	Wake Forest, NC					Unknown Injuries
25-Mar-2010	Belmond, IA	1				
29-Mar-2010	Anderson County, SC					Unknown Injuries
30-Mar-2010	Lexington, KY	2		1		
1-Apr-2010	San Diego, CA				1	
2-Apr-2010	Petersburg, VA					No Injuries
2-Apr-2010	Syracuse, NY	1				
5-Apr-2010	Bushkill, PA	1				
8-Apr-2010	Miami Township, OH					No Injuries
9-Apr-2010	Portland, Maine					No Injuries
12-Apr-2010	Royersford, PA			1		
14-Apr-2010	Conway, AK	1				
15-Apr-2010	Sullivan City, IN	1		2		
16-Apr-2010	Kirksville, MO	1				
17-Apr-2010	Paterson, NJ			1		
24-Apr-2010	Cleveland, OH			1		
24-Apr-2010	Raleigh, NC					No Injuries
24-Apr-2010	Fort Drum, NY	1	1	2		
27-Apr-2010	Cabell, WV					No Injuries
27-Apr-2010	Anaheim, FL	2				
29-Apr-2010	Columbus, OH					No Injuries
5-May-2010	Charlotte, NC	1				
7-May-2010	Lexington, KY			1		
9-May-2010	Brookston, MN		1			
9-May-2010	Columbia, MO	2				
9-May-2010	Pocatello, ID					No Injuries
13-May-2010	Beaver, IA		1	2	1	
14-May-2010	Floyd, GA					No Injuries
17-May-2010	Park Slope, NY				1	
17-May-2010	Dunnellon, FL				2	
19-May-2010	Duquesne, PA	1		2		
20-May-2010	Belmont County, WV		1			
22-May-2010	Bristol, VA	1		2		
23-May-2010	Desert Center, CA	1		1		
23-May-2010	Syracuse, NY	1		2		
24-May-2010	Louisville, KY	3		2		
24-May-2010	Chicago, IL	1		1		
30-May-2010	Aurora, IN					No Injuries

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
30-May-2010	Midtown, TN	1				
30-May-2010	Sophia, WV					No Injuries
31-May-2010	Richmond, CA					No Injuries
8-Jun-2010	McAlley, TX		1	2		
9-Jun-2010	Denver, CO	1		2		
13-Jun-2010	Jackson Township, NJ		1			Motorcycle crash
16-Jun-2010	Dunbar, WV	3				
17-Jun-2010	Waco, TX		1			
20-Jun-2010	Smyrna, DE	1				
21-Jun-2010	Lincoln City, MO	2		1		
21-Jun-2010	Columbus, OH	1				
30-Jun-2010	Los Angeles, CA					Unknown Injuries
1-Jul-2010	West Windsor, NJ					No Injuries
2-Jul-2010	Woodbury, NY	1				
2-Jul-2010	Rutherford, TN	2		2		
4-Jul-2010	James Island, SC	1				
7-Jul-2010	Watertown, NY	1				
7-Jul-2010	Brunswick, MN	1				
7-Jul-2010	Brentwood, NY	3	1	1		
7-Jul-2010	Charleston Co, SC	1		1		
7-Jul-2010	Pollocksville, NC	3		4		
7-Jul-2010	Dayton, OH	3				
8-Jul-2010	Nebraska					No Injuries
10-Jul-2010	Hartford, CT					No Injuries
10-Jul-2010	Wisconsin					No Injuries
10-Jul-2010	Tennessee	15				
13-Jul-2010	Tennessee	2				
16-Jul-2010	New Jersey			1		
19-Jul-2010	Michigan	1				
26-Jul-2010	Pittsburg, PA	1				
26-Jul-2010	Texas		1			
26-Jul-2010	Queensburg, NY	2		1		
26-Jul-2010	Nevada					Unknown Injuries
27-Jul-2010	Pennsylvania					Unknown Injuries
27-Jul-2010	Hyannis, MA					Unknown Injuries
28-Jul-2010	Texas	6				
31-Jul-2010	Washington	1	2	1		
3-Aug-2010	Ohio		1		1	
6-Aug-2010	Ohio			1		
8-Aug-2010	Maryland	5		3		
8-Aug-2010	Kansas City, MO	2		2		
9-Aug-2010	Alaska		2	3		
12-Aug-2010	Cornelius, NC					No Injuries
14-Aug-2010	Staten Island, NY	1				

Date	Location	Civilian Injuries	Civilian Deaths	Emergency Staff Injuries	Emergency Staff Deaths	Additional Comments
14-Aug-2010	North Dakota	2				
19-Aug-2010	Lincoln, NB					No Injuries
21-Aug-2010	Becker County, MN					Unknown Injuries
21-Aug-2010	Illinois	1		1		
28-Aug-2010	Springfield, MA			1		
28-Aug-2010	Maryland			4		
30-Aug-2010	Texas	1	1			
5-Sep-2010	Arkansas				3	
5-Sep-2010	Georgia	1				
13-Sep-2010	Maryland		1	1		
13-Sep-2010	West Virginia	1		1	1	
15-Sep-2010	New York	1	1	2		
16-Sep-2010	Ohio	1	1	2		
16-Sep-2010	Maryland		3	2		
19-Sep-2010	Alabama			1		
19-Sep-2010	North Carolina			3		
22-Sep-2010	Floyd, GA			2		
4-Oct-2010	South Carolina	6	2	1		
4-Oct-2010	Kentucky	4		2		
6-Oct-2010	Ohio	2		1	1	
9-Oct-2010	Connecticut	1		2		
9-Oct-2010	Arizona	6		2		
9-Oct-2010	Pennsylvania	2	1	2		
11-Oct-2010	Tennessee			2		
11-Oct-2010	Illinois	1	1	1	1	
13-Oct-2010	North Carolina	1	1	1		
14-Oct-2010	Florida					No Injuries
15-Oct-2010	Georgia	3		2		
18-Oct-2010	Connecticut					No Injuries
18-Oct-2010	Florida	2		3		
19-Oct-2010	Nebraska	1				
20-Oct-2010	Massachusetts		1	2		
20-Oct-2010	Pennsylvania			2		
21-Oct-2010	Utah			1		
22-Oct-2010	Pennsylvania					No Injuries
23-Oct-2010	Delaware	5				
29-Oct-2010	Maryland					No Injuries
29-Oct-2010	Minnesota					Unknown Injuries
31-Oct-2010	Ohio	1		2		
Totals	242	222	40	188	14	

4. STATE AND LOCAL DATA COLLECTION ACTIVITIES

A key operating feature to the overall data collection infrastructure is the information collected on a state and local basis. This data information provides a fundamental backbone for the stream of information that feeds into an overall national data collection effort.

Data collection efforts relating to ambulance crashes are commonly processed through certain state government agencies, and in some cases they are processed locally with the particular state. Data collected among multiple states are needed for nationally based programs, and are important for identifying problems, establishing performance measures, allocating resources, evaluating program progress, and implementing effective countermeasures. However, from a national perspective, a lack of uniformity exists among and within the states, and this hinders on-going efforts to use a collective and cohesive data set for broadly embraced, programmatic improvements.

Model Minimum Uniform Crash Criteria (MMUCC)

Foremost among nationally-based efforts to coordinate state-based data addressing ambulance crashes and related topics is the Model Minimum Uniform Crash Criteria (MMUCC). The program provides a minimum recommended standardized data set for describing motor vehicle crashes and the vehicles, persons and environment involved in the event.⁶⁸

MMUCC is funded and supported by the NHTSA and jointly managed by NHTSA and the Governors Highway Safety Association (GHSA) with input from other offices in the U.S. Department of Transportation, including the Federal Highway Administration (FHA), Federal Motor Carrier Safety Administration (FMCSA), and Research and Innovative Technology Administration (RITA). The first edition of this program was released in 1998, followed by the second edition in 2003 and third edition in 2008. An updated fourth edition is scheduled for release in the spring of 2012.

The MMUCC program uses a voluntary and collaborative effort that seeks to generate uniform crash data that is credible, reliable, and accurate for data-based safety decisions at the national, state, and local levels. The use of the minimum recommended data set in MMUCC is voluntary, but incentives exist for its use. Most notably, the “Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users” (SAFETEA-LU) was signed into law by President Bush in 2005, and Section 408 requires that a state must certify that it has adopted and uses identified model data elements to receive Traffic Safety Information System Improvement Grants. MMUCC elements were identified by US DOT as one set of model crash-related data elements that apply to Section 408, while in similar fashion NEMSIS was identified for EMS-related data.⁶⁹

A collaborative effort involving stakeholders is providing significant input into the new fourth edition of MMUCC. Stakeholder groups include federal agencies, state governor representatives, state dept. of transportations, state dept. of motor vehicles, emergency responders, medical community representatives, safety professionals, and others. The current Third Edition addresses 107 data elements that include 75 data elements to be collected at the scene, 10 data elements to be derived from the collected data, and 22 data elements to be obtained after linkage to driver history, injury, and roadway inventory data.⁷⁰

State-Based Data Collection

Ambulance crash data and the associated collection methods appear to vary considerably among states and territories. Yet despite this diversity, there are common themes and attributes on how these data collection frameworks have evolved.

Information collection for ambulance crashes appears to be occurring on two basic fronts: through the state dept. of public health, often including or in collaboration with the state EMS agency, and also through police accident reports (PARs) that are typically collected through the state dept of transportation. In some cases these separate data collection streams are coordinating and sharing information, and in other cases they are effectively independent.

There are certain governmental entities that can be found in most if not all states and territories. For instance, every state has a Traffic Records Committee which coordinates crash-related data and serves as a useful point of contact within a particular state.⁷¹ Further, each state has a lead agency responsible for EMS activities, which once again serves as an important point of contact for ambulance crash data.⁷²

Published articles in the mainstream literature directly addressing state-oriented data collection methods provide a useful case-study perspective for how states utilize the available national frameworks to implement their own state-based data collection efforts to address their specific needs. For example, one recent study in the state of Michigan identified critical factors associated with the occurrence of emergency vehicle crashes, to distinguish among the characteristics of crashes involving different types of emergency vehicles, and to determine those factors affecting the injury severity resulting from emergency vehicle crashes.⁷³

In the Michigan study, the most prevalent types of crashes were identified as angle, head-on, and sideswipe collisions, and were typified by involving high-risk driving behaviors (e.g., speeding, non-use of safety restraint devices, etc). In this study, emergency vehicle crashes had a higher likelihood of occurring near intersections, in darkness, and during the evening rush hour. Among other factors, injuries tended to be most severe at high speeds and with angle collisions.

As part of this study, an effort has been made to contact each state to clarify how they are handling their data collection for ambulance crashes and the points of contact within the state. This information is captured in Table 4-1, which summarizes the on-going efforts within each U.S. state to collect data on ambulance crashes.

