

Transportation Research Board Annual Meeting,
National Academies Washington, DC, January 22nd, 2007
"Transportation, Institutions, Finance and Workforce –
Meeting the needs of the 21st Century"

Emergency Medical Service (EMS) Transport Safety: Where is the state of the art, and where SHOULD it be?



Nadine Levick, MD MPH
CEO, Research Director
EMS Safety Foundation
Objective Safety LLC

Introduction

Emergency Medical Services – (EMS)

- ▶ Important interface between public health, public safety and emergency and acute care and the community
- ▶ Unique challenges - patient, provider and public safety and transportation safety
- ▶ Unique needs of this important part of our health care and transportation system

Some odd facts

- ▶ Ambulances are generally not built by the automotive industry
- ▶ Intelligent Transportation Systems (ITS), transportation safety engineering and transport systems engineering are not generally integrated into EMS systems
- ▶ Although all EMS systems have medical direction and oversight, it is rare for there to be transportation expertise oversight

What happened??

- ▶ Why is it that Emergency Medical Services have developed outside the umbrella of transportation safety infrastructure??

A very serious gap in data, performance and oversight

- ▶ FMCSA Truck safety goals – to decrease the fatality rate of 2.8 per 100 million truck-miles in 1996 to 1.65 by 2008
- ▶ EMS crash fatality estimates are - 7.66 - 41.93 fatalities per 100 million ambulance-miles

Scope

- ▶ Safety data on EMS transport and its oversight
- ▶ EMS vehicle crash rates are in excess of similar sized vehicles
- ▶ EMS worker transport fatality rates are above other emergency services
- ▶ Is a part of the transportation system that is largely exempt from most of the Federal Motor Vehicle Safety Standards (FMVSS), and not covered by other national transportation system safety oversight (ie. FMCSA)
- ▶ 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.

Scope

- ▶ A synthesis of the TRB research truck and bus conducted to date that applies to or could be applied to this field - has potential for substantively enhancing EMS transport safety.
 - ▶ 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.
- ▶ EMS transport safety is a unique gap in the standards, oversight and coordination of the transport system.

What are the solutions?

- ▶ Training?
- ▶ Practice Policy?
- ▶ Transportation Systems Engineering?
- ▶ Automotive Engineering?
- ▶ Education of other road users???

EMS

- ▶ Emergency Medical Services (EMS) - an important and unique aspect of the transportation system, it encompasses public safety, public health and an emergency service.
- ▶ What are the system wide transportation safety issues and challenges faced by the Emergency Medical Services?

Transport related aspects of EMS

- ▶ dispatch of EMS vehicles
- ▶ transport policies and protocols
- ▶ vehicle fleets and vehicle design
- ▶ vehicle purchase standards
- ▶ Intelligent Transportation Systems technology
- ▶ driver training
- ▶ training simulation
- ▶ driver performance monitoring
- ▶ roadside and road design
- ▶ integrated traffic safety technologies
- ▶ scene safety and visibility
- ▶ safety data capture
- ▶ safety oversight

USA EMS

- ▶ EMS Systems - >15,000
- ▶ Personnel - ~1 million
(~30% FIT professional & 70% volunteer)
- ▶ Vehicles - ~50,000
(Type I, Type II, Type III, Freightliners, ?motorcycles)
- ▶ Transports - ~50 million
(to Emergency Depts ~ 50%, < 1/3 emergent)
- ▶ Cost - ~\$8 Billion annually
- ▶ Safety Oversight - ? Disparate

Transport oversight?

- ▶ In contrast to the bus and truck industries, which have comprehensive safety oversight, and transportation safety interventions, as well as transportation safety data capture via the Federal Motor Carrier Safety Administration (FMCSA) - EMS has been focused more as an acute health care delivery and emergency service and largely outside of much of the other transportation oversight infrastructure that exists.
- ▶ This is an opportunity for transportation planners, engineers, and system operators to see a comprehensive overview some of the multidisciplinary transportation challenges faced by Emergency Medical Services.

EMS Definition

- ▶ An Emergency Medical Services system is –
 - A coordinated arrangement of resources (including personnel, equipment, and facilities) which are organized to respond to medical emergencies, regardless of cause. (ASTM, 1988).
- ▶ EMS –
 - The services provided to accident victims and patients suffering from severe acute illness and psychiatric emergencies.
 - Detection and reporting of medical emergencies, initial care, transportation and care for patients in route to health care facilities, medical treatment for the acutely ill and severely injured within emergency departments, and the provision of linkages to continued care or rehabilitation services. (EMS Research Agenda 2001)

What is the scope of EMS?

