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Abstract:

Emergency Medical Service (EMS) is an essential and transportation based emergency service, and now key component of the new SAFETEA-LU required State Strategic Highway Safety Plans. Ground EMS responds to approximately 30 million emergency medical/injury calls annually. In contrast to other commercial transport vehicles, ambulance transport safety is not currently encompassed by the Federal Motor Carrier Safety Administration (FMCSA), nor formally by any other overseeing body and hence the safety oversight of this transport system is fragmented and largely devoid of current technical transportation safety input. This is of serious concern, particularly when the crash fatality rate for these EMS vehicles per mile traveled is estimated to be in excess of 10 fold higher than that for heavy trucks. Additionally there are ambulance 'wake effect' crashes, with rates in excess of five fold of the identified ambulance crash rates. These deficiencies in EMS transportation safety process range in spectrum from safety performance data capture, to transportation system safety engineering, and vehicle design, vehicle safety performance and occupant protection. There is also no process for formal knowledge transfer of existing transportation safety understanding and expertise or vehicle design and safety technical expertise either from the commercial vehicle industry or the automotive safety industry to the ambulance industry. This paper identifies some of the unique challenges of this EMS transportation system and addresses existing and innovative approaches for augmenting knowledge transfer potential from other transportation areas to enhance the safety of this special transportation system.

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EMERGENCY MEDICAL SERVICES: A UNIQUE TRANSPORTATION SAFETY CHALLENGE

ABSTRACT

Emergency Medical Service (EMS) is an essential and transportation based emergency service, and now key component of the new SAFETEA-LU required State Strategic Highway Safety Plans. Ground EMS responds to approximately 30 million emergency medical/injury calls annually. In contrast to other commercial transport vehicles, ambulance transport safety is not currently encompassed by the Federal Motor Carrier Safety Administration (FMCSA), nor formally by any other overseeing body and hence the safety oversight of this transport system is fragmented and largely devoid of current technical transportation safety input.

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These deficiencies in EMS transportation safety process range in spectrum from safety performance data capture, to transportation system safety engineering, and vehicle design, vehicle safety performance and occupant protection. There is also no process for formal knowledge transfer of existing transportation safety understanding and expertise or vehicle design and safety technical expertise either from the commercial vehicle industry or the automotive safety industry to the ambulance industry.

This paper identifies some of the unique challenges of this EMS transportation system and addresses existing and innovative approaches for augmenting knowledge transfer potential from other transportation areas to enhance the safety of this special transportation system.

INTRODUCTION

Emergency Medical Service (EMS) is a relatively recent public service and public safety infrastructure, only being formally established in the 1960’s in the USA. It is now a key and essential and transportation based emergency service, responding to approximately 30 million emergency medical/injury calls annually (including 1.9 million transport crash injury and ~40,000 transportation fatality calls). There has been much recent focus nationally[1,2,3,4,5,6], federally[7] and academically[8] on the issues pertaining to air EMS safety, and extensive focus in many dimensions on general motor carrier safety, particularly truck and bus safety. However, safety issues pertaining to ambulance transport have not shared this either focus or oversight.[9,10] Furthermore, ground EMS is a part of the transportation system that is largely exempt from most of the Federal Motor Vehicle Safety Standards (FMVSS), particularly the rear passenger compartment of the ambulance. EMS is also not covered by other national transportation system safety oversight, asides from the KKK GSA specification for ambulance design – however the KKK specification is not written by automotive or transportation safety engineers – and solely addresses the static features of ambulances and does not address transportation safety performance generally or reference any of the relevant technical literature. Current transport system safety research and development - Intelligent Transportation Systems (ITS), (interactive traffic signal technologies, in vehicle and in system driver performance improvement technologies); Simulators for training and competencies; Vehicle design and safety; Safety and practice policies (Dispatch, shift length, safety oversight); Interaction with other road users (‘wake effect’ and high density EMS traffic and hospital access road design) – may benefit EMS. The findings of limited research conducted to date suggest EMS transportation safety is in need of urgent focus and has been left behind commercial truck and bus safety. EMS transport safety is a unique gap in the standards, oversight and coordination of the transport system. Knowledge transfer from the truck and bus industry of the research conducted to date that applies to or could be applied to this field has potential for substantively enhancing EMS transport safety.