Table 4-1: Summary of State Ambulance Crash Data Collection

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
Alabama	No	DOT	No information collected. Referred to the DPS	www.nhtsa-tsis.net/crashforms/Pages/state/al/AL.htm
	YES; Lead Collection Point for State Crash Data	DPS	The Center for Advanced Public Safety's website was used to create a report for 1999 – 2008. Changes to the form in June, 2009 such as the addition of Emergency status, while helpful for the future, created untrusted data for 2009 + 2010. From 2011 onward it will be accepted.	www.dps.state.al.us/Home/wfContentTableItem.aspx?ID=10&PLH1=ADMINACCIDENTSUMMARY#INFO
	No	DPH OEMS	While they mandate that the PAR report be sent to them if there is an injury or fatality, they do not keep any databases besides paper files.	www.adph.org/ems/Default.asp?id=803
	Yes	CARE, Research and Development	CARE is a complex but very in-depth computer database program which can be used to sort through Alabama's PARs to create filtered outputs for ambulances. Both the program and database have to be downloaded then worked with to create the output in MS Access. Interested in EMS data collection and would like to be kept in mind for future data collection programs.	caps.ua.edu/downloads/downloads.aspx
Alaska	No	DOT Data Services	While they produce annual reports for the statewide auto crashes, ambulances simply are not a category specified in the PAR therefore no report can be made for ambulances. The PAR is currently MMUCC 2 compliant but a new version that is MMUCC 3 compliant (has ambulance category) is out for review.	www.nhtsa-tsis.net/crashforms/Pages/state/ak/AK.htm www.dot.alaska.gov/stwdplng/transdata/crash.shtml
	No	EMS Program	Interested in this kind of information, but they do not currently collect it.	www.chems.alaska.gov/
Arizona	No	DOT	While the PAR collects whether it is an emergency vehicle or not, it does not subdivide it into ambulances. Therefore, no report can be collected through the PARs.	www.nhtsa-tsis.net/crashforms/Pages/state/az/AZ.htm
	No	Bureau of EMS	While they are beginning to collect NEMSIS data, they do not collect anything regarding the crash.	www.azdhs.gov/bems/index.htm
Arkansas	No	State Police Traffic Records	While the PAR collects whether it is an emergency vehicle, it does not break it down into an ambulance category.	www.nhtsa-tsis.net/crashforms/Pages/state/ar/AR.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	Unknown	EMS	Status unconfirmed regarding an additional EMS incident form.	www.healthy.arkansas.gov/programsServices/hsLicensingRegulation/EmsandTraumaSystems/Pages/default.aspx
California	YES; Lead Collection Point for State Crash Data	Highway Patrol Information Services Unit	They have a unit type of ambulance for 2003 onward, but warned to only rely on the 2007 onward for full completeness.	www.nhtsa-tsis.net/crashforms/Pages/state/ca/CA.htm www.chp.ca.gov/publications/form190.html
	Unknown	EMS Authority	Status unconfirmed regarding Incident and EMS form.	www.emsa.ca.gov/
Colorado	No	DOT Safety & Traffic Engineering Branch	They do not collect ambulance accident data within the PAR system even though there is an ambulance category in the CMV overlay C on the NHTSA website. No information available.	www.nhtsa-tsis.net/crashforms/Pages/state/co/CO_DR2447_2_1_2006_sub_4_25_07_0005.jpg www.coloradodot.info/library/traffic/traffic-manuals-guidelines/safety-crash-data
	No	State Patrol	Confirmed that yes the PAR should include the information from the CMV overlay if it was an ambulance. The state police only have information from their own calls which is about 1/3 of the total calls for the state. A reportable accident includes fatality/injury/or if the vehicle was towed. The DOT, DOR, or FMCSA are better contacts for statewide.	www.colorado.gov/cs/Satellite/StatePatrol-Main/CBON/1251593175702
	No	Dept of Revenue	Unconfirmed if they have any information regarding ambulances based on the CMV overlay.	www.colorado.gov/cs/Satellite/Revenue-MV/RMV/1177024843137
	No	DPH EMS	All the MMUCC criteria is within the PAR with the DOT, so a separate form isn't necessary. They have some voluntary reporting but nothing standardized or mandated.	www.cdphe.state.co.us/em/certificationeducation/index.html
	No	EMS Org in state	Ambulance licensing is run on a county level not by the state.	www.emsac.org/index.php

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
Connecticut	No	DOT	Handle the PAR data, but can only narrow down to emergency vehicles and it is not ambulance specific. No report available. Currently in transition to having CT University control all the PAR records in a centralized location. Uses Route and Kill Analytical System. PR1 always filled out, PR2 if any fatalities.	www.nhtsatsis.net/crashforms/Pages/state/ct/CT.htm
	No	DPH OEMS	Usually notified by phone when the incident first occurs to decide if a larger investigation is necessary, then has the PAR sent to them afterward. There is no computerized system, simply the PARs in file folders sorted by year.	www.ct.gov/dph/cwp/view.asp?a=3127&q=387362
Delaware	No	EMS Dept	Currently there is no state form that is sent to the EMS Dept. Would like to obtain this information but the infrastructure is not set up. State has mostly volunteer depts. who typically only keep internal records.	dhss.delaware.gov/dph/ems/ems.html
	No	State Fire Prevention Commission	An ambulance regulatory group for the state. Confirmed that state does not collect information regarding crash data.	statefirecommission.delaware.gov/
	No	DOT	Currently no way to track crash data due to having switched reporting systems in the past few years. The NHTSA version is an older version whereas the new one does not have an emergency vehicle option. Since 2009 State Police have been using CARS (Crash Analysis Reporting System).	www.nhtsa-tsis.net/crashforms/Pages/state/de/DE.htm www.deldot.gov/home/contact_info/contact.shtml
	YES; Lead Collection Point for State Crash Data	State Police	While "Ambulance" has been a category for years, an investigation into the data collection last year (2010) found that officers were using it to record if an ambulance came to the scene, not if the ambulance itself was in the crash. For that reason, data collected prior to 2010 is not reliable. They use the ECRASH electronic reporting system.	dsp.delaware.gov/reports.shtml
Florida	Yes	DPH Bureau of EMS	Department receives and maintains the database for an EMS Incident Reporting System, which includes EMS crashes. Working to integrate it with the PARs, hopefully within the next year. Data elements are collected based on NEMSIS MUCC dataset, and currently get input from 50% of the state. NFIRS is also filled out for each incident but at a local level.	www.doh.state.fl.us/demo/ems/Providers/datahome.html#DContact www.floridaemstars.com/

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	YES; Lead Collection Point for State Crash Data	DOT	PAR collects the "Special Function of a Motor Vehicle" which includes ambulance. Reports that are needed can be requested through the Office of Statistics.	www.nhtsa-tsisis.net/crashforms/Pages/state/fl/FL.htm
Georgia	YES; Lead Collection Point for State Crash Data	DOT	Ambulance category is an available data field within information regularly collected.	www.nhtsa-tsisis.net/crashforms/Pages/state/ga/GA.htm
	No	OEMS	DOT is the best contact for this information. There is no separate incident form collected.	ems.ga.gov/programs/ems/contactus.asp
Hawaii	YES; Lead Collection Point for State Crash Data	DOT	Ambulance is a special function category.	www.nhtsa-tsisis.net/crashforms/Pages/state/hi/HI.htm
	No	EMS Branch	They do not collect any data, and only provide administration. The department for each island is the best source of data.	hawaii.gov/health/family-child-health/ems/index.html#factsheets
	No	EMS	Private companies are the best source, and in particular the four largest companies covering the islands (AMR, Hawaii County FD, Federal Fire, and EMS).	
	Unknown	AMR	Status unconfirmed.	www.amrhawaii.net/
Idaho	YES; Lead Collection Point for State Crash Data	DOT	Ambulance specified under vehicle type.	www.nhtsa-tsisis.net/crashforms/Pages/state/id/ID.htm
	No	EMS Bureau	Licenses all ambulance companies (private, commercial, public) which upon renewal each year provides the number of accidents from the previous year. However, detailed analysis of this data is not provided.	healthandwelfare.idaho.gov/Medical/EmergencyMedicalServices/tabid/117/Default.aspx healthandwelfare.idaho.gov/AboutUs/PublicRecordsRequest/OnlinePublicRecordsRequestForm/tabid/756/Default.aspx

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
Illinois	YES; Lead Collection Point for State Crash Data	DOT	Ambulance specified under vehicle type.	www.nhtsa-tsis.net/crashforms/Pages/state/il/IL.htm
	No	DPH EMS	Compile the reports from DOT data and works closely with the DOT. Further clarification of status is unconfirmed.	www.idph.state.il.us/ems/index.htm app.idph.state.il.us/emsrpt/form-crash-ac.asp
Indiana	YES; Lead Collection Point for State Crash Data	Open Portal Solutions	State Police indicate a third party is contracted to collect and manage all the data from the Crash reports. Have access to all the PAR data back until 2003.	openportalsolutions.com/
	No	DHS EMS	Status unconfirmed.	www.in.gov/dhs/3525.htm
Iowa	YES; Lead Collection Point for State Crash Data	DOT	Ambulance is a category on the PARs. The report form was changed in 2001 therefore the earliest reliable data is 2002.	www.nhtsa-tsis.net/crashforms/Pages/state/ia/IA.htm
	No	Bureau of EMS	Require a copy of the PAR be sent to them for possible investigation if necessary; however, no database is kept. They do not have a separate EMS incident form.	www.idph.state.ia.us/ems/default.asp
Kansas	YES; Lead Collection Point for State Crash Data	DOT	Began using a new data form in 2009 that breaks down ambulance in Vehicle Use. Previous data analysis based on interpreting narratives.	www.nhtsa-tsis.net/crashforms/Pages/state/ks/KS.htm
	No	EMS Association	Does not have any information on crashes, recommended contacting the Board of EMS.	www.kemsa.org/contact.html
	Unknown	KBEMS	Status unconfirmed.	www.ksbems.org/ems/
Kentucky	No	Transportation Cabinet, Highway Safety Division	Division has full access to state PARs and able to handle data queries or reports. However, data is limited to unit type of "Emergency Vehicle - In Response" (and Non-Response), without detail for ambulance.	www.nhtsa-tsis.net/crashforms/Pages/state/ky/KY.htm
	Unknown	EMS Bureau	Status unconfirmed.	kbems.kctcs.edu/

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	YES; Lead Collection Point for State Crash Data	State Police	Through their online crash report system, all their PAR data can be searched specifically for ambulances.	crashinformationky.org/KCAP/KYOPS/SearchWizard.aspx www.kentuckystatepolice.org/data.htm
Louisiana	No	State Police	Only provide input for PAR, and not analysis or reports which are provided by the LSU research group. Ambulances are included in the category for "Emergency Vehicle in Use" without further specifics.	www.nhtsa-tsis.net/crashforms/Pages/state/la/LA.htm
	No	OPH Bureau of EMS	Statistical information or a trauma registry are not coordinated among the private and third-party ambulance companies that provide most service. So far have not been successful mandating data collections.	www.dhh.state.la.us/offices/contacts.asp?ID=220
	No	DOT	Source of reports using the PARs, but confirmed that queries are limited due to the broad category of "Emergency Vehicle in Use" on the PAR which includes ambulances among other response vehicles.	www.nhtsa-tsis.net/crashforms/Pages/state/la/LA.htm
	Unknown	Acadian Ambulance	Status unconfirmed.	www.acadian.com/acadian
	No	LSU Highway Safety Research Group	Limitations of existing data confirmed based on data collection effort not further defining "emergency vehicle".	lhsc.lsu.edu/
Maine	YES; Lead Collection Point for State Crash Data	DOT	Currently transitioning into a new system that will begin recording specialized vehicles involved in the crash, using MMUCC version 3. Previous data requires identifying an ambulance from the narratives based on "Emergency Vehicle Involved".	www.maine.gov/mdot/mainedotorg.htm#rio
	No	OEMS	They do not collect any crash data, nor do they require completion of an EMS incident form.	www.maine.gov/dps/em/contact.html
	Yes	State Police	Collects PARs for each incident into a searchable database. Currently transitioning into a new system in 2011.	www.nhtsa-tsis.net/crashforms/Pages/state/me/ME.htm
Maryland	YES; Lead Collection Point for State Crash Data	State Highway Admin., Traffic Records	A standard report can be generated which includes nearly every piece of data collected on the PAR. Ambulance is a category under vehicle type (both emergency and non-emergency).	www.nhtsa-tsis.net/crashforms/Pages/state/md/MD.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	No	Maryland Institute for Emergency Medical Services Systems (MIEMSS)	Commercial Ambulance Dept. has a form that is required for a vehicle collision and personal injuries. The information is received, investigated for accuracy, and then put into folders for each commercial company's record. However, no database exists in support of this captured data.	www.miemss.org/home/Home/WhoWeAre/tabid/74/Default.aspx www.miemss.org/home/LinkClick.aspx?fileticket=F0deMc9MBwI%3D&tabid=68&mid=499
	Unknown	DOT, Data Center	Status unconfirmed.	www.dbm.state.md.us/phonebook/IndDetails.asp?EmpID=14989&OID=2681
Massachusetts	YES; Lead Collection Point for State Crash Data	RMV, Accident Records	Status unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/ma/MA.htm
	No	OEMS, Evaluation & Research	Requires a form submittal for serious EMS incidents involving ambulance crashes with injury/fatality/property damage. However, this data is not captured in a database. They have connected PAR and EMS data from 2006-2010, and linked their trauma registry to the PARs from 2008-2010.	www.mass.gov/?pageID=eohhs2terminal&L=5&L0=Home&L1=Government&L2=Departments+and+Divisions&L3=Department+of+Public+Health&L4=Programs+and+Services+K+-+S&sid=Eeohhs2&b=terminalcontent&f=dph_emergency_services_g_about&csid=Eeohhs2 www.mass.gov/Eeohhs2/docs/dph/emergency_services/forms/incident_report.pdf
Michigan	YES; Lead Collection Point for State Crash Data	University of Michigan Transport Research Institute	Collected data includes a variable for ambulance under Special Vehicles. All PAR report data is available online. EMS is almost all private in Michigan.	www.michigantrafficcrashfacts.org/datatool/build www.michigantrafficcrashfacts.org/ www.nhtsa-tsis.net/crashforms/Pages/state/mi/MI.htm
	Unknown	EMS	Status unconfirmed.	www.michigan.gov/mdch/0,1607,7-132-2946_5093_28508-47476--,00.html