- ▶ Emergency care, public health, public safety and patient transport
- ▶ Bridge between the community and the hospital
- ▶ Volunteer – professional
- ▶ Urban – rural
- ▶ Disaster response
- ▶ Majority of transports NOT critical or life threatening

The 'workplace' is also a crash scene



Today's news

Jan 22, 2007 8:09 am US/Eastern

Caught On Video: EMT Struck By Car

Low Young Reporting

(CBS) BROWNSVILLE The car hit 46-year-old Capt. Steven Quindongo so violently it smashed the vehicle's windshield and sent him flying through the air.

Quindongo, a 17-year veteran of the city's emergency medical services, was on the scene of a fire on Riverside Avenue in the Brown Sunday afternoon when a civilian car moved past police barricades and caught him from behind. Chief Wayne McPartland was on the scene as the damaged health food store where his men had successfully put out the flames.

"We had two firefighter minor injuries," he told us, "and they were taking care of our men and when he (Quindongo) was walking back to the ambulance he was struck by the civilian vehicle."

Emergency Medical Service (EMS) vehicles - Ambulances

- ▶ What are the transport safety issues that pertain to this important public service and public safety industry?
- ▶ What do we know of the risks and hazards and how can we measure these ?
- ▶ How can the safety of this transport system be optimized?

USA EMS System Finance

- ▶ Annual Cost: \$27 per capita
- ▶ > \$8 billion per year
- ▶ Need to provide the biggest bang for the buck

What's missing

1. What data is collected nationally?
 - We have no denominator data
 - We have incomplete numerator data
2. Absent population based national injury data or injury mechanics data
3. Absent structured transportation safety engineering input

1+2+3 = resultant inability to design and evaluate efficacy of injury interventions
4. What oversight is there?
5. Which organizations would determine policy?

History of EMS

- ▶ EMS is a relatively new industry
- ▶ An unusual history of beginnings within the mortician industry.
 - Early ambulances were hearses, once motorized usually a Cadillac, a vehicle in which an occupant could be transported in the recumbent position
- ▶ Over the past 100 years, the sophistication of EMS medical care has advanced dramatically
- ▶ EMS communications and transportation technology have not kept up with that pace

A devastating tragedy...

- ▶ An ETT down the wrong hole may kill your patient and be a terrible burden for the pts family and for the medic involved
- ▶ BUT an EMS crash can kill all involved AND wipe out an EMS systems response capacity.....

JEMS
Journal of Emergency Medical Services

Crashes Take Toll on EMS

By Blake Dawson

September was a bad month for EMS workers on North Carolina highways. After crossing the median of I.C. 103, 16-year-old Omar Lopez Verdin hit Sunny County Director of Emergency Services John Shelton and kept going. Authorities have charged Verdin with felony hit and run, driving while impaired, having no operator's license and disabling a fictitious registration. A good Samaritan followed Verdin until his car finally stopped and subdued the perpetrator until authorities could arrest him. Shelton was treated and released at Northern Hospital for neck problems.

In Hendersonville, EMS providers needed rescue after a vehicle crashed into them and the two-car wreck they were working on Spartanburg Highway. The crew were extracting a woman from her vehicle when a van barreled into the hot zone, causing the second accident.

The two victims from the initial accident and four rescuers were all taken to area hospitals. Firefighter Joey Drake and paramedic Curtis Oler were airlifted to Mission St. Joseph's Hospital in Asheville. Drake was treated and released, but Oler was admitted with two broken legs.

Firstly!

- ▶ **An accident ?**
- ▶ or a predictable and preventable event

This IS a transportation safety issue

- ▶ Systems engineering
 - Where do ambulance crashes occur?
 - What transportation safety engineering interventions
 - ITS –
 - Does optimum work effectively in this environment given the traffic density and emergency vehicle density?
 - Merit of emergency vehicles being fitted with early warning technologies
 - Proper design of emergency vehicle traffic flow
 - Fleet mix to match anticipated transport environmental challenges (ie police model – bicycle, motorcycle, horse, three wheeled, cruiser, van, truck)?