What are the safety issues? What do we know of the risks and hazards? How can we measure these? And how can we optimize the safety of this system? Remain challenging questions for EMS.

The published research addressing these safety questions is scant and very recent, the vast majority being published over the past 5 years. The relevant literature is in a combination of multidisciplinary fields bridging epidemiology and public health literature, engineering and ergonomic literature as well as in the liability and risk management field.[12]

Despite the large strides that the automotive and transportation safety, occupational health and safety as well as public safety have made in the last 30 years, this expertise has not yet been translated to the safety of emergency medical service transport, unlike the related fields of air medical safety or the truck and bus industry. Ambulance transport practice and policy have developed largely outside of the purview of both the transportation safety and occupational safety and health arenas in most issues asides from biohazards.[9] Compounding this further is the fact that ground ambulance vehicles are a very diverse fleet: vans, light and heavy trucks and freightliners. Of serious concern, it is a fleet exempt from the Federal Motor Vehicle Safety Standards (FMVSS) for all occupants seated 60cm behind the drivers seating position.[13] . This is in stark contrast to helicopter and fixed-wing medical transport safety standards and the FAA oversight and regulations and the safety oversight over the truck and bus industry and FMCSA.

Thus, ascertaining the safety of ground ambulance transport, its vehicles and products used in that environment, remains limited to expert opinion and peer evaluation in a piecemeal fashion. Ground ambulance vehicle crashes have been shown to be the most likely cause of a work related fatality in EMS.[14] The rear patient compartment has been demonstrated in both biomechanical and epidemiological studies to be the most dangerous part of the ground ambulance vehicle with regards to vehicle occupants.[15,16,17,18,19] . Additionally, although EMS systems are required to have medical control/direction, from a licensed medical practitioner, there is no requirement for a trained transport practitioner, even though insurance data shows that EMS operators are 27 times more likely to be sued for the way in which they operate their vehicles than they for medical malpractice. Unfortunately, no reporting system or database exists specifically for identifying ambulance crash-related injuries and their nature. Therefore, specific details as to which injuries occurred and what circumstances and mechanisms specifically caused them are currently scarce. Even this information for fatal ground ambulance injuries is lacking or very difficult to access.

There have been a number of publications in the epidemiology literature addressing ground ambulance transport morbidity and mortality crash related statistics.[12,14,16,20-24] These publications reach very similar general conclusions and identify serious risk and hazard from intersection collisions and the use of high speed and lights and sirens., [15] Also identified was the risk of serious injuries and fatalities from failure to use seat belts in the rear patient compartment, with very high fatality risk for unbelted providers in the rear compartment (83%).[15] There are also hazards to ground EMS providers at an emergency rescue scene, where they are at risk of being struck by a passing vehicle due to poor visibility. Recent data suggests that one in five EMS provider transportation-related fatalities occur in this type of setting.[24]

The peer reviewed automotive safety engineering testing conducted for the EMS environment[16-20,24] has clearly identified some predictable and largely preventable hazards, which pertain to the rear compartment design, layout and vehicle crashworthiness,

This is a unique transportation and health care delivery environment for a number of reasons. Even though there is comprehensive medical and clinical oversight, training and standards in EMS - this is not the case with the transportation safety aspect of this system. There are few applicable transportation system safety standards for EMS, no vehicle crash safety testing standards that pertain to ambulance vehicles and no comprehensive personal protective equipment standards. There is only very limited national data captured on the safety of this transportation system, primarily by the Fatality Analysis Reporting System (FARS), which is far from comprehensive.

There have been extensive studies that have identified that intersections are responsible for many ambulance crash fatalities and injuries. It has also been demonstrated that for each ambulance occupant killed in an adverse event involving an ambulance vehicle, that there are 3 bystanders killed, either in an unrelated passenger vehicle or pedestrians being struck. Also the rear patient compartment has been identified as the most dangerous part of the ambulance for its occupants, yet this part of the vehicle is currently not regulated by the Federal Motor Vehicle Standards. Unfortunately also, no reporting system or database exists specifically for identifying ambulance crash related injuries and their nature, so specific details as to which injuries occurred and what specifically caused them are extremely scarce.