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
Minnesota	Unknown	Driver and Vehicle Services	Special Vehicle Use covers Ambulance both in and out of Emergency use. Otherwise status is unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/mn/MN.htm
	YES; Lead Collection Point for State Crash Data	Office of Traffic Safety, Traffic Records	Handles the PAR data and publishes an annual report with basic fatality/injury/property-damage data, and able to provide specific reports on request.	dps.mn.gov/divisions/ots/reports-statistics/Pages/default.aspx
Mississippi	YES; Lead Collection Point for State Crash Data	DPS	Data collected on emergency vehicles is not specific to ambulances. Otherwise status is unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/ms/MS.htm
	No	Dept of EMS	Required to be notified of an ambulance crash and collect some limited data, though do not maintain a database.	msdh.ms.gov/msdhsite/static/47.html
Missouri	YES; Lead Collection Point for State Crash Data	State Highway Patrol	Provide extensive annual report for Emergency Service Vehicle Crashes posted on their website.	www.nhtsa-tsis.net/crashforms/Pages/state/mo/MO.htm www.msdp.dps.missouri.gov/MSHPWeb/SAC/publication_traffic_960grid.html
	Unknown	Missouri EMS	Status unconfirmed.	www.missouriems.com/
	No	Bureau of EMS	Highway Patrol reports are the best information for ambulance crashes. Patient data covered through CODES database.	health.mo.gov/safety/ems/ health.mo.gov/data/policies.php
Montana	YES; Lead Collection Point for State Crash Data	Highway Patrol, Records Management Section	State Highway Traffic Safety Office is able to provide data and reports. They include Ambulance under vehicle body style in data.	www.nhtsa-tsis.net/crashforms/Pages/state/mt/MT.htm
	No	DPH EMS	Do not collect data on crashes and do not have an incident data collection form.	www.dphhs.mt.gov/ems/
	Yes	DOT	Have access to Highway patrol's PAR reports, which have ambulance under body type. Otherwise, status unconfirmed.	www.mdt.mt.gov/publications/datastats.shtml
Nebraska	YES; Lead Collection Point for State Crash Data	Dept of Roads, Highway Safety Division	Ambulances data can be queried and provided in a report. Otherwise status unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/ne/NE.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	No	EMS, Data Collection	They do not have a specific incident form or ambulance crash data. Confirmed that while they do collect some patient information for EMS,	www.hhs.state.ne.us/ems/emsindex.htm
Nevada	No	DPS, Traffic Records	While they work closely with the DOT and their crash data, the DOT is the main contact.	www.nhtsa-tsis.net/crashforms/Pages/state/nv/NV.htm
	Yes	OEMS	The OEMS dept does require a separate incident form be filled out for every accident involving an ambulance within 4 days of occurrence. No fatal accidents recorded recently, only injury and PDO. He requires a written request sent to him for crash data. Status unconfirmed.	health.nv.gov/EMS_EmergencyMedical.htm
	YES; Lead Collection Point for State Crash Data	DOT, Safety Engineering Office	They do have a section for ambulances on the PARs to be queried.	www.nevadadot.com/About_NDOT/NDOT_Divisions/Planning/Safety_Engineering/Safety_Engineering.aspx www.nevadadot.com/uploadedFiles/NVCrashMedia_Crash_Request.pdf
New Hampshire	No	Dept. of Safety, DMV	Collect all NH's crash data, but only address commercial vehicles and not specific to ambulances. A new system is being implemented in approximately 18 months that will have a special function category for ambulances.	www.nhtsa-tsis.net/crashforms/Pages/state/nh/NH.htm www.nh.gov/safety/divisions/dmv/index.html
	No	Bureau of EMS	They do not currently collect data and the DMV is the source of all the crash data through PARs.	www.nh.gov/safety/divisions/fstems/ems/contactus.html www.nh.gov/safety/divisions/fstems/ems/research/index.html
New Jersey	No	OEMS	No data is collected that is currently published or public information. A Crash Data Warehouse is being created that will combine PAR, DMV, and EMS data records but not yet available. Only licensed state agencies are required to report incidents (approximately 50%), while non-licensed are not.	www.nj.gov/health/ems/index.shtml web.doh.state.nj.us/apps2/forms/subforms.aspx?pro=ems#basic-provider

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	Yes	DOT, Accident Records	Ambulances are recorded in the PAR under special function use. Raw non-processed data is posted on their website.	www.nhtsa-tsis.net/crashforms/Pages/state/nj/NJ.htm www.state.nj.us/transportation/refdata/accident/rawdata01-03.shtm
New Mexico	No	DOT Traffic Safety Bureau, Statistics Section	Report are available and are generated through the university.	www.nhtsa-tsis.net/crashforms/Pages/state/nm/NM.htm
	YES; Lead Collection Point for State Crash Data	UNM Division of Government Research	Lead collection point for crash data in New Mexico, and they provide the DOT's information through their "Uniform Accident Reports". They can subdivide their data for ambulances.	www.unm.edu/~dgrint/dgr.html
	No	DOH EMS Bureau	Maintains an EMS run report database, but it does not capture ambulance crashes.	nmems.org/Contact%20us.htm
New York	No	DMV	DMV collects data but the DPH Bureau of EMS handles data and creates reports.	www.nhtsa-tsis.net/crashforms/Pages/state/ny/NY.htm
	YES; Lead Collection Point for State Crash Data	DPH, Bureau of EMS:	Mandated to report both PAR and a Reportable Incident Form for any incident where an EMS provider is injured.	www.health.state.ny.us/nysdoh/ems/main.htm www.health.state.ny.us/forms/doh-4461.pdf
North Carolina	YES; Lead Collection Point for State Crash Data	DOT, Safety Evaluation Group	Ambulance total/fatal/injury crashes are collected in the vehicle type section of the yearly report crash facts, and special reports are also available.	www.nhtsa-tsis.net/crashforms/Pages/state/nc/NC.htm www.ncdot.org/doh/preconstruct/traffic/safety/crashdata/
	No	OEMS	Currently there data collection does not include a classification breakdown for emergency vehicles involved in a crash. Connected with the PAR system so they can investigate a specific incident as needed. They also coordinate a Trauma Registry System.	www.ncdhhs.gov/dhsr/EMS/staff.htm www.ncems.org/pdf/Trauma/NCTR_Data_Dictionary_5-14-2007.pdf
North Dakota	No	DOT	Ambulance crash data is based on analyzing individual narratives. "Unit Configuration" on the PARs narrows the field to "Emergency Vehicle," but at this time their system is unable to narrow it to ambulances.	www.nhtsa-tsis.net/crashforms/Pages/state/nd/ND.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	Yes	DoH EMS and Trauma	Starting two years ago they provide ambulance collision report entry on their website. The information gathered is input into an access database and can be referenced as needed.	www.ndhealth.gov/EMS/Reports/AmbulanceCollision.aspx
Ohio	Yes	Delaware OH, Fire Dept.	Provide compilation of fire/EMS runs via website which, although not directly applicable, promotes need for compiling transparent data.	www.delawareohio.net/Departments/Fire/fireemsruns.aspx
	YES; Lead Collection Point for State Crash Data	DPS	Crash statistics are posted via website that allows for queries for specific reports.	ext.dps.state.oh.us/crashreports/crashreports.aspx ohiohighwaysafetyoffice.ohio.gov/index.stm#
	No	DPS EMS	Does not collect any separate EMS Incident forms or the PARs.	www.ems.ohio.gov/contacts.stm#
	Unknown	DOT, Office of Traffic Engineering	Status unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/oh/OH.htm
	No	Medical Transportation Board	Does not have any mandates/requirements for submittal of data. While they do receive some data, no organized database exists.	ombt.ohio.gov/
	No	State Patrol	Generates statistical maps and charts from the information is from the DPS data.	statepatrol.ohio.gov/statistics/default.asp
Oklahoma	YES; Lead Collection Point for State Crash Data	Highway Safety Office	Data collected only addresses "crashes" that occur on public roads. In 2007, the PAR was revised to include if vehicle was in emergency use.	www.nhtsa-tsis.net/crashforms/Pages/state/ok/OK.htm
	No	Dept of Health, EMS	While they periodically receive a paper copy of an ambulance report from the HSO, they do not collect any incident report forms or ambulance accidents data.	www.ok.gov/health/Protective_Health/Emergency_Medical_Services/
Oregon	YES; Lead Collection Point for State Crash Data	DOT	Provide reports on fatality/injury/property damage involving emergency vehicles.	www.nhtsa-tsis.net/crashforms/Pages/state/or/OR.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	No	EMS	Collect incident forms for changes made within EMS depts., but it is not in a searchable database. The form is required when reporting an accident but does only includes limited data fields.	public.health.oregon.gov/ProviderPartnerResources/EMSTraumaSystems/Pages/emsstaff.aspx public.health.oregon.gov/ProviderPartnerResources/EMSTraumaSystems/EMSTrainingCertification/Pages/forms.aspx
Pennsylvania	YES; Lead Collection Point for State Crash Data	Bureau of Highway Safety & Traffic Engineering, Crash Division	Ambulances are captured under "Special Usage" on the PAR. The data can also be pulled from existing Ambulance crash reports or a more specific report.	www.nhtsa-tsis.net/crashforms/Pages/state/pa/PA.htm
	No	Bureau of EMS	Organizations are required to report incidents using an EMS incident form. This is collected in a database that can be queried, but only recent information on crashes is considered credible. While they create the reports, the data is originally from the Bureau of Highway Safety.	www.portal.state.pa.us/portal/server.pt/community/emergency_medical_services/14138
Rhode Island	No	DPS	Does not collect data of traffic incidents.	www.dps.ri.gov/contact/
	Yes	DPH	Have some available reports though concerned that data may be incomplete.	www.health.state.ri.us/emergency/medicalservices/
	Unknown	DOT	Collect and record traffic reports, but there is no category within the PAR system to narrow down the query results for ambulances crashes.	www.nhtsa-tsis.net/crashforms/Pages/state/ri/RI.htm
South Carolina	YES; Lead Collection Point for State Crash Data	Dept. of Public Safety, Statistical Research	Able to provide reports on ambulance crashes, including factors such as collision type, harmful event, weather, road condition, route categories, etc.	www.nhtsa-tsis.net/crashforms/Pages/state/sc/SC.htm
	No	Division of EMS and Trauma	Do not collect any crash report information, and only collect patient care with an EMS focus rather than the crash itself. Active use of NEMSIS for data collection. No EMS incident report form.	www.scdhec.gov/health/ems/data.htm
South Dakota	YES; Lead Collection Point for State Crash Data	Dept. of Public Safety	For data collection they provide categories for ambulances and if in emergency use.	www.nhtsa-tsis.net/crashforms/Pages/state/sd/SD.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	No	Dept. of Public Safety	Data collection includes all vehicle incidents with fatalities/injuries/\$1000+ in damage, though this is not coordinate in a database. Currently attempting to implement NEMESIS statewide	dps.sd.gov/emergency_services/emergency_medical_services/contact.aspx
Tennessee	YES; Lead Collection Point for State Crash Data	Dept. of Safety & Homeland Security, Office of Research and Statistics	Data collection includes a category for ambulance under special use. The report format was changed in 2003 so anything before that would be difficult. Data collection is not mandatory.	www.nhtsa-tsis.net/crashforms/Pages/state/tn/TN.htm
	No	Division of Health Statistics	No information regarding vehicle crashes, though they collect information on patient fatalities and injuries through EMS.	health.state.tn.us/ems/
Texas	YES; Lead Collection Point for State Crash Data	DOT	Provide ambulance crash data that includes details such as body style and if it was in emergency use.	www.nhtsa-tsis.net/crashforms/Pages/state/tx/TX.htm www.txdot.gov/drivers_vehicles/crash_records/form.htm www.txdot.gov/txdot_library/drivers_vehicles/publications/crash_statistics/default.htm
	No	EMS	Responsible for EMS dept licensing, and ambulance crashes are required to be reported within 24 hours if there is an injury or fatality, or 5 days for property damage only. Data is submitted through a Notification Changes Form, but there is no database compilation available.	www.dshs.state.tx.us/emstraumasystems/11conference.shtm www.dshs.state.tx.us/WorkArea/DownloadAsset.aspx?id=58091
Utah	YES; Lead Collection Point for State Crash Data	DPS	Ambulance crash data is available, though this was updated in 2006 so valid information exists from that point onward.	www.nhtsa-tsis.net/crashforms/Pages/state/ut/UT.htm
	No	DPH	No information is collected through the DPH on vehicle crashes specifically.	health.utah.gov/ems/data/
Vermont	YES; Lead Collection Point for State Crash Data	Agency of Transportation	Collect data and provide applicable reports using PAR data for ambulance crashes.	www.nhtsa-tsis.net/crashforms/Pages/state/vt/VT.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
	No	DPH/OEMS & Injury Prevention	No programmatic data submittals of collection are required, and only track higher profile incidents.	healthvermont.gov/hc/ems/ems_index.aspx
Virginia	No	OEMS	Currently do not collect any information regarding ambulance crashes and do not have a separate EMS Incident report form. They do require that each dept keeps a record of any repairs that are done to the vehicles so that during an inspection that information can be referenced.	www.vdh.state.va.us/OEMS/
	YES; Lead Collection Point for State Crash Data	DMV Transportation Safety Services	Collect data and provide reports. Ambulances are covered as Emergency Vehicles and in special function category.	www.nhtsa-tsis.net/crashforms/Pages/state/va/VA.htm
Washington	YES; Lead Collection Point for State Crash Data	DOT Statewide Travel & Collision Data Office	Collect data and provide reports based on multiple data points.	www.nhtsa-tsis.net/crashforms/Pages/state/wa/WA.htm www.wsdot.wa.gov/mapdata/collision/collision_datarequest.htm
	No	DHS OEMS	Do not collect any ambulance crash data. They are active in using WEMSIS but it currently does not collect crash data.	www.doh.wa.gov/hsqa/emstrauma/default.htm
West Virginia	Unknown	DOT Division of Highway	Status unconfirmed.	www.nhtsa-tsis.net/crashforms/Pages/state/wv/WV.htm
	Unknown	OEMS	Status unconfirmed.	www.wvoems.org/
Wisconsin	YES; Lead Collection Point for State Crash Data	DOT/DMV Incident Records	Produce an annual report detailing the number of accidents (including an ambulance category) by crash severity, and more detailed reports are available upon request. The PAR does not have an ambulance category, but when input into the database, the recorder reads the narrative and unit type to break out ambulance specifics.	www.nhtsa-tsis.net/crashforms/Pages/state/wi/WI.htm www.dot.wisconsin.gov/safety/motorist/crashfacts/index.htm www.dot.wisconsin.gov/safety/motorist/crashfacts/crashfacts-archive.htm
	No	DHS EMS Section /Health and Family Services	Working to link EMS patient incident data with the PAR.	www.dhs.wisconsin.gov/ems/EMSsection/EMS_Section.htm