Balance of concerns and risk during transport



- ▶ Response and transport time
- ▶ Clinical care provision
- ▶ Occupant safety/protection
- ▶ Public Safety

Goals

- ▶ Standards for safety
- ▶ Policy based on Science
- ▶ Databases to demonstrate outcome

General Concerns

- ▶ Consequences can be predictable & likely preventable
- ▶ Costs of these adverse events are high in loss of life, financial burden and negative impact on delivery of EMS care
- ▶ Other high speed vehicles (eg. racing cars) have a different safety paradigm
- ▶ Design of interventions to mitigate injury is predicated on a valid testing model
- ▶ Complex both engineering and public health issues

the EMS transport process

- ▶ communications/dispatch
- ▶ the patient
- ▶ restraining device/seat
- ▶ transporting device/gurney
- ▶ paramedics/transport nurses, doctors & family
- ▶ patient monitoring equipment
- ▶ clinical care & interventions
- ▶ protective equipment
- ▶ the vehicle
- ▶ the driver/driving skill
- ▶ other road users
- ▶ the road



Challenges to Optimizing EMS Transport Safety

- ▶ Disparate and fragmented safety infrastructure
- ▶ Lack of a centralized EMS Safety oversight or data
- ▶ A large number of small groups of end users, with a mix of volunteers and professionals
- ▶ Ambulances are hybrid non-standard vehicles, a truck chassis and an after market box or a modified van
- ▶ EMS vehicle safety is not integrated as a part of the transport safety industry

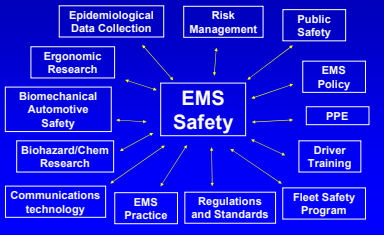
Challenges to Optimizing EMS Transport Safety

- ▶ Rear compartment exempt from FMVSS
- ▶ Complex automotive safety area bridging acute clinical care, public health, public safety and automotive safety
- ▶ Very recent history as a research issue
- ▶ Limited fiscal support for cross disciplinary EMS transport safety research

Benefit of Safety

- ▶ Any cost of addressing these issues is dwarfed in contrast to the huge burden of not doing so - in financial costs let alone the personal, societal, ethical and litigation costs

EMS Transport Safety IS Complex AND Multidisciplinary



Is there an acceptable rate of morbidity and mortality for pre-hospital transport systems??

This is not acceptable

In the USA*

- ▶ ~ 5,000 crashes a year
- ▶ ~ One fatality each week
 - ~ 2/3 pedestrians or occupants of other car
 - Approximately 4 child fatalities per year
- ▶ ~10 serious injuries each day
- ▶ Cost estimates > \$500 million annually
- ▶ USA crash fatality rate/capita 35x higher than in Australia

*FARGUSTE 2004.6

Is it your services tragic year?

- ▶ ~ 50 fatalities a year
- ▶ 15,000 EMS services
- ▶ Each year one in 300 services experiences a fatality

Paramedic charged in crash that killed 2

By Mike Franck, Rocky Mountain News
July 21, 2006

STORY TOOLS

Email the story (Print)

STERLING - A paramedic with MetroPound Ambulance has been charged with careless driving in connection with an accident in May that killed two people and injured two others.

Chris Larusso, 32, of Lees Summit, was issued a summons for two counts of careless driving resulting in death and two counts of careless driving resulting in serious bodily injury.

All are misdemeanor charges and carry possible sentences of 10 days to a year in jail and fines of \$100 to \$1,000.

Larusso was driving an ambulance May 9 on Interstate 76, about 15 miles west of Sterling, when he apparently rear-ended a semi-tractor truck.

Two passengers in the ambulance - nurse Karen Woods, 43, of Elizabeth, and ultrasound technician Vicky Thomas, 35, of Ooodland, Kan. - were killed.

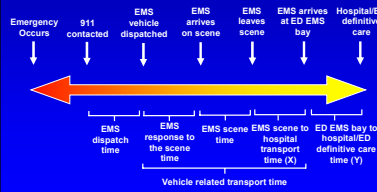
A patient, Viktor Gutlichemauer, 43, of Burlington, was seriously injured, but hours after the accident, gave birth to a boy at Sterling Regional Medical Center.

Larusso and paramedic Dan Baza, 31, of Centennial, were treated for their injuries and released.

Key Issues

- ▶ **Mythology**
 - That Emergency Medical Service personnel are safe
- ▶ **Injury Hazards**
 - Biohazard
 - Chemical/Radiation
 - Physical/Mechanical trauma – THE BIG PROBLEM
- ▶ **Motor Vehicle Crashes are the highest cause of death at work – EMS has > 2X the mean national rate**
- ▶ **An R & D and Regulatory Gap**
 - Occupational Health and Safety
 - the workplace is in a vehicle – exposure data are scant
 - Automotive Safety
 - a vehicle is the work place – exempt from automotive research and regulation

911 Call to Hospital/ED Definitive Care Time Intervals*



Safety oversight of what and by ... whom

- ▶ Vehicle Safety
- ▶ Vehicle Design
- ▶ Safety Equipment Design
- ▶ Vehicle and Safety Equipment Testing and Standard development
- ▶ Safety policies

A Simple Question....