While some crashes may not have been preventable, many fatal and injurious ground ambulance crashes are related to risky driving practice by EMS personnel. One paper cites that 80% of the crashes are caused by 20% of the drivers.[12,29] Failure to stop at intersections has been identified as an extremely high risk practice.[12,23] Some of the larger EMS services have clear policies in place requiring ground ambulances to come to a complete stop at a red light or stop sign. However there is no national requirement for such transportation safety policies.

The engineering studies conducted demonstrate the benefit of use of existing restraints and securing equipment, identifying hazardous surfaces, as well as a need for personal protective equipment such as head protection, protective and high visibility clothing. Lack of use of seatbelts by EMS personnel is cited most frequently in the literature as one of the predominant causes for the high injury and fatality rates for EMS providers, this is supported by the engineering data from ambulance safety research involving crash tests. Similarly, failure to secure equipment in the patient compartment has been found to cause serious injury in the event of a rash or a near collision, however there has been no evaluation of the human factors and ergonomics aspects of this transportation system in the USA. There has been no appraisal of EMS safety as part of a transportation system – with scarce systematic evaluation of the transportation circumstances that were factors in these adverse events.

To optimize driver performance and safety and to enhance collision avoidance there are a number of new technologies, pertaining to intelligent vehicle design and other safety technologies. There have been some limited studies of the use of pre-emptive systems to change the traffic lights to give the EMS vehicle right of way, however it is not clear that such systems are generalizable to all environments. Also, driver feedback technology has been implemented in some regions, and has shown very promising safety enhancements of driving behavior. These auditory feedback devices provide real time immediate feedback and data recording that has shown impressive positive change in behavior and performance, specifically in reducing risky driving practice, decreasing the number of collisions, as well as reducing the number seatbelt violations by EMS personnel. Additionally such devices also assist in providing denominator data which can be applied to enhanced understanding of system wide safety performance. In one site in the USA has there been any piloting of integrating these devices with other aspects of the transportation system and GIS technologies.

Safety standards from the USA and internationally that pertain to the EMS transport environment are very limited. There are EMS vehicles design and dynamic safety testing and performance standards in Europe, UK and Australia. USA has no performance or testing standards for ambulance vehicles but rather a purchase specification (KKK specification) which at present has no dynamic or crash testing safety performance component, and no fleet management information. The new USA ANSI/ASSE Z15.1 fleet management standard, approved in March 2006 is the first national fleet management standard to have oversight which includes over EMS fleets. Currently also a specific standard pertaining specifically to EMS transport is underdevelopment.

Clearly what has been demonstrated to date is that EMS is a complex transport and health delivery system with a multidisciplinary need in the transport safety management environment. Management of the safety of this transportation system bridges: automotive safety, transportation safety (including driver performance and interaction with the environment), occupational health and safety, ergonomics and human factors, practice policy and acute health care delivery as well as public safety and essentially involves a multi disciplinary systems safety engineering approach Utilizing a systems based multidisciplinary approach, including ergonomic and automotive safety perspectives in conjunction with safety standards development is necessary to ensure improved outcomes in EMS transport safety. An innovative framework bridging key EMS safety research and current ergonomic and automotive technology with a safety systems approach is necessary in the future to facilitate enhanced cross disciplinary collaboration in development of safety initiatives in EMS transport.

NEGATIVE IMPACT OF AN EMS CRASH

In contrast to any other highway crash, and EMS vehicle crash has a number of unique consequences – firstly the crash takes that EMS vehicle out of service, and also generates an increased demand on the EMS as it too will require an EMS response, and often a response beyond that of a similar vehicle. The net effect being an unplanned direct negative impact on EMS resources, asides from the more extensive indirect negative impact (involving the consequences from an insurance, litigation and negative press and psychological sequelae – and may also result in substantively compromising the ability of that EMS system from responding to other and unrelated emergencies. Iit has been documented that EMS crashes result in prolongation of the EMS system s response times generally. Additionally, it is unique in that the patient being transported may sustain further injury, or be killed – and or the providers or public.