State	Amb. Crash Database?	Point of Contact	Comments	Website (Forms)
Wyoming	YES; Lead Collection Point for State Crash Data	DOT	Collect data and provide reports. Ambulance is categorized under vehicle owner, emergency use, and special functions.	www.dot.state.wy.us/wydot/safety/safety_statistics www.nhtsa-tsis.net/crashforms/Pages/state/wy/WY.htm
	No	EMS Public Health Division	Collect EMS and ambulance trip data and are working to link to the patient care information and to the PAR. Do not collect any information on the crash itself, although they do use MMUCC in both EMS and PAR reports.	www.health.wyo.gov/sho/ems/emsdata.html

The collection of information in Table 4-1 allows observations to be made of certain possible trends. For example, the data collected in several states (i.e., Alabama, Delaware, Idaho, Iowa, Kansas, Maine, Maryland, and North Carolina) through their Police Accident Reports use common data collection fields for ambulance crashes, and in particular, for “first harmful event” and “primary contributing circumstance” fields.

This information reveals certain details. For instance, based on the information collection of the “first harmful event” field, nearly 70% of the accidents claimed collision with another moving vehicle as the most harmful event. The “second harmful event” was collision with a parked vehicle at approximately 7%, followed by collision with a fixed object at 6%, and collision with an animal at approximately 5%.

The “primary contributing circumstance” field reveals that most common were “unseen object/person/vehicle” and “failed to yield the right of way,” each at approximately 20% of the crashes. These were followed closely by “driver inattention/distraction/fatigue” and “animals (wild or domestic)” at approximately 18% each. Other less common factors included: “followed too close,” “avoid vehicle/object/non-motorist,” “speed too fast for conditions,” “fail to heed sign or signal,” and “improper lane change or use.”

However, the data that are gathered among multiple different sources needs to be used with significant care, including the discussion above. This is especially important when attempting to address trends in the data, which may have been collected in ways that could distort a trend analysis. An example would be the data collection identified in the state of Delaware. For years they have included a category for “ambulance” in their crash data collection, but a recent investigation revealed that the data input recorded if an ambulance came to the scene, not if the ambulance itself was in the crash. This exemplifies the sensitivity required when reviewing this historical data collected under relatively disparate data collection methods.

In some states, further statistical information was available from the points of contact identified in Table 4-1, based on their respective database available for further queries. Where

possible, this information was obtained and reviewed with a focus on the number of ambulance crashes between 2000 through 2010. This information is tabulated in Table 4-2, Summary of Selected State Ambulance Crash Data. Table 4-2 is intended to exemplify the type of data available through individual state databases.

For the thirty-one states that had available data included in Table 4-2, the diversity of the level of detail is significant. Some provided relatively straight-forward summaries, while others included very specific sub-category detail. Some only provided totals, while others only had data for some but not all the years between 2000 and 2010. Further, some states either don't have data collected on ambulance crashes, or confirmed that the data they do have are not useable for summaries or details relating to ambulance crashes, and thus are not included in Table 4-2.

The six states that confirmed no available practical data sets are: Alaska, Arizona, Arkansas, Connecticut, Louisiana, and New Hampshire. The thirteen states from whom data was not able to be obtained, and/or have not confirmed data availability, include: Colorado, Florida, Indiana, Massachusetts, Minnesota, Mississippi, Nebraska, New Jersey, New York, North Dakota, Ohio, Rhode Island, and West Virginia.

The tabulated information in Table 4-2 is divided according to crash severity, based on the numbers of fatalities, injuries, or crashes with property damage only (PDO). Note that these numbers do not reflect the actual number of overall crashes, since a single crash event could involve multiple fatalities, injuries, or vehicles. Other information not used but available from these state databases includes crash of cause, emergency use status of vehicle, and number of vehicles involved in the crash.

Table 4-2: Summary of Selected State Ambulance Crash Data

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Alabama	Fatality	0	2	0	1	1	4	0	2	1	-	-
	Injury	30	30	31	26	34	36	27	21	28	-	-
	PDO	120	79	97	89	130	112	99	117	106	-	-
	Total	150	111	128	116	165	152	126	140	135	-	-
Alaska	<i>Confirmed no practical data sets available</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Arizona	<i>Confirmed no practical data sets available</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Arkansas	Confirmed no practical data sets available	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
California	Fatality	-	-	-	0	2	2	2	3	2	4	0
	Injury	-	-	-	36	39	71	68	108	88	73	42
	PDO	-	-	-	87	135	200	174	244	254	245	171
	Total	-	-	-	123	176	273	244	355	344	322	213
Colorado	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Connecticut	Confirmed no practical data sets available	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Delaware	Fatality	-	-	-	-	-	-	-	-	-	-	0
	Injury	-	-	-	-	-	-	-	-	-	-	7
	PDO	-	-	-	-	-	-	-	-	-	-	14
	Total	-	-	-	-	-	-	-	-	-	-	21
Florida	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Georgia	Fatality	-	-	-	-	-	-	-	-	-	-	-
	Injury	-	-	-	-	-	-	-	-	-	-	-
	PDO	-	-	-	-	-	-	-	-	-	-	-
	Total	280	272	287	263	323	332	285	313	289	307	198
Hawaii	Fatality	-	-	-	-	-	-	-	-	-	-	-
	Injury	-	-	-	-	-	-	-	-	-	-	-
	PDO	-	-	-	-	-	-	-	-	-	-	-
	Total	10	7	12	15	18	13	13	14	5	-	-
Idaho	Fatality	0	0	0	0	1	0	0	0	0	1	0
	Injury	1	5	1	2	4	5	6	4	0	1	0
	PDO	10	8	4	9	7	14	12	11	6	5	7
	Total	11	13	5	11	12	19	18	15	6	7	7
Illinois	Fatality	-	-	-	-	2	2	0	2	2	1	2
	Injury	-	-	-	-	176	205	173	143	175	150	156
	PDO	-	-	-	-	386	402	418	373	379	227	224
	Total	-	-	-	-	564	609	591	518	556	378	382