WINGS, WHEELS & ROTORS

A Simple Question

Why have all these other doctors to have just seen the same problem side of the way in which our society works in general as members. The entire NHTSA inquiry into the "simple question" is a "simple question" – "How does it work?" But just step back for a moment, and ask a simple question, "How does it work?" There has been over three pages of my more than the approximately 14 lines for a single year in almost 100

...and we care for the lives of the sick and injured. We follow your strengths to ensure the safety of the clearly identifiable and support? And how does it not to know that of these ground EMS? ... It challenges all of us to think about this, and then to act in new ways to ensure the safety of your ground EMS practice, and to do whatever is the best and right action to have the NHTSA address both ground and air EMS safety. It is one of the National Transportation Safety Board. The work of it

TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

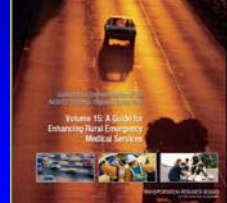
Active Projects

(all due late 2006)

- ▶ Commercial Motor Vehicle Driver Training Curricula and Delivery Methods and Their Effectiveness
- ▶ Commercial Motor Vehicle Carrier Safety Management Certification
- ▶ The Role of Safety Culture in Preventing Commercial Vehicle Crashes
- ▶ The Impact of Behavior-Based Safety Techniques on Commercial Motor Vehicle Drivers
- ▶ Health and Wellness Programs for Commercial Motor Vehicle Drivers



NCHRP REPORT 500



What about FMCSA's Mission

- ▶ Office of Research and Analysis is committed to reducing the large truck-related fatality rate from 2.8 per 100 million truck-miles in 1996 to 1.65 by 2008.

Mission

- ▶ The mission of FMCSA's Office of Research and Analysis is to reduce the number and severity of commercial motor vehicle (CMV) crashes and enhance the efficiency of CMV operations by:
 - Conducting systematic studies directed toward fuller scientific discovery, knowledge, or understanding
 - Adopting, testing, and deploying innovative driver, carrier, vehicle, and roadside best practices and technologies
 - By expanding the knowledge and portfolio of deployable technology, the research and technology program will help FMCSA reduce crashes, injuries, and fatalities and will deliver a program that contributes to a safe and secure commercial transportation system.

FMCSA's Objectives

- ▶ Produce Safer Drivers:
- ▶ Improve Safety of Commercial Motor Vehicles:
- ▶ Produce Safer Carriers:
- ▶ Advance Safety Through Information-Based Initiatives:
- ▶ Improve Security Through Safety Initiatives:
- ▶ Enable and Motivate Internal Excellence:

What type of passenger carrier do you need ?

An AMBULANCE!!!

Federal Motor Carrier Safety Administration

Regulations & Compliance Training & Safety Tools & Resources

Regulations Search Results

All Regulations found containing "ambulance"

Doc No.	Regulation	Part	Subpart	Section	Text
49 CFR 393.203	Occupant protection in motor transport	393	203	1	Ambulance means a motor vehicle designed exclusively for the purpose of emergency medical care, as endorsed by the presence of a passenger compartment to:
49 CFR 393.203	Occupant protection in motor transport	393	203	1	Compliance with Interstate Motor Carrier Noise Emission Standards:
49 CFR 393.203	Occupant protection in motor transport	393	203	1	49 CFR 393.203: An emergency motor vehicle, such as a fire engine, an ambulance, a public bus, or a school bus, when it is responding to an emergency call.

USA Ambulances: FMVSS Exempt

DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration

49 CFR Parts 571, 572, and 589
(Docket No. 92-28; Notice 7)
(RIN No. 2127-6848)

Federal Motor Vehicle Safety Standards
Final Report Publication

On October 1, 1992, the Department of Transportation (DOT) issued a final rule exempting ambulances from the Federal Motor Vehicle Safety Standards (FMVSS) that apply to passenger cars, light trucks, and vans. This exemption was based on the unique design and function of ambulances, which are primarily used for emergency medical services. The exemption applies to ambulances manufactured on or after September 1, 1992, and does not apply to ambulances manufactured before that date. The exemption is based on the fact that ambulances are designed to provide emergency medical services and are not used for general passenger transport. The exemption is based on the fact that ambulances are designed to provide emergency medical services and are not used for general passenger transport. The exemption is based on the fact that ambulances are designed to provide emergency medical services and are not used for general passenger transport.

