Emergency Medical Services: A Unique Transportation Safety Challenge

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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 presentation 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

EMS ambulance transport has been recently described as highly hazardous. Per estimated mile traveled, ambulances are the most lethal vehicle on the road. Detailed safety data is limited, as there is no specific data capture or oversight of the transportation safety of the EMS system nationally – and it is exempt from FMCSA.

BACKGROUND

The USA fleet of ~50,000 ambulance vehicles perform ~60 million trips annually (1.9 million transportation crash injury calls and ~40,000 transportation fatality calls). Fewer than 3% of ambulance trips are for life threatening emergencies. Ambulance crashes result in at least one fatality/week (not including 'wake effect' crashes), 2/3 of these ambulance crash fatality victims are not part of the original EMS transport itself. These fatality data are incomplete and ambulance crash injury data are lacking.

NEGATIVE IMPACT OF AN EMS CRASH

In contrast to every other highway crash, an ambulance crash results in a number of serious outcomes that occur with no other vehicle crash scenario (see Fig. 1).

1. When the ambulance crashes en route to a medical emergency call – then that response time is prolonged and emergency care is seriously delayed
2. When the ambulance crashes and there is a patient onboard en route to the hospital – then that patient (and providers) are at risk of serious injury or death.
3. In addition to the ambulance crash taking an emergency vehicle and its personnel out of service, the ambulance crash itself requires an EMS response, and often a more overwhelming response than for a routine vehicle crash.
4. EMS is a scarce resource, particularly in the rural setting – and the replacement personnel and ambulance vehicle may not be available or may have to come from a nearby region diminishing the EMS response capacity of more than one region.

OPTIMIZING SAFETY & SYSTEMS ENGINEERING

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 requires a multidisciplinary systems safety engineering approach Utilizing a systems based multidisciplinary approach, bridging transportation safety perspectives and health care delivery in conjunction with safety standards development is necessary to ensure improved outcomes in EMS transport safety. The key fields include: Data Capture, Vehicle Crashworthiness, Design, and Occupant Safety Devices, Ergonomics and Biohazards, Transportation Environment, EMS Practice and Fleet Safety Management (see Table 1).

Fig. 1. Recent catastrophic ambulance crash outcomes

Table 1. Primary Issues in Optimizing EMS Safety and Systems Engineering

Data Capture
- System profile
  - Denominator – vehicles, runs, miles travelled, personnel, HOS
  - 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 &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
  - Health care delivery
  - 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

DISCUSSION

EMS is a relatively young field, and although a comparatively small fleet of 50,000 vehicles, it is a critically important fleet for the safety of our public and a key element of the highway safety system. However, it also remains a fleet of vehicles that for historical and other reasons that has developed outside of both transportation systems/fleet safety, as well as vehicle and automotive safety infrastructure and oversight. While recently being clearly described as having serious transportation safety failures - in contrast to the safety culture and the comprehensive safety oversight of the commercial vehicle industry (such as the bus and truck and also for air ambulance transport) - the ground ambulance transport environment is lacking in both safety standards and safety oversight. An innovative framework bridging EMS health care delivery needs with safety research, embracing current ergonomic and automotive technology with a safety systems approach is necessary to facilitate enhanced cross disciplinary collaboration and development of effective safety initiatives in EMS transport.

SUMMARY

EMS transportation is hazardous, and the most hazardous form of ground transport per mile traveled. Its safety is in need of urgent focus and has been left behind commercial truck and bus and air transport safety infrastructure and 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. It is key that the knowledge and resources to minimize these hazards and optimize safety with design and practice aspects and also policy and oversight be applied to EMS transport urgently.

The TRB has a unique opportunity to facilitate the development of both transport systems and vehicle areas. Additionally the SAFETEA-LU legislation should create an environment to facilitate knowledge transfer between transport and highway safety and EMS practitioners.

EMS transport safety is a unique gap in the standards, oversight and coordination of the transport system. The SAFETEA-LU legislation is also a major potential benefit to EMS to assist in integrating EMS with engineering, enforcement and education within the highway system

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