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Indiana	<i>Unable to obtain data or confirm availability</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Iowa	Fatality	-	-	0	0	0	0	0	0	0	1	1
	Injury	-	-	9	5	11	6	8	4	3	13	9
	PDO	-	-	16	7	8	6	10	6	7	23	25
	Total	-	-	25	12	19	12	18	10	10	37	35
Kansas	Fatality	-	-	-	0	0	0	0	0	0	0	0
	Injury	-	-	-	4	1	5	2	1	3	4	5
	PDO	-	-	-	11	14	18	11	12	14	14	19
	Total	-	-	-	15	15	23	13	13	17	18	24
Kentucky	Fatality	-	3	2	2	1	4	2	2	1	0	0
	Injury	-	30	31	33	23	28	24	30	28	30	18
	PDO	-	153	163	120	171	167	150	187	181	217	123
	Total	-	186	196	155	195	199	176	219	210	247	141
Louisiana	<i>Confirmed no practical data sets available</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Maine	Fatality	-	-	-	0	0	0	0	1	0	0	0
	Injury	-	-	-	33	22	16	16	22	28	33	41
	PDO	-	-	-	25	19	26	16	24	29	20	14
	Total	-	-	-	58	41	42	32	47	57	53	55
Maryland	Fatality	-	0	0	0	3	2	0	1	2	0	3
	Injury	-	42	68	60	54	53	62	68	52	45	50
	PDO	-	262	255	326	279	310	342	313	330	357	313
	Total	-	304	323	386	336	365	404	382	384	402	366
Massachusetts	<i>Unable to obtain data or confirm availability</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Michigan	Fatality	-	-	-	-	3	6	0	0	1	1	3
	Injury	-	-	-	-	53	52	54	38	62	51	34
	PDO	-	-	-	-	244	279	250	264	272	290	244
	Total	-	-	-	-	300	337	304	302	335	342	281
Minnesota	<i>Unable to obtain data or confirm availability</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mississippi	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Missouri	Fatality	-	-	0	1	1	1	0	2	2	2	-
	Injury	-	-	30	38	40	23	27	27	22	45	-
	PDO	-	-	138	121	112	106	110	126	125	121	-
	Total	-	-	168	160	153	130	137	155	149	168	-
Montana	Fatality	0	0	0	0	0	0	0	0	0	0	0
	Injury	4	4	9	4	1	0	2	23	0	3	8
	PDO	6	6	8	8	12	3	13	8	9	15	9
	Total	10	10	17	12	13	3	15	31	9	18	17
Nebraska	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Nevada	Fatality	0	0	0	0	0	0	0	0	0	0	0
	Injury	5	10	9	7	6	4	4	8	7	0	1
	PDO	12	15	18	15	11	8	6	21	10	6	0
	Total	17	25	27	22	17	12	10	29	17	6	1
New Hampshire	Confirmed no practical data sets available	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
New Jersey	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
New Mexico	Fatality	1	-	-	-	1	-	-	-	-	-	-
	Injury	5	5	4	1	1	2	2	6	4	3	2
	PDO	4	8	8	7	8	21	10	13	20	7	20
	Total	10	13	12	8	10	23	12	19	24	10	22
New York	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
North Carolina	Fatality	2	1	1	3	2	3	1	1	1	0	2
	Injury	59	57	52	65	66	59	53	71	54	46	56
	PDO	104	91	76	109	113	93	112	111	138	117	142
	Total	165	149	129	177	181	155	166	183	193	163	200

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
North Dakota	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Ohio	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Oklahoma	Fatality	-	0	1	2	1	0	0	2	1	0	0
	Injury	-	17	14	17	10	9	22	66	39	83	74
	PDO	-	39	42	30	37	42	39	68	54	64	70
	Total	-	56	57	51	48	51	61	136	94	147	144
Oregon	Fatality	-	-	1	0	0	0	0	0	0	0	0
	Injury	-	-	1	9	4	6	6	7	11	7	11
	PDO	-	-	7	5	8	5	15	8	19	7	9
	Total	-	-	9	14	12	11	21	15	30	14	20
Pennsylvania	Fatality	-	-	-	-	-	-	-	-	-	-	-
	Injury	-	-	-	-	-	-	-	-	-	-	-
	PDO	-	-	-	-	-	-	-	-	-	-	-
	Total	160	244	356	292	235	219	195	218	208	209	193
Rhode Island	Unable to obtain data or confirm availability	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
South Carolina	Fatality	-	1	2	0	2	1	0	1	4	2	3
	Injury	-	38	44	43	43	50	44	53	51	38	45
	PDO	-	71	81	95	87	96	85	93	92	122	101
	Total	-	110	127	138	132	147	129	147	147	162	149
South Dakota	Fatality	-	-	-	-	-	-	0	0	0	0	0
	Injury	-	-	-	-	-	-	0	0	0	1	2
	PDO	-	-	-	-	-	-	4	0	4	6	3
	Total	-	-	-	-	-	-	4	0	4	7	5
Tennessee	Fatality	-	-	-	3	0	1	1	0	1	3	1
	Injury	-	-	-	36	40	45	24	32	40	33	49
	PDO	-	-	-	111	118	136	160	144	153	152	195
	Total	-	-	-	150	158	182	185	176	194	188	245
Texas	Fatality	-	-	-	-	-	-	2	0	3	3	2
	Injury	-	-	-	-	-	-	-	-	-	-	-
	PDO	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	250	250	295	252	354

State	Crash Severity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Utah	Fatality	-	-	-	-	-	-	0	0	0	0	-
	Injury	-	-	-	-	-	-	10	11	9	9	-
	PDO	-	-	-	-	-	-	10	31	29	16	-
	Total	-	-	-	-	-	-	20	42	38	25	-
Vermont	Fatality	0	0	0	0	0	0	1	1	-	-	-
	Injury	1	1	2	0	1	3	0	1	-	-	-
	PDO	-	-	-	-	-	-	-	-	-	-	-
	Total	1	1	2	0	1	3	1	2	-	-	-
Virginia	Fatality	-	-	-	-	-	-	0	0	0	1	1
	Injury	-	-	-	-	-	-	31	22	57	52	53
	PDO	-	-	-	-	-	-	53	53	114	92	73
	Total	-	-	-	-	-	-	84	75	171	145	127
Washington	Fatality	-	-	0	1	0	0	0	0	0	0	1
	Injury	-	-	25	25	15	17	21	19	22	20	18
	PDO	-	-	53	30	44	45	42	47	44	42	52
	Total	-	-	78	56	59	62	63	66	66	62	71
West Virginia	<i>Unable to obtain data or confirm availability</i>	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
Wisconsin	Fatality	0	0	0	0	0	2	0	0	0	-	-
	Injury	3	3	3	5	5	2	4	8	2	-	-
	PDO	11	8	12	9	5	3	5	9	15	-	-
	Total	14	11	15	14	10	7	9	17	17	-	-
Wyoming	Fatality	2	0	0	1	0	0	1	0	0	0	0
	Injury	29	20	24	21	25	28	28	24	7	2	5
	PDO	53	79	83	91	82	96	115	102	20	11	7
	Total	84	99	107	113	107	124	144	126	27	13	12
Totals	# of States	12	16	20	23	26	26	30	29	29	26	25
	Total	912	1611	2080	2361	3300	3505	3730	4015	4031	3702	3283
	Avg. Crashes/State/Year	76	101	104	103	127	135	124	138	139	142	131

It is noted that the data collected from the various states cover an appreciable spectrum with a noteworthy range of values in any one particular field. Care should be used on the interpretation of this data, recognizing the ranging and relatively diverse conditions under which they have been collected. For example, states with very aggressive and robust data

collection efforts would be expected to have higher values, versus others that struggle with certain data collection features.

5. SUMMARY OBSERVATIONS

The information collection infrastructure for ambulance crash data is relatively well evolved, but at the same time has room for future enhancements and improvements. At the national level, key initiatives such as NEMSIS and MMUCC provide well established guidelines for the collection of EMS data and vehicle crash data, respectively. This guidance information provides clear direction for state- and local-based data collection efforts.

Ambulance crash data collection at the state level is significant, but from a national perspective, a lack of uniformity exists among and within the states. This hinders on-going efforts to use a collective and cohesive data set for broadly embraced programmatic improvements. State-based data provides a fundamental backbone for the stream of information that feeds into an overall national data collection effort.

The focus on improving accuracy, credibility, and reliability of EMS and ambulance crash data is not new and has been proceeding for decades.⁷⁴ Significant effort has been expended over this time period, resulting in the current infrastructure that balances the individuality of the U.S. states and territories with the need for broad policies that are effective on a national scale.

An additional influence has been the overall changing landscape for the technologies used for collecting and handling data. On-going improvements with information-technology hardware and software have altered the landscape in the ability to capture and coordinate data collection.⁷⁵ New technology is providing the ability to coordinate data not possible before. An example is the processing of emergency responder dispatch data, electronically captured on a large scale, and coordinating these data with other data sets such as EMS data or vehicle crash data.⁷⁶

Assessing the characteristics between the individual state data collection efforts is a challenging task based on their current operational diversity. One document that provides a useful assessment was issued by NHTSA in July 2011 and provides a review of the state-level accomplishments in improving data systems used in traffic safety decision making.⁷⁷ Because its focus is more expansive than simply ambulance crashes, its value toward this specific subject is limited. Nevertheless, the report measures improvements in crash, roadway, driver, vehicle, citation/adjudication, and injury surveillance datasets.

Certain observations became apparent as a result of this study. For example, every state has a Traffic Records Committee which coordinates crash related data and serves as a useful point of contact within a particular state, and each state has a lead agency responsible for EMS activities, which once again serves as an important point of contact for ambulance crash data.

Data that are gathered among the available multiple different sources needs to be used with significant care, especially when attempting to address trends in the data which may have been collected in ways that could distort an analysis. As an example, in one state (Delaware) an investigation revealed that historical ambulance crash data was based on input that was incorrectly interpreting ambulance "response" as being "involved" in a motor vehicle crash, i.e. the ambulance simply responded to the call and was thus "involved". In another state (New Jersey), data is only captured for licensed providers which do not include private companies.

The deliverables for this project provide a comprehensive overview of existing efforts involving data collection methods at the national, state and local level, along with observations and recommendations relating to the future direction of these data collection efforts. The following are the key observations that have been discussed throughout this report and summarized here:

National Data Collection

- The information collection infrastructure for ambulance crash data is relatively well evolved, but at the same time has room for future enhancements and improvements.
- At the national level, the NEMSIS program provides well established guidelines for the collection of EMS data.
- At the national level, the MMUCC program provides well established guidelines for the collection of emergency responder vehicle crash data.

State-Based Data Collection

- Ambulance crash data collection at the state level is significant in quantity.
- From a national perspective a lack of uniformity exists among and within the states.
- State-based ambulance crash information collection appears to be occurring on two basic fronts: through the state dept. of public health, often including or in collaboration with the state EMS agency, and also through police accident reports that are typically collected through the state dept of transportation.
- In some cases these separate data collection streams are coordinating and sharing information, and in other cases they are effectively independent.
- Efforts to promote and use the MMUCC program guidelines by individual states should continue.