OPTIMIZING SAFETY AND SYSTEMS ENGINEERING

Optimizing the safety of EMS transport bridges the expertise of a number of technical fields: Data capture, Intelligent Transportation Systems (ITS), vehicle biomechanics and crashworthiness, occupant safety and personal protective equipment (PPE) design, ergonomics/human Factors (and biohazards), EMS practice and policy, fleet management policies and transportation systems engineering. A comprehensive systems engineering approach to bridge these diverse disciplines to enhance the safety of the system as a whole is key.

Initiatives to optimize safety for EMS transport should be focused on a multidisciplinary systems approach to safety and risk management. This includes vehicle selection for safer visible, more compact vehicles with non-hostile interiors, practical policies on vehicle operation and driver selection and training, integration of ITS technology, use of PPE that addresses identified injury hazards and implementation of a structured fleet safety program, with formal safety management oversight.

The very recently developed American National Standards Institute/American Society of Safety Engineers Z15.1 Fleet Safety Standard (ANSI 2006) is possibly the only nationally approved safety standard in the USA that is now applicable to the safety management of ground EMS vehicle fleets. It is likely that the implementation of this standard will provide more emphasis on EMS vehicle safety generally, enhance the data collected regarding EMS vehicle safety, and assist in bringing EMS vehicle safety more inline with state of the art automotive safety practices. The development of an EMS specific systems safety standard is underway currently via the American Society of Safety Engineers standards committee.

Data capture

One of the as yet unmet challenges is EMS – is comprehensive data capture on system performance and safety. Basic data on number of vehicles, number of miles traveled – is not available nationwide. Nor is the number of providers clear, nor health and wellness information easily identifiable or accessible. There are a number of initiatives underway via NHTSA to augment the capture of EMS data and enhance system safety. There needs to be robust data for both denominator and the numerator of safety performance outcomes.

Vehicle Crashworthiness and Design and Occupant Safety Devices

The few engineering studies have highlighted the failures in crashworthiness performance if the current fleet of USA ambulances and a need for better seat design. The studies have also demonstrated the benefit of using existing restraints (lap belts) for all seated occupants; the importance of over the shoulder harnesses for the recumbent patient on the stretcher (with the stretcher back in an upright or 45 degree angle where medically acceptable; and at all times the need to firmly secure all equipment.[17-19,26] These studies also specifically identify hostile interior surfaces and hazardous head strike zones, poor design and interior layout of the rear compartment, and a non crashworthy rear compartment as well as a need for head protection.[17,18,19] Automotive grade energy absorbing padding in 'head strike' zones would likely assist in minimizing the inevitable injury in the event of a crash.

The inadequacies of current vehicle safety design guidelines and lack of realistic vehicle safety testing standards has been highlighted in these engineering studies [44, 45, 46, 49].

The issue of head protection devices is a potential strategy for enhancing occupant safety[31,32] however also devoid of a specific EMS standard. Design and safety standards for head protection are currently being addressed. Based on research conducted to date,[32] a head protection device for ground transport needs to be protective in a range of conditions.

Additionally, high visibility vehicle markings (as well as medic clothing) will optimize the safety of providers both during transport and at an emergency scene – and should be a routine for all vehicles and all providers, and standards for the optimal safety of these vehicle markings and apparel should be developed for this environment.