AMBULANCE MANUFACTURERS DIVISION (AMD)

AMD Position Statement on Ambulance Safety and Occupant Protection

The purpose of this paper is to establish the position of the membership of the Ambulance Manufacturers Division (AMD) of the National Truck Equipment Association.

Ambulances must comply with some of the strictest safety and performance standards applicable to vehicles in the United States. All motor vehicles operated on public roads and highways must conform to Federal Motor Vehicle Safety Standards (FMVSS) contained in Title 49 of the Code of Federal Regulations Part 571. Ambulances are no exception. FMVSS are the most visible and vigorously enforced safety standards governing the design, engineering and production of such vehicles. Nearly all government purchased ambulances, and the overwhelming majority of those sold to the public, also must be certified to the safety requirements of the Federal Star of Life Specification for Ambulances, KKK-A-182, promulgated by the Federal government. These requirements are in addition to FMVSS.

Very Predictable...

- Intersections are lethal environments

"Are our policies killing people?"

- 1991-2000, 302,969 Emergency vehicles were involved in MVCs - 1,565 involving fatalities*
- In PA 1997-2001, ambulances were more likely than similar sized vehicles to be involved in*:
 - 4 way intersection crashes (43% vs 23%, p=0.001)
 - Collisions at traffic signals (37% vs 18%, p=0.001)
 - MVCs with more people injured (76% vs 61%, p=0.001)

*Comparison of Crashes Involving Ambulances with those of similar sized vehicles - Adam Ray, Douglas Kupas, PEC Dec 2005;3:412-415

So.. The real world for an EMS vehicle approaching a red light

- You think they heard you...
- You know they must have seen you...
- And maybe they did
- But..
- There is NO way humanly possible that they could stop.....

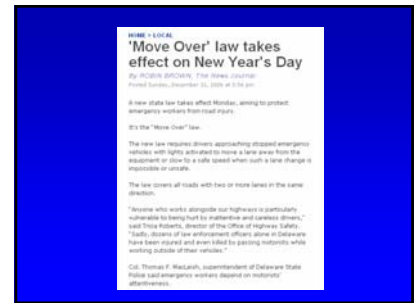
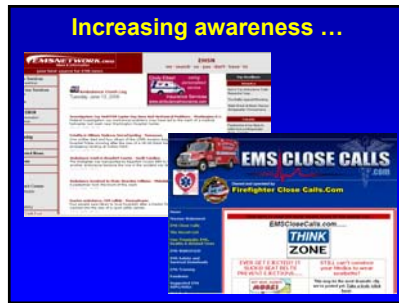
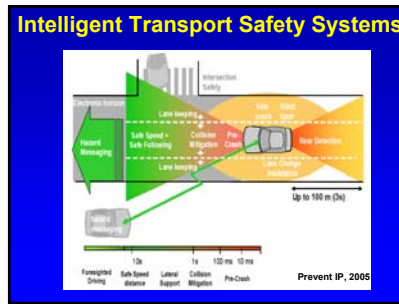
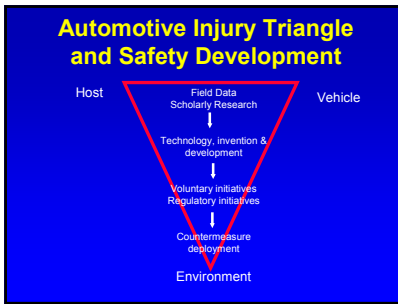
The real world

Intersection passenger car stopping distance* at 40 mph dry and wet

* Stopping distance: Perception time + Reaction time + Vehicle braking time (varies with age, skill, alertness + vehicle type, tire pressure, road etc)

A peer reviewed tragedy

- Persistent disconnect between automotive safety science and EMS transport safety approach
- Pre-hospital and Emergency Care 2004
 - "EMS vehicle drivers are advised to approach the intersection, slowing to ensure that traffic has stopped and making eye contact with other drivers before entering the intersection."
- In the modern era of road safety to suggest that a strategy of "eye contact" to be made at an intersection with a driver traveling at ~40mph in the hope that this would result in a safety intervention, is at best frightening



Some challenges

- ▶ No accepted national safety standards for -
 - EMS fleet management or safety practice
 - Ambulance vehicle rear compartment design and performance
 - Provider occupational injury protective equipment
- ▶ Yet convincing data for injury risk and hazard
- ▶ Need for patient, provider and public safety focus

An important and unique system

- ▶ Public safety, public health and emergency service
- ▶ Is there to save lives
- ▶ A more recent service compared to Fire and Police

EMS Best Practice, Sept 2006

Q: What are emergency services leaders doing to ensure ambulance safety?