6. BIBLIOGRAPHY

References Cited

The following reference sources are cited throughout this report:

- 1) Section 3.3.26, NFPA 450, *Guide for Emergency Medical Services and Systems*, National Fire Protection Association, Quincy MA, 2009 edition
- 2) Yvorra, J., "Mosby's Emergency Dictionary: Quick Reference for Emergency Responders," C. V. Mosby Company, St Louis MO, 1989, pg. 144
- 3) Section 3.3.70.1, NFPA 450, *Guide for Emergency Medical Services and Systems*, National Fire Protection Association, Quincy MA, 2009 edition
- 4) Section 3.3.4, NFPA 450, *Guide for Emergency Medical Services and Systems*, National Fire Protection Association, Quincy MA, 2009 edition
- 5) Yvorra, J., *Mosby's Emergency Dictionary: Quick Reference for Emergency Responders*, C. V. Mosby Company, St Louis MO, 1989, pg. 17
- 6) Krakeel, J., "Emergency Medical Services and the Fire Department," *Fire Protection Handbook*, 20th edition, Section 13, Chapter 9, National Fire Protection Association, Quincy MA, 2008, pg 13-145
- 7) Nolan, D.P., *Encyclopedia of Fire Protection*, Thompson Delmar Learning, Clifton Park NY, 2nd edition, 2006, pg. 129
- 8) NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, National Fire Protection Association, Quincy MA, Section 3.3.30.1, 2007 edition
- 9) Hall, J.R., "The Total Cost of Fire in the United States," National Fire Protection Association, Quincy MA, Feb 2011, pg.5
- 10) U.S. Department of Labor, Occupational Safety & Health Administration, Washington DC, website: www.osha.gov/SLTC/emergencypreparedness/responder.html#First, cited: 16 Apr 2009
- 11) NASEMSO "2003 National Emergency Medical Services (EMS) Survey," National Association of State EMS Officials, on behalf of U.S. Dept of Health and Human Services, Health Resources Services Administration, University of NC, Chapel Hill, Dept of Emergency Medicine, Washington DC, 2003
- 12) NREMT, "What is EMS," National Registry of Emergency Medical Technicians, website: www.nremt.org/nremt/about/What_is_EMS.asp, cited: 6 Jul 2011
- 13) Karter, M.J., Stein, G.P., "U.S. Fire Department Profile Through 2009," National Fire Protection Association, Quincy MA, Oct 2010, pg. 27
- 14) *ibid*, pg. 28
- 15) AAA, "Position Paper: Safe Driving Statement," American Ambulance Association, 6 May 2002, website: <http://www.the-aaa.org/default.asp?contentID=103>, cited: 9 June 2011

- 16) "Third Needs Assessment of the U.S. Fire Service: Conducted in 2010 and Including Comparisons to the 2011 and 2005 Needs Assessment Surveys," National Fire Protection Association, Fire Analysis Research Division, June 2011, pg. 16
- 17) "Four Years Later - A Second Needs Assessment of the U.S. Fire Service: A Cooperative Study," Authorized by U.S. Public Law 108-767, Title XXXVI, U.S. Fire Administration FA-303, October 2006
- 18) "Third Needs Assessment of the U.S. Fire Service: Conducted in 2010 and Including Comparisons to the 2011 and 2005 Needs Assessment Surveys," National Fire Protection Association, Fire Analysis Research Division, June 2011, pgs 16 & 38
- 19) *ibid*, pgs 63 & 66
- 20) "Third Needs Assessment of the U.S. Fire Service: Conducted in 2010 and Including Comparisons to the 2011 and 2005 Needs Assessment Surveys," National Fire Protection Association, Fire Analysis Research Division, June 2011, pgs 63 & 66
- 21) Krakeel, J., "Emergency Medical Services and the Fire Department," *Fire Protection Handbook*, 20th edition, Section 13, Chapter 9, National Fire Protection Association, Quincy MA, 2008, pg 13-151
- 22) NHTSA, "EMS Education Agenda for the Future: A Systems Approach," National Highway Traffic Safety Administration, 2005, pg. 30, website: www.nhtsa.gov/people/injury/ems/FinalEducationAgenda.pdf, cited: 25 June 2011
- 23) *ibid*
- 24) Krakeel, J., "Emergency Medical Services and the Fire Department," *Fire Protection Handbook*, 20th edition, Section 13, Chapter 9, National Fire Protection Association, Quincy MA, 2008, pg 13-152
- 25) NHTSA, "EMS Education Agenda for the Future: A Systems Approach," National Highway Traffic Safety Administration, 2005, pg. 30, website: www.nhtsa.gov/people/injury/ems/FinalEducationAgenda.pdf, cited: 26 July 2011
- 26) NREMT, *2010 Annual Report*, National Registry of Emergency Medical Technicians, pg. 8, website: www.nremt.org/nremt/downloads/2010_Annual_Report.pdf, cited: 8 July 2011
- 27) Ahrens, M., Frazier, P., and Kelch, G., "Use of Fire Incident Data and Statistics," *Fire Protection Handbook*, 20th edition, Section 3, Chapter 4, National Fire Protection Association, Quincy MA, 2008, pg 3-83
- 28) *ibid*, pg 3-69
- 29) Grant R.J., Gregor M.A., Maio R.F., Huang S.S., "The Accuracy of Medical Records and Police Reports in Determining Motor Vehicle Crash Characteristics," Transportation Research Board of the National Academies, 1996, website: trid.trb.org/view.aspx?id=476096, cited: 17 August 2011
- 30) Section 3.3.4, NFPA 450, *Guide for Emergency Medical Services and Systems*, National Fire Protection Association, Quincy MA, 2009 edition
- 31) Grant, C., "Last Dance at the Coconut Grove," *NFPA Journal*, May/June 1991, pg. 82
- 32) Kim K. and Nitz L, "Application of Automated Records Linkage Software in Traffic Records Analysis," Transportation Research Board of the National Academies, 1994, website: htrid.trb.org/view.aspx?id=425369, cited: 17 August 2011
- 33) AAA, "State Ambulance Associations," American Ambulance Association, website: www.the-aaa.org/default.asp?contentID=44, cited: 21 June 2011

- 34) NHTSA Links, National Highway Traffic Safety Administration, website: www.nhtsa-tsis.net/trd/pages/Links.htm, cited: 18 August 2011
- 35) "Government of the United States," U.S. Dept. of the Interior, website: www.doi.gov, cited: 13 May 2011
- 36) "The Bill of Rights," National Archives and Records Administration, Website: www.archives.gov/exhibits/charters/bill_of_rights_transcript.htm, cited 13 May 2011
- 37) NHTSA, National Highway Traffic Safety Administration, Washington DC, website: www.nhtsa.gov, cited: 7 July 2011
- 38) NHTSA, "EMS.gov," National Highway Traffic Safety Administration, Washington DC, website: www.ems.gov, cited: 7 July 2011
- 39) NHTSA, "2009 FARS / NASS GES Standardization," DOT HS 811 356, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, Washington DC, July 2010
- 40) TRB, "Model Minimum Uniform Crash Criteria: Updated Third Edition," Transportation Research Board of the National Academies, Washington DC, website: www.trb.org/Main/Blurbs/Model_Minimum_Uniform_Crash_Criteria_Updated_Third_160_121.aspx, cited: 5 July 2011
- 41) NHTSA, "2009 FARS / NASS GES Standardization," DOT HS 811 356, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, Washington DC, July 2010
- 42) CDC, "Ambulance Crash-Related Injuries Among Emergency Medical Services Workers --- United States, 1991-2002," *Morbidity and Mortality Weekly Report (MMWR)*, Center for Disease Control and Prevention, Volume 52, Number 8, 28 Feb 2003
- 43) "Injury Facts," National Safety Council, Itasca IL, 2011 edition, pg. 118
- 44) *ibid*
- 45) Mears, G., Dawson, D., & Ornato, J., "Emergency Medical Services Information Systems and a Future EMS National Database," *Prehospital Emergency Care*, January/March 2002, Volume 6, Number 1, 123-30, 2002
- 46) NEMSIS, National EMS Information System, website: www.nemsis.org, cited: 6 July 2011
- 47) NEMSIS Technical Assistance Center (TAC), National EMS Information System, website: www.nemsis.org, cited: 8 Aug 2011
- 48) NEMSIS, "Extended Definition Document, NEMSIS/NHTSA 2.2.1 Data Dictionary," National Association of State EMS Officials, EMS Data Managers Council, version 1-6-2008, website: www.nemsis.org/referenceMaterials/articlesAndPublications.html#FactSheets, cited: 10 June 2011
- 49) NHTSA, "National EMS Research Agenda," joint effort supported by the National Highway Traffic Safety Administration, Department of Transportation and Maternal and Child Health Bureau, Health Resources Services Administration, Department of Health and Human Services, 15 Dec 2001, website: www.nhtsa.gov/people/injury/ems/ems-agenda/data.htm, cited: 1 July 2011
- 50) US Consumer Product Safety Commission, "National Electronic Injury Surveillance System," website: www.cpsc.gov/library/neiss.html, cited: 9 Aug 2011
- 51) Worker Health Chartbook 2001, "National Electronic Injury Surveillance System (NEISS)," National Institute for Occupational Safety and Health, NIOSH Publication Number 2004-

- 146, website: www.cdc.gov/niosh/docs/2004-146/appendix/ap-a/ap-a-11.html, cited: 9 Aug 2011
- 52) Work-RISQS, "Work-Related Injury Statistics Query System," National Institute for Occupational Safety and Health, website: www2.cdc.gov/risqs/, cited: 9 Aug 2011
- 53) USFA, "National Fire Incident Reporting System," U.S. Fire Administration, Emmitsburg MD, website: www.usfa.dhs.gov/fireservice/nfirs, cited: 5 July 2011
- 54) USFA, "Facts about NFIRS," National Fire Incident Reporting System, U.S. Fire Administration, Emmitsburg MD, website: www.usfa.dhs.gov/fireservice/nfirs/about.shtm, cited: 5 July 2011
- 55) USFA, "About NFIRS," National Fire Incident Reporting System, U.S. Fire Administration, Emmitsburg MD, website: www.usfa.dhs.gov/fireservice/nfirs/about.shtm, cited: 5 July 2011
- 56) Ahrens, M. and Stewart, S., "Fire Data Collection and Databases," *Fire Protection Handbook*, 20th edition, Section 3, Chapter 3, National Fire Protection Association, Quincy MA, 2008, pg 3-52
- 57) NHTSA, "Uniform PreHospital EMS Dataset," Version 2.2.1, National Highway Transportation Safety Administration, Washington DC, website: www.emspic.org/documents/PDF/SCEMSDataset11-2009.pdf, cited: 29 June 2011
- 58) BLS, "About BLS," Bureau of Labor Statistics, Washington DC, Website: www.bls.gov, cited: 7 July 2011
- 59) HDLI, "About Us," Insurance Institute for Highway Safety, Highway Loss Data Institute, Arlington VA, website: www.iihs.org/about.html, cited: 15 June 2011
- 60) HDLI, "Research & Statistics," Insurance Institute for Highway Safety, Highway Loss Data Institute, Arlington VA, website: www.iihs.org/research/default.html, cited: 15 June 2011
- 61) IAEMSC, "IAEMSC & Intermedix Plan Development of a National EMS Health Surveillance System" News Release, 2009, International Association of Emergency Medical Services Chiefs, Washington DC, website: www.iaemsc.org/pdfs/IAEMSC%20ADPI%20National%20EMS%20Health%20Surveillance%20Press%20Release.pdf, cited: 8 July 2011
- 62) IAEMSC, "Development of the National Emergency Medical Services Health Surveillance Data Base" News Release, International Association of Emergency Medical Services Chiefs, Washington DC, website: www.iaemsc.org/news.html, cited: 8 July 2011
- 63) EMSWorld, "Ambulance Crash Roundup," 30 March 2011, Mar 2011 issue, website: [www.emsworld.com/print/EMS-World/Ambulance-Crash-Roundup/1\\$16279](http://www.emsworld.com/print/EMS-World/Ambulance-Crash-Roundup/1$16279), cited: 8 July 2011
- 64) Sanddal, T.L., Sanddal, N.D., Ward, N., and Stanley, L., "Ambulance Crash Characteristics in the US Defined by the Popular Press: A Retrospective Analysis," *Emergency Medicine International*, Hindawi Publishing Corp, Volume 2010, Article ID 525979, 2010
- 65) "EMSNetwork," crashes news wire web log, website: www.emsnetwork.org
- 66) "EMSNetwork," crashes news wire web log, website: www.emsnetwork.org, compiled by Clackamas Fire District 1, Milwaukee, OR
- 67) *ibid*
- 68) MMUCC, "Model Minimum Uniform Crash Criteria," About MMUCC, website: www.mmucc.us, cited: 18 August 2011