TABLE 1: System Safety -Optimizing EMS Ground Transport Safety

Data Capture

- **System profile**
    - Denominator – vehicles, runs, miles traveled,personnel
    - Numerator – safety outcomes and performance

Vehicle Design, Biomechanics and Crashworthiness

- **Vehicle**
    - Structurally built by the automotive industry
    - Non-hostile interiors
    - Lock down positions for routine equipment
    - Seat belts for all seated occupants
    - Over-shoulder harnesses for all patients on the stretcher
    - Crashworthiness features for vehicle structure and seating design
    - Forward and rear facing seating positions, not side facing
    - Enhanced vehicle stability

Ergonomics and Biohazards

- **PPE**
    - Head protection and Protective Clothing
    - Conspicuity/Visibility
    - Biohazard protection

- **Equipment and Vehicle Layout and Design**
    - Equipment and vehicle interface ergonomics and human factors
    - Vehicle conspicuity /visibility and appropriate warning signals

Transportation Environment

- **Intelligent Transportation System (ITS) Technologies**
    - Driver/vehicle performance monitoring and feedback devices
    - Collision avoidance vehicle technologies
    - Signal systems
- **Integration with Strategic Highway Safety Planning**
    - Roadside safety design and planning technologies
    - Safe hospital ambulance bay access and egress
- **Fleet mix**
    - Rapid response vehicles
    - Vans and Trucks
    - Motorcycles

Safety Management

- **Fleet Management**
    - Safety program
    - ANSI/ASSE Z.15
- **EMS Practice and Policy**
    - Safe driving policy and practice
    - Seat belt use policy - for providers, patients and passengers
    - Secure all equipment
    - Stop at intersection policy - red lights, stop signs
    - Emergency Vehicle Operators Course (EVOC)
    - Use portable communications
    - Notify driver if rear occupants are in vulnerable positions

Intelligent Transportation Systems (ITS)

There are a number of new technologies currently available and on the horizon in the automotive and transportation industry to enhance safety and collision avoidance. These technologies pertain to driver behavior modification,[33,34, 47] intelligent vehicle design[35] and other roadside safety technologies.[36] ITS is a well established field in the passenger vehicle safety industry and hopefully will soon be an integral component in ground ambulance safety as well.

After market electronic feedback technology with real-time driver monitoring and auditory feedback has been implemented in some regions in the U.S. and has shown impressive improvement of driving behavior and enhancements in safety performance in a number of studies.[33,34,47.] These devices provide real time and immediate feedback to the driver. This driver performance data recording that has shown great promise in optimizing safety in the EMS ground transport environment. These devices have been demonstrated to reduce the number of seatbelt and speed violations by EMS personnel, decrease the number and severity of vehicle collision events and also minimize vehicle maintenance costs. Properly implemented, these devices have been demonstrated to be not only cost effective, but to pay for themselves within 6 months in vehicle maintenance savings alone and have in some regions shown an up to 90% reduction in ambulance crashes. These devices have also been shown to optimize safety, cost effectiveness and response times. There are now trials underway to integrate these technologies with GIS systems. Other devices are available that provide video capture of the driver and vehicle. However, these devices appear to be more intrusive and also require a substantial administrative burden for monitoring and feedback. They also appear to have less impact on preemptively addressing risky driving practices and have not yet been subjected to independent peer review.

There are now ITS technologies available in some passenger vehicles that give preemptive warnings to the driver of potential road or other vehicle hazards. Notifications are communicated via dashboard warnings or projected onto the windshield. These technologies are not integrated into routine ground EMS vehicle. There are technologies now that have the ability of the vehicle to take over vehicle operations and avoid a crash that the driver appeared unable to navigate to avoid. Enhanced vehicle stabilization systems which have been shown to be highly effective to prevent vehicle roll and promote vehicle control in swerves or high torque turns are also yet to be integrated into ground ambulance vehicles.

Other devices, such as systems which interact with the road signals, have been piloted in some regions with some success.[35] However, their applicability and generalizability to other environments has not yet been demonstrated.

Ergonomics and Biohazards and Health and Wellness

There is to date only one peer reviewed published paper on the ergonomics of the ground ambulance transport environment, published in 2005 from the United Kingdom.[37]

A proper understanding of the ergonomics of this work place would assist greatly in enhancing and optimizing ground ambulance vehicle design and safety for effective patient care during transport, and may facilitate in creating an environment where there is a decreased perceived need for risky driving practice. The complexities of tasks performed in the ambulance vehicle, lend it well to ergonomic evaluation. Focused attention should be requested by EMS from those expert in this field of ergonomics, particularly from the government agencies whose charter it is to address safety in the workplace. The National Institute for Occupational Safety and Health (NIOSH) is an organization that is historically geared, focused and staffed toward epidemiology, biohazards and ergonomic research. Yet, there exists not one published paper in the US addressing ground ambulance ergonomics, while there are millions of EMS transports annually; provider deaths every year; and thousands of work related injuries. Many of these adverse events are related to poor ergonomics in and around the ground ambulance vehicle.