Full back on previous safety recalls, lower all equipment - emergency vehicles, defibrillators, cell phones, there is no concern for an alarm on the ground. Ambulances have several safety-related recalls, a full phase in the field in 45 states per hour can kill one.

Family member patients with over-the-boarded patients. If medically unstable, there should be an attempt to provide for safety. For both all passengers, non-emergency, emergency, emergency and others. Most of the time EMS providers do not need to come around the vehicle.

Personnel Not Buckling up

As a survey reported and working from 12 states, and one full on just receiving a survey of more than 200 EMS providers. Customer Emergency Medics. The survey did not identify the correct medical of person did not observe the correct medical despite the fact that most respondents do not allow unbuckling any staff.

When necessary, before the drive:

- Establish and maintain vehicle inspection policies.
- Request a full stop at and avoid driving through wet lights.
- Human actions in practice and equipment to prevent excessive EMR and prevent accidents.
- Check through and comprehensive safety education and training.
- Use real-time about monitoring and health devices.

Crash Avoidance

Crash Avoidance: The New Frontier

Development and Application of a Dynamic Testing Procedure for Ambulance Pediatric Patient Restraint Systems

Biomechanics of the patient compartment of ambulance vehicles under crash conditions: testing countermeasures to mitigate injury

Best Practice....? The technology described in your junk mail is far more advanced than that used in EMS



Data

- ▶ What national statistics are there for EMS transport safety
- ▶ What is known about 'wake effect'

Ambulance Safety Research: A New Field

Don Berry
Transport Canada, Ministry of Health



We should use the best safety practices demonstrated in engineering

Development of an Effective Ambulance Patient Restraint

Development and Application of a Dynamic Testing Procedure for Ambulance Pediatric Patient Restraint Systems

Biomechanics of the patient compartment of ambulance vehicles under crash conditions: testing countermeasures to mitigate injury

2001-01-1173

Authors: Nadine Lenoir, Guisela Li, John Tammone

So for EMS personnel...

- ▶ What's going to kill you?
- ▶ What's going to injure you?

The Wisconsin EMS Association

Monday August 21, 2006 08:21:41

Hot Sheets

Fatal Ambulance Crash Still Under Investigation

Questions remain unanswered as to what is believed to be Wisconsin's first fatal ambulance crash in its state. The tragedy occurred on July 31, 2005 in Madison as the Wisconsin State Troop near Ambulance Service was transporting a 52-year-old patient to the hospital for a hip injury. According to reports, the transport company started out within the use of red lights and sirens but was upgraded to an emergency transport when the patient's level of consciousness deteriorated. The 27-year-old driver of the ambulance had crossed over the Cedar Creek Road and #1-30. The ambulance hit the road, rolled and landed on its side in the woods. A 52-year-old male was seriously injured in the crash. The patient was pronounced dead at the scene. The Wisconsin State Troop is currently investigating the Madison County

ambulance crash involving ambulance vehicle. From 1995 to 2005, the Center for Street and Paramedic (CSC) estimates that there were at least 500 fatal crashes involving ambulances, resulting in the death of 12 ambulance occupants, including 17 EMS providers. Most other cases between were not as fatal, but some 400 result, in a good number, with the use of red lights and sirens. Statistics have shown that the fat crash rate among EMS providers increases the chance of a crash. In total, there were 491 of individuals during the ambulance are cited for their actions, 41% of those drivers are found to have been driving records. These statistics are according to a recent research published in EMS Journal.

Investigating EMS Accidents: Why is it so hard for the way that EMS operators vehicles in the way that medical transportation.