- 69) MMUCC Guideline, "Model Minimum Uniform Crash Criteria," Third Edition, 2008, website: www.mmucc.us/sites/default/files/2008MMUCCGuideline.pdf, cited: 18 August 2011
- 70) MMUCC, "Model Minimum Uniform Crash Criteria," About MMUCC, website: www.mmucc.us, cited: 18 August 2011
- 71) "Traffic Records Coordinating Committee," U.S. Dept of Transportation, website: www.dottrcc.gov, cited: 19 August 2011
- 72) NASEMSO, "State EMS Agencies," National Association of State EMS Officials," website: www.nasemso.org/About/StateEMSAgencies/StateEMSAgencyListing.asp, cited: 18 August 2011
- 73) Savolainen P.T., Dey K.C., Ghosh I., Karra T.L., Lamb A., "Investigation of Emergency Vehicle Crashes in the State of Michigan," Transportation Research Board of the National Academies, 2009, website: trid.trb.org/view.aspx?type=MO&id=908636, cited: 17 August 2011
- 74) Grant RJ, Gregor MA, Maio RF, Huang SS, "The Accuracy of Medical Records and Police Reports Determining Motor Vehicle Crash Characteristics," *Prehospital Emergency Care*, Volume 2, Number 1, 1998, Pgs 23-28
- 75) Kim K, Nitz L, "Application of Automated Records Linkage Software in Traffic Records Analysis," Transportation Research Board, 1994, Pgs 50-55
- 76) Upson R, Notarianni K, "Quantitative Evaluation of Fire and EMS Mobilization Times," Fire Protection Research Foundation, May 2010
- 77) Scopatz R.A. and DeLucia B.H., "State Traffic Information Systems Improvements: Promising Practices," NHTSA, National Highway Traffic Safety Administration, Report No. 811 502, July 2011

Additional Reading References from Peer and Non-Peer Publications

The following is a summary of the readily available literature identified during this study addressing EMS interests and applicable to ambulance crash concerns.

Codes and Standards

- ASTM F1086-94, *Standard Guide for Structures and Responsibilities of Emergency Medical Services Systems Organizations*, American Society for Testing and Materials, West Conshohocken PA, 2002 edition
- ASTM F1149-93, *Standard Guide for Qualifications, Responsibilities, and Authority of Individuals and Institutions Providing Medical Direction of Emergency Medical Services*, American Society for Testing and Materials, West Conshohocken PA, 2003 edition
- ASTM F1224-89, *Standard Guide for Providing System Evaluation for Emergency Medical Services*, American Society for Testing and Materials, West Conshohocken PA, 2004 edition
- ASTM F1268-90, *Standard Guide for Establishing and Operating a Public Information, Education, and Relations Program for Emergency Medical Services Systems*, American Society for Testing and Materials, West Conshohocken PA, 2003 edition

- ASTM F1286-90, *Standard Guide for Development and Operations of Level I Pediatric Trauma Facilities*, American Society for Testing and Materials, West Conshohocken PA, 2002 edition
- ASTM F1288-90, *Standard Guide for Planning and Response to a Multiple Casualty Incident*, American Society for Testing and Materials, West Conshohocken PA, 2003 edition
- ASTM 1339-92, *Standard Guide for Organization and Operation of Emergency Medical Services Systems*, American Society for Testing and Materials, West Conshohocken PA, 2003 edition
- ASTM F1493-93, *Standard Guide for Financing and Financial Accountability of Medical Transportation Systems*, American Society for Testing and Materials, West Conshohocken PA, 2003 edition
- ASTM F1517-94, *Standard Guide for Scope of Performance of Emergency Medical Services Ambulance Operations*, American Society for Testing and Materials, West Conshohocken PA, 2007 edition
- ASTM F1629-95, *Standard Guide for Establishing Operating Emergency Medical Services and Management Information Systems, or Both*, American Society for Testing and Materials, West Conshohocken PA, 2007 edition
- ASTM F1652-95, *Standard Guide for Providing Essential Data Needed in Advance for Prehospital Emergency Medical Services*, American Society for Testing and Materials, West Conshohocken PA, 2007 edition
- GSA, "Federal Specification for the Star-of-Life Ambulance," KKK-A-1822F, U.S. General Services Administration, Washington DC, 1 Aug 2007, website: www.gsa.gov/portal/content/100721, cited: 20 June 2011
- NFPA 450, *Guide for Emergency Medical Services and Systems*, NFPA, Quincy MA, 2009 edition
- NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction*, NFPA, Quincy MA, 2008 edition
- NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, NFPA, Quincy MA, 2010 edition
- NFPA 1250, *Recommended Practice in Fire and Emergency Services Organization Risk Management*, NFPA, Quincy MA, 2010 Edition
- NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*, NFPA, Quincy MA, 2007 Edition
- NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, NFPA, Quincy MA, 2007 edition
- NFPA 1561, *Standard on Emergency Services Incident Management System*, NFPA, Quincy MA, 2008 Edition
- NFPA 1581, *Standard on Fire Department Infection Control Program*, NFPA, Quincy MA, 2010 edition
- NFPA 1600®, *Standard on Disaster/Emergency Management and Business Continuity Programs*, NFPA, Quincy MA, 2010 Edition

- NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, NFPA, Quincy MA, 2010 edition
- NFPA 1720, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments*, NFPA, Quincy MA, 2010 Edition
- NFPA 1917, *Construction and Design of Ambulances*, NFPA, Quincy MA, proposed 2012 edition
- NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, NFPA, Quincy MA, 2007 edition
- NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations*, NFPA, Quincy MA, 2008 edition

Crashworthiness/Interventions

- American Colleges of Emergency Physicians, et al, "Equipment for Ambulances, Position Paper of American College of Surgeons Committee on Trauma," *Prehospital Emergency Care*, Volume 13, Number 3, July/ September 2009
- Bull M, Weber K, Talty J, Manary M, "Crash Protection for Children in Ambulances," 45th Proceedings, *Association for the Advancement of Automotive Medicine*, September 24 – 26, 2001
- CDC, "Ambulance Crash-Related Injuries Among Emergency Medical Services Workers --- United States, 1991-2002," *Morbidity and Mortality Weekly Report (MMWR)*, Center for Disease Control and Prevention, Volume 52, Number 8, 28 Feb 2003
- Chadwick KW, "Improving Driver Performance by Installing Vehicle Monitoring Devices on Ambulances," Executive Fire Officer *EFO Paper*, US Fire Administration, National Fire Academy, February 2009
- Custalow CB, Gravitz GS, "Emergency Medical Vehicle Collisions and Potential for Preventive Intervention," *Prehospital Care*, Volume 8/Number 2, April/June 2004
- Current RS, Moore PH, Green JD, Yannaccone JR, Whitman GR, Sicher LA, "Crash Testing of Ambulance Chassis Cab Vehicles," SAE, Technical Paper Number 2007-01-4267, 2007
- Gilad, I and Byran E, "Ergonomic Evaluation of the Ambulance Interior to Reduce Paramedic Discomfort and Posture Stress," *Human Factors*, December 2007
- Green, JD, et.al., "Assessing the performance of various restraints on ambulance patient compartment workers during crash events," *International Journal of Crashworthiness*, Volume 15, Number 5, Pgs 517 – 541, , October 2001
- Green JD, Moore P, Current R, Yannacconne J, Whitman G, Day D, Proudfoot S, Bobick T, Romano N, "Reducing Vehicle Crash-Related EMS Worker Injuries Through Improvements in Restraint Sytems," 2006 World Safety Congress, September 2006
- Levick NR, Donnelly BR, Blatt A, Gillespie G, Schultze M, "Ambulance Crashworthiness and Occupant Dynamics in Vehicle to Vehicle Crash Tests: Preliminary Report," Paper Number 452 Conference Proceedings, May 2001

- Levick N, Guhua L, Yannacconne J, “Development of a Dynamic Testing Procedure to Assess Crashworthiness of the Rear Patient Compartment of Ambulance Vehicles,” Paper Number 454, Conference Proceedings
- Moore, L., et al, “Report on EMS Field Experiments,” International Association of Fire Fighters, Wash DC, website: [www.iaff.org/tech/PDF/EMS%20Nist%20Report LORES.pdf](http://www.iaff.org/tech/PDF/EMS%20Nist%20Report%20LORES.pdf), cited: 10 June 2011
- Rodriguez SS, Martinez SL, Vicente CT, “Experimental Evaluation of the Wheelchair Under Different Impact Conditions using Commercial Wheelchairs,” *International Journal of Crashworthiness*, Volume 11, Number5, 2006, pgs. 425-441
- Savolainen PT, Dey CK, Ghosh I, Karr TL, Lamb A, *Investigation of Emergency Vehicle Crashes in the State of Michigan*, Region V Regional University Transportation Center, Purdue University, 2009
- Waldron DM, “An Analysis of Red Lights and Sirens Use Responding to Emergency Medical Services Incidents,” Executive Fire Officer *EFO Paper*, US Fire Administration, National Fire Academy, September 2008
- Zhang, J, Yaganandan, N, Pintar, FA, “Dynamic Biomechanics of the Human Head in Lateral Impacts,” 53rd AAAM Annual Conference, *Annals of Advances in Automotive Medicine*, 5-7 October 2009

Date Collection Methodology

- Ahrens, M., Frazier, P., and Kelch, G., “Use of Fire Incident Data and Statistics,” *Fire Protection Handbook*, 20th edition, Section 3, Chapter 4, National Fire Protection Association, Quincy MA, 2008
- Averill, J., et al, “National Fire Service Data Summit: Proceedings,” NIST Technical Note 1696, National Institute of Standards and Technology, Gaithersburg MD, May 2011
- Cummins R., et al, “Recommended Guidelines for Uniform Reporting of Data from Out-of-Hospital Cardiac Arrest,” *Annals of Emergency Medicine*, Volume 20:8, 1991, pgs. 861-874
- FEMA, “National Fire Incident Reporting System (NFIRS),” Federal Emergency Management Agency, Washington, DC, website: nfirs.fema.gov, cited: 16 June 2011
- Gates DG, “Emergency Service Call Processing Time,” Executive Fire Officer *EFO Paper*, US Fire Administration, National Fire Academy, October 2007
- Grant RJ, Gregor MA, Maio RF, Huang SS, “The Accuracy of Medical Records and Police Reports Determining Motor Vehicle Crash Characteristics,” *Prehospital Emergency Care*, Volume 2, Number 1, 1998, Pgs 23-28
- IAFC, “EMS Data Survey,” International Association of Fire Chiefs, Washington DC, 2000.
- JEMS, “Annual Survey: 200 Most Populated Cities,” *Journal of Emergency Medical Services*, 2004
- Karter, M. and Stein, G., “U.S. Fire Department Profile Through 2008,” NFPA, Oct 2009
- Kim K, Nitz L, “Application of Automated Records Linkage Software in Traffic Records Analysis,” *Transportation Research Board*, 1994, Pgs 50-55
- Krakeel, J., “Emergency Medical Services and the Fire Department,” *Fire Protection Handbook*, 20th edition, Section 13, Chapter 9, National Fire Protection Association, Quincy MA, 2008