Personal Protective Equipment (PPE) is primarily designed for biohazard protection, even though mechanical vehicle and transport related injury risks are high for providers. It would appear important that PPE should be designed to protect providers from the hazards that they are exposed to, both the biohazards and importantly also physical injury hazards and that these two aspects of PPE design should be compatible. It is also important to ensure that vehicle design allows for proper decontamination from body fluids and that surfaces are such that cleaning is effective and easily achieved. Also, it is important to ensure that biohazard protective clothing is effectively integrated with other safety and protective issues in EMS ground transport.

EMS Practice, Policy and Fleet Management and Highway Safety

It is key that safety practice and oversight should address patient and provider safety, as well as public safety.

There is one aspect of ground ambulance transport that does make addressing safety more easily manageable than in many other fleet workforces – practice and policy are well structured in EMS providers. Personnel and patient safety awareness and practice is a model that is well understood and applied in air medical environment – an environment of structured safety practice and safety policy. It is an irony that the stringent safety precautions, monitoring and oversight that are so accepted to be an essential part of air EMS, are not currently so readily translated to the ground EMS transport environment by the very same program and medical directors and even the same personnel. Ground EMS providers are a fundamentally highly responsible cohort and are accustomed to being routinely closely monitored for performance. They are also accustomed to following highly structured policy and procedure, particularly in reference to delivery of medical care. They expect close supervision and scrutiny. It would appear that this should also extend into the realm of ground vehicle operations and safety.

There is a close relationship between the clinical situations of the patient and the nature of the transportation hazards. The days of running ’hot’ with lights and sirens through busy urban areas to reach a benign patient should be over. Many EMS systems are now using a tiered dispatch system, and working toward minimizing the use of risky driving practice, or use of lights and sirens.

Identifying best safety practice with respect to vehicle safety has been a challenge for the ground EMS industry[9,10,11]. There have been longstanding exemptions for ambulance vehicles from the Federal Motor Vehicle Safety Standards (FMVSS). This is true, even in the face of the National Transportation Safety Board (NTSB) making recommendations to the contrary, as far back as in 1979[38]. However there is now enough data available in the peer-reviewed literature to address the important elements of a data driven safety culture and practice policies.

To optimize driver performance and fleet safety there are also a number of driver training courses available. One is the Emergency Vehicle Operators Course (EVOC), a result of the 1979 NTSB[38] recommendations, that is an expert panel derived risk and safety awareness driver training program. EVOC is not mandated across the US. Until the ANSI/ASSE Z.15 standard[30], there has been limited guidance nationally for general EMS fleet vehicle and driver performance safety management. The national EMS associations and accreditation organizations (the Committee on the Accreditation of Ambulance Services (CAAS) and the Committee on the Accreditation of Medical Transport Systems (CAMTS) for example) provide guidance and certification for the management of an ambulance service. The guidelines for these organizations cover the broad scope of what is involved in managing an ambulance service and advance awareness for ambulance vehicle safety issues.

In Australasia and Europe there exist specific ambulance vehicle safety standards: The AS/NZS 4535:1999 in Australasia,[39] and the EN 1789:2002 [40] in Europe. Both are true safety performance standards and specifically address the design, restraint system integrity, safety performance testing, dynamic crash testing and safety features of ambulance vehicles. The only guidelines in the US specifically addressing ambulance vehicles are the KKK specifications, which are Federal purchase specifications for a General Services Administration (GSA) Star of Life ambulance.[41] These are purchase specifications, not safety performance standards. These purchase specifications do not address crashworthiness issues or any dynamic crash or impact performance testing – nor do they address equipment or occupant restraint safety or performance, in contrast to the international standards. There is also the Do's and Dont's guideline for the transport of children in ambulances,[42] but these do not address vehicle design or safety performance Rather, they are practical guidelines to optimize the safety of transporting pediatric patients in ambulances. Improving specific policies (Dispatch, shift length, safety oversight); Interaction with other road users ('wake effect' and high density EMS traffic and hospital access road design) – may benefit EMS.