EMS Research /Data Vacuum

- ▶ ? total no. of ambulances
- ▶ ? total no. of medics
- ▶ ? total no. of runs (per age & severity)
- ▶ ? total pt. miles (per age & severity)
- ▶ ? true crash fatality rate per mile
- ▶ ? crash injury rate
- ▶ ? adverse events

Predictable risks

- ▶ More often at intersections, & with another vehicle (p < 0.001)*
- ▶ Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)*
- ▶ 82% of fatally injured EMS rear occupants unrestrained**
- ▶ > 74% of EMT occupational fatalities are MVC related***
- ▶ Serious head injury in >65% of fatal occupational injuries#
- ▶ 70% of fatal crashes EMS crashes during Emergency Use#
- ▶ More likely to crash at an intersection with traffic lights (37% vs 18% p=0.001) & more people & injuries/crash than similar sized vehicles##

*Klein CA, Pirralo RG, Kuhl EM. *Prehospital Emergency Care* 2001; 14(5):261-9
 **Bosker, Zandbergen, Lenoir, Li, Minto. *Accident Anal Prev* 2003
 ***Maguire, Hastings, Smith, Lenoir, Kavanagh. *Emergency Medical Care* 2002
 #WISCOR, 2003
 ##Wong, JEM, Rucinski DE. *Prehospital Emergency Care* 2005; Dec; 18(4):412-418
 ###WITSJA. 49 CFR Parts 371, 372 & 399 Coastal no. 30-28, n0006 7

EMS Provider Fatalities

- ▶ 12.7 fatalities/100,000 EMS workers
- ▶ Greater than 2 X the national average (5.0 fatalities/100,000)
- ▶ Similar to Police (14.2/100,000) and Fire Fighters (16.5/100,000)

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

and what is killing EMS ?

EMS personnel fatalities*

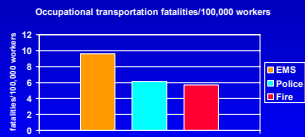
- ▶ 74% transportation related
 - + 1/5 of ground transport fatalities were struck by moving vehicles
- ▶ 11% were cardiovascular
- ▶ 9% were homicide
- ▶ 4% needle sticks, electrocution, drowning and other

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

So does it make sense ?

- ▶ Gloves and universal precautions?...
... good biohazard protection BUT aren't going to give much protection in a ambulance crash

A word about occupational transportation fatalities..



▶ WE HAVE A BIG PROBLEM HERE

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

Fleet Mix ?

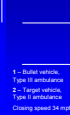


Full Vehicle Crash Tests

Test 1 - Right side impact



Test 2- Frontal



Air EMS is a role model for safety initiatives and focus



Safety Management

- ▶ A Safety Culture
- ▶ Protective Policies
- ▶ Protective Devices
 - ♦ In the event of a crash
 - ♦ To prevent a crash
- ▶ Continuous Education and Evaluation

Protective devices/concepts

- To prevent a crash
- ▶ Driver feedback
 - ▶ Driver monitoring
 - ▶ Driver training
 - ▶ Vehicle Intelligent Transportation System (ITS) technologies
 - ▶ Tiered dispatch
 - ▶ Appropriate policies
- In the event of a crash
- ▶ Vehicle crashworthiness
 - ▶ Seat/seat belt systems
 - ▶ Equipment lock downs
 - ▶ Padding
 - ▶ Head protection

Tiered Dispatch



Back up Camera..... Shouldn't all vehicles have one of these?

VRBCS300 - Backup Camera

Backup Camera

- Complete with all accessories. Nothing else to buy
- 110° Horizontal Camera Viewing Angle
- 90° Vertical Camera Viewing Angle
- Monitor Mounts on Dash or Visor
- For Use with 12 Volt DC Electrical Systems
- Great for Cars, SUVs, RVs and Delivery Vehicles!
- Helps Avoid Accidents & Injuries!

English product manual
FAQs - English

The "Black Box"

Driver behavior monitoring and feedback device

How to modify the risk taking behaviour of emergency medical service drivers?

How to modify the risk taking behaviour of emergency medical service drivers?

Dr. Steven S. Davis, MD, CA, PA, Yorkville, ON, Sudbury, ON.

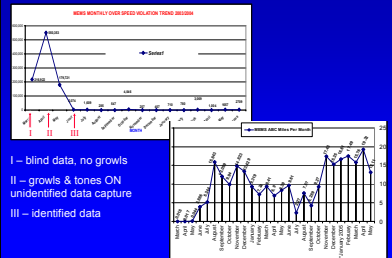
High speed emergency medical services have an inherent safety, accident, and an aggressive style of driving. Furthermore, we are convinced that a "black box" is a good tool to modify the risk taking behaviour of emergency medical service drivers.

Consequently, building emergency medical service vehicles from an integrated solution (i.e. the report on test studies designed to modify the risk taking behaviour of emergency medical service drivers).