- Krueger J, "Garbage In? Evaluating the Consistency of the Data Input into the MTFPD NFIRS Compliant Database," Executive Fire Officer *EFO Paper*, US Fire Administration, National Fire Academy, October 2010
- NASEMSO "2003 National Emergency Medical Services (EMS) Survey," National Association of State EMS Officials, on behalf of U.S. Dept of Health and Human Services, Health Resources Services Administration, University of NC, Chapel Hill, Dept of Emergency Medicine, Washington DC, 2003
- NFPA, "Third Needs Assessment of the U.S. Fire Service: Conducted in 2010 and Including Comparisons to the 2011 and 2005 Needs Assessment Surveys," National Fire Protection Association, Fire Analysis Research Division, June 2011
- NHTSA, "Traffic Safety Facts," 1994 – 2008, Motor Vehicle Crash Data from FARS and GES, National Highway Transportation Safety Administration, Washington DC
- NHTSA, "Uniform PreHospital EMS Dataset," Version 2.2.1, National Highway Transportation Safety Administration, Washington DC, website: www.emspic.org/documents/PDF/SCEMSDataset11-2009.pdf, cited: 29 June 2011
- Nolan, D.P., *Encyclopedia of Fire Protection*, Thompson Delmar Learning, Clifton Park NY, 2nd edition, 2006
- Patterson P, Probst JC, Moore CG, "Expected Annual Emergency Miles per Ambulance: An Indicator for Measuring Availability of Emergency Medical Services Resources," *Journal of Rural Health*, Volume 22, 2006, Pgs 102-111
- Upson R, Notarianni K, "Quantitative Evaluation of Fire and EMS Mobilization Times," Fire Protection Research Foundation, May 2010
- Yvorra, J., "Mosby's Emergency Dictionary: Quick Reference for Emergency Responders," C. V. Mosby Company, St Louis MO, 1989

Injury and Risk

- AHA, "Advanced Cardiovascular Life Support: Section 1: Introduction to ACLS 2000: Overview of Recommended Changes in ACLS from the Guidelines 2000 Conference," American Heart Association, Dallas TX, 2000:102 (Supplement I), pgs. I-89
- AMA, "Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care," Emergency Cardiac Care Committee and Subcommittees, Part I - Introduction, *JAMA* 268:16, American Medical Association, Chicago IL, 1992
- Auerbach PS, Morris JA, Phillips JB, Redinger SR, Vaughn WK, "An Analysis of Ambulance Accidents in Tennessee," *JAMA*, Volume 258, Number 11, 18 September 1987
- Becker LR, Zaloshnja E, Levick N, Guohua L, Miller TR, "Relative Risk of Injury and Death in Ambulances and Other Emergency Vehicles," *Accident Analysis & Prevention*, Volume 35, 2003, pgs. 941 – 948
- Brown, WE, Dickison PD, Misselbeck, WJA., Levine, R, "Longitudinal Emergency Medical Technician Attribute and Demographic Study (LEADS) Interim Report," *Prehospital Emergency Care*, Volume 6, Number 4, October/December 2002
- Centers for Medicare Services, Negotiated Rulemaking Committee, *Federal Register*, Washington DC, 2001

- Heick R, Young, T, Peek-Asa, C, "Occupational Injuries Among Emergency Medical Services Providers in the United States," *Journal of Occupational and Environmental Medicine*, Volume 51, Number 8, August 2009
- IAFC "Fire Department Guide to Pandemics," International Association of Fire Chiefs, Washington DC, 2005
- IAFC "Fire Department Guide to Smallpox," International Association of Fire Chiefs, Washington DC, 2001
- Kahn CA, Pirrallo, RG, Kuhn, EN, "Characteristics of Fatal Ambulance Crashes in the United State: An 11-year Retrospective Analysis," *Prehospital Emergency Care*, Volume 5, 2001, pgs. 261 – 269
- Maguire, BJ, Hunting KL, Smith GS, Levick NR, "Occupational Fatalities in Emergency Medical Services: A Hidden Crisis," *Annals of Emergency Medicine*, 40:6, December 2002
- Maguire BJ, Hunting KL, Guidotti TL, Smith GS, "Occupational Injuries among Emergency Medical Services Personnel," *Prehospital Emergency Care*, Volume 9, Number 4, October/December 2005
- National Research Council, "Accidental Death and Disability: The Neglected Disease of Modern Society," National Academy of Sciences, Washington, DC, 1966
- NIH, "Staffing and Equipping EMS Systems: Rapid Identification and Treatment of Acute Myocardial Infarction," Pub No 93-3304, National Heart Lung and Blood Institute, National Institutes of Health, Bethesda MD, Sept 1993
- Pantridge, F. and Geddes, J., "A Mobile Intensive-Care Unit in the Management of Myocardial Infarction" *Lancet*, Volume 2, Cardiac Dept., Royal Victoria Hospital, Belfast, Northern Ireland, 1967, Pgs 271–273
- Pirrallo, RG, Swor, RA, "Characteristics of Fatal Ambulance Crashes during Emergency and Non-Emergency Operation," *Prehospital and Disaster Medicine*, Vol 9, No 2, April – June 1994, pgs 55/125 – 61/131
- Proudfoot SL, "Ambulance Crashes, Fatality Factors for EMS Workers," *Emergency Medical Services, Journal of Emergency Care, Rescue, and Transportation*, Volume 34, Number 6, June 2005
- Proudfoot SL, Moore P, Levine R, "Safety in Numbers, A Survey of Ambulance Patient Compartment Safety," *JEMS Journal of Emergency Medical Services*, March 2007
- Proudfoot SL, Romano NT, Bobick TG, Moore PH, "Ambulance Crash-Related Injuries Among Emergency Medical Services Workers --- United State, 1991 – 2002," *Division of Safety Research NIOSH, Morbidity and Mortality Weekly Report*, Volume 52(08), 28 February 2003, pgs. 154-156
- Ray A.M., Kupas D.F., "Comparison of Crashes Involving Ambulances with Those of Similar Sized Vehicles," *Prehospital Emergency Care*, Volume 9, Number 4, October/December 2005, pgs 412-415
- Ray AM, Kupas DF, "Comparison of Rural and Urban Ambulance Crashes in Pennsylvania," *Prehospital Emergency Care*, Volume 11, Number 4, October 2007
- Reichard AA, and Jackson LL, "Occupational Injuries Among Emergency Responders," *American Journal of Industrial Medicine*, S3:1-11, 2010

- Sanddal, ND, Albert, S, Hansen, JD, Kupas, DF, “Contributing Factors and Issues Associated with Rural Ambulance Crashes: Literature Review and Annotated Bibliography,” *Prehospital Emergency Care*, Volume 12 / Number 2, April/June 2008
- Silver, DE. “The hazards of providing care in emergency vehicles: an opportunity for reform,” *Prehospital Emergency Care*, Volume 13/Number 3, July/September 2009
- Studnek, JR, Ferketich, A, Crawford, JM, “On the Job Illness and Injury Resulting in Lost Work Time Among a National Cohort of Emergency Medical Services Professionals,” *American Journal of Industrial Medicine* 50:921–931, 2007
- Suyama, J, Rittenberger, JC, Patterson, PD, Hostler, D, “Comparison of Public Safety Provider Injury Rates,” *Prehospital Emergency Care*, Volume 3, Number 4, October/December 2009
- Tetreault MW, “Evaluating Injuries to Firefighters While Performing Patient Care in a Moving Ambulance,” Executive Fire Officer *EFO Paper*, US Fire Administration, National Fire Academy, May 2009
- Weiss SJ, Randall E, Ernst AA, Land RF, Austin G, “A Comparison of Rural and Urban Ambulance Crashes,” *American Journal of Emergency Medicine*, Volume 19, Number 1, January 2001

Policies, Procedures, and Ergonomic Issues

- AAA, “EMS Structured for Quality: Best Practices in Designing, Managing and Contracting for Emergency Ambulance Service,” American Ambulance Association, McLean VA, website: www.the-aaa.org/micro-site/about.asp, cited: 15 June 2011
- Eisenberg, M., Bergner, L., and Hallstrom, A., “Cardiac Resuscitation in the Community: The Importance of Rapid Delivery of Care and Implications for Program Planning,” *JAMA*, Volume 241, 1979, pgs. 1905–1907
- Eisenberg, M., et al, “The Revolution and Evolution of Pre-Hospital Cardiac Care,” *Archives of Internal Medicine*, Volume 156, Number 15, 1996
- FEMA, “Guide for the Development of a State and Local Continuity of Government Capability: Civil Preparedness Guide,” Federal Emergency Management Agency, Washington, DC, 1987, website: www.slideshare.net/mrhempAHotmailDOTcom/civil-preparedness-guide-fema-1-10, cited: 15 June 2011
- IAFC/IAFF, “Memorandum of Understanding,” International Association of Fire Chiefs and International Association of Fire Fighters, Washington DC, 1991
- IAFF “EMS System Performance Measures,” International Association of Fire Fighters, Washington DC, website: www.iaff.org/tech/ops/performance.htm, cited: 10 June 2011
- IAFF, “Fire Service Based EMS Electronic Tool Kit,” International Association of Fire Fighters, Wash DC, website: www.iaff.org/Tech/PDF/FBEMSTools/FBEMStoolkit.pdf, cited: 10 June 2011
- Johnson TD, Lindholm D, Dowd D, “Child and Provider Restraints in Ambulances: Knowledge, Opinions, and Behaviors of Emergency Medical Services Providers,” *Academic Emergency Medicine*, Volume 13 Number 8, August 2006

- Larmon B, LeGassick, TF, Schriger DL, “Differential Front and Back Seat Safety Belt Use by Prehospital Care Providers,” *American Journal of Emergency Medicine*, Volume 11, Number 6, November 1993
- NHTSA, “A Leadership Guide to Quality Improvement for EMS Systems,” National Highway Transportation Safety Administration. Washington DC, website: www.nhtsa.gov/people/injury/ems/leaderguide, cited: 6 July 2011
- NHTSA, Delbridge, T., et al, “Emergency Medical Services: Agenda for the Future,” DOT HS 808-441, NTS-42, National Highway Traffic Safety Administration, Washington DC, August 1996, website: www.nhtsa.dot.gov/people/injury/ems/EdAgenda/final, cited: 21 June 2011
- NHTSA, “Emergency Medical Services Agenda for the Future Implementation Guide,” National Highway Traffic Safety Administration, Washington DC, website: www.nhtsa.dot.gov/people/injury/ems/agenda, cited: 21 June 2011
- NHTSA, “EMS Education Agenda for the Future: A Systems Approach,” National Highway Traffic Safety Administration, 2005, pg. 30, website: www.nhtsa.gov/people/injury/ems/FinalEducationAgenda.pdf, cited: 25 June 2011
- NHTSA, “EMS Education Agenda for the Future: A Systems Approach,” National Highway Traffic Safety Administration, Washington DC, website: www.nhtsa.gov/people/injury/ems/EdAgenda/Peer/EMS%20Educ%20Agenda.htm, cited: 7 June 2011
- NHTSA, “NEMSIS: National EMS Information System,” National Highway Transportation Safety Administration. Washington DC, website: www.nemsis.org, cited: 28 June 2011
- NHTSA, “National EMS Research Agenda,” National Highway Traffic Safety Administration, 31 Dec 2001, website: www.nhtsa.dot.gov/people/injury/ems/ems-agenda/EMSResearchAgenda.pdf, cited: 22 June 2011
- NHTSA, “National EMS Scope of Practice Model,” National Highway Traffic Safety Administration, Washington DC, 2005
- “Open Source EMS Initiative,” website: www.mhf.net/opensource, cited: 30 June 2011
- Studnek JR, Ferketich A, “Organizational Policy and Other Factors Associated with Emergency Medical Technician Seat Belt Use,” *Journal of Safety Research*, Volume 38, 2007, pgs. 1 – 8
- Weiss H., Sirin H, Levine J. A., Sauber E., “International Survey of Seat Belt Use Exemptions,” *Injury Prevention*, 2006, Volume 12, pgs. 258 – 261