Until the newly approved American Society of Safety Engineers and American National Standards Institute[30] fleet vehicle standard (released March 2006) there was no national standard in the US specifically for fleet management that encompassed EMS fleets. The ANSI/ASSE Z 15.1 fleet management standard is a major advance and provides a comprehensive template for the safety oversight and safety management of a fleet of vehicles. This is a most valuable adjunct in addition to EMS specific safe practices such as safe driving practice, coming to a full stop at red lights, stop signs, and requiring EVOC training.

TRANSPORTATION SYSTEMS SAFETY INFORMATION

Highway Safety Collaboration and Knowledge Transfer

The SAFETEA-LU legislation and the October 1, 2007 State Strategic Highway Safety Plans – which require EMS input and integration are an excellent opportunity for facilitation of transportation systems safety knowledge transfer for EMS. Additionally active involvement at a research level for EMS transportation issues at the Transportation Research Board provides for a unique opportunity for EMS to rapidly enhance familiarity with transportation systems a safety engineering and approaches. In a valuable

Accessing EMS Safety Information

One of the true challenges to optimizing ground ambulance transport safety is accessing safety information that is reliable and objective. Additionally, understanding and interpreting transportation safety technical and systems engineering information is outside the purview of most EMS practitioners background, expertise and training. This is a complex, technical and very multidisciplinary field, much of the relevant technical information and peer reviewed literature is in the transportation, engineering, safety and other non-EMS literature[9,12]. This makes it very difficult for EMS practitioners to keep abreast of current developments addressing ambulance transport safety.

To address this in part, publications and presentations relating to ground transport safety at scientific meetings are helpful. It is important that the sources represented are of information that is objective and data based in the appropriate safety disciplines. Specific Safety Summits, such as those established within the air medical discipline[43] are major steps forward. Modeling initiatives such as this for ground transport, with representation from the different disciplines and infrastructure relating to ground transport safety (such as engineering and automotive safety and crashworthiness) would be an important and valuable approach. A regular biennial or twice decade summit to bring together ground and air ambulance transport safety could provide for those involved in fleet management an opportunity to hear the latest in safety practice and management developments. This will also provide an environment which facilitates the translation of the safety practices in the aviation environment to ground transport.

SUMMARY

In contrast to the safety culture and the comprehensive safety oversight of the commercial vehicle industry such as the bus and truck and also air ambulance transport, the ground ambulance transport environment - whilst having recently been clearly described as having serious safety failures - is lacking in both safety standards and safety oversight. There is a need for a systems engineering approach to bridge the diverse disciplines that are part of the EMS transport environment and to address the risks and hazards involved in EMS transport, and have the knowledge and resources to minimize these hazards and optimize safety both with design and practice aspects and also policy.

There are simple solutions that are available now to address technology, practice and policy as well as optimized design. Use of technologies such as the electronic driver monitoring and feedback devices to optimize safe driving and vehicle handling has been demonstrated to be highly effective, as well as more comprehensive integration of EMS with transportation and highway safety infrastructure more generally.

The new Z15 standard is a valuable tool in designing and maintaining a transportation safety program, culture and safety oversight for the ground ambulance component for patient transport systems. Additionally the SAFETEA-LU legislation should create an environment to facilitate knowledge transfer between transport and highway safety and EMS practitioners.

The findings of limited research conducted to date suggest EMS transportation safety is in need of urgent focus and has been left behind commercial truck and bus safety. EMS transport safety is a unique gap in the standards, oversight and coordination of the transport system. A synthesis of the research conducted to date that applies to or could be applied to this field has potential for substantively enhancing EMS transport safety.

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