Purpose of 'Black box' Program

- ▶ Enhance Safety
- ▶ Improve Driver Performance
- ▶ Save Maintenance Dollars
- ▶ Aid Accident / Incident Investigation

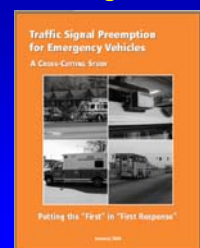
Demonstrated Effectiveness



Other monitoring devices

- ▶ Primarily to record events during and immediately preceding a crash
- ▶ Give no driver crash prevention feedback
- ▶ Administratively burdensome
- ▶ Intrusive
- ▶ Not demonstrated to be as effective in improving vehicle maintenance costs or as effective in modifying driver behavior long term

Data, but is it generalizable



EMS is emerging in the transport safety arena

- ▶ First and only presentation of ambulance safety research at ESV Congress was 2001
- ▶ SAE Toptec on Military and Emergency Vehicles, USA, September 2001
- ▶ Emergency Vehicle Symposium, Australia, Melbourne, May 2003
- ▶ Sporadic Ambulance safety research presented at peer reviewed AAAM, ITMA, SAEM, Safe America, World Injury, Asia Pacific Injury Conferences 1999-2005
- ▶ Next week at inaugural meeting at 2007 TRB Congress in DC

Global EMS Vehicle Safety Standards v Specifications and Guidelines

- ▶ EMS Safety and Performance Standards
 - Australia & New Zealand 4535
 - Common European Community (CEN) EN1789
- ▶ Non EMS Specific USA Standards
 - [Aviation - FAA/CAA/JAA]
 - Z15 – Fleet vehicles safety management
- ▶ USA EMS Specification & Guidelines
 - Purchase Specification: KKK & NTEA – AMD
 - Guideline: EMSC Dos and Dents
ASTM, CAAS and CAMTS

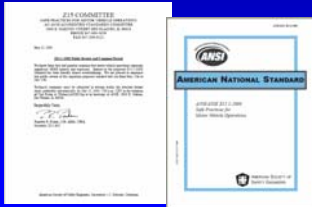
USA ambulance purchase specifications GSA:KKK-A-1822E, 2002

- ▶ Static Pull test
- ▶ 2200 Lbs. (8G's) in Longitudinal and Lateral
- ▶ No dynamic test
- ▶ No definition to manikin mass
- ▶ No restraint for equipment
- ▶ Voluntary



American National Standard ANSI/ASSE Z15.1-2006

Safe Practices for Fleet Motor Vehicle Operations



What Z15 encompasses

- ▶ Safety Program
- ▶ Safety Policy
- ▶ Responsibilities and Accountabilities
- ▶ Driver Recruitment, Selection and Assessment
- ▶ Organizational Safety Rules
- ▶ Orientation and Training
- ▶ Reporting Rates and Major Incidents to Executives
- ▶ Oversight

Healthcare Safety

- ▶ Importance of safety as an organizational value
- ▶ Proactive approaches to safety management and leadership
- ▶ Prevention of accidents, injuries
- ▶ Presents authoritative data from OSHA, EPA, NFPA, NRC, and JCAHO
- ▶ ? EMS Transport Safety? – Not a mention



EMS Risk/Hazards

- ▶ Predictable risks
- ▶ Predictable fatal injuries
- ▶ Serious occupational hazard
- ▶ Public safety hazards

What's new

- ▶ New automotive safety technologies
 - EVS
 - ITS
 - Monitoring and feedback enhancements
- ▶ New expertise
 - TRB
 - ASSE
 - SAE
 - UTRC
 - Ergonomics
 - Industrial Design

Regional University Transportation Research Centers



FDNY a leader in safety



Future

- ▶ Meaningful Goals
- ▶ New policies
- ▶ New practices
- ▶ New standards
- ▶ New vehicles
- ▶ New technologies

Very Important Principle

Ambulance transport safety is part of a **SYSTEM**, the overall balance of risk involves the safety of all occupants and the public

Conclusion

- ▶ Major advances in EMS safety research, infrastructure and practice over the past 5 years
- ▶ New technologies for vehicle design, occupant PPE and equipment restraint and driver performance are now available
- ▶ Development of substantive EMS transport safety standards is a necessity and a reality
- ▶ Enhanced cross disciplinary collaboration in development of safety initiatives now exist
- ▶ EMS is still way behind the state of the art in transport and vehicle safety and occupant protection

And....

- ▶ It is no longer acceptable for EMS to be functioning outside of transportation, automotive and PPE safety standards for prevention of and protection of EMS providers and the public from injury and death

Any Questions??

Electronic handout available online
<http://www.objectivesafety.net>

