


WAMI 2007  
 18th Annual Trauma Conference, Washington, Alaska, Montana, and Idaho (WAMI), Current Practices in Adult and Pediatric Trauma  
 Seattle, WA, May 30th, 2007

**EMS Transport: Where is the State of the Art and Where Should It Be?**



Nadine Levick, MD MPH  
 Research Director  
 EMS Safety Foundation  
 New York, USA

**Science behind Policy**

▶ "For successful technology, reality must take precedence over public relations, for Nature cannot be fooled."

Richard P. Feynman 1988

**Outline**

- I. Review of data on ambulance crashes and safety standards and guidelines that exist for the ground EMS
- II. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public
- III. Highlight unacceptable mythology and challenges to advancing EMS transport safety
- IV. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient transport

.....May 21st, 2007

KOMOTV.COM

EMT seriously injured in crash on I-5



SEATTLE — An emergency medical technician was seriously injured early Sunday morning when he was struck by a pickup truck on Interstate 5.

The State Patrol says it was around 1:45 a.m. when a Ford Motor ambulance was in the northbound travel lane of I-5, about 10 miles north of Seattle, when it was struck by a pickup truck. The driver pushed the ambulance forward another 500 feet, nearly

**In a nutshell**

▶ Comprehensive perspective on:

- + system wide data
- + the challenges
- + the cutting edge
- + the gaps in knowledge and application of transportation systems safety in the big picture of Emergency Medical Services transportation

**Interactive handout**  
<http://www.objectivesafety.net>



**Emergency Medical Service Transport**

▶ 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?

**Recent adverse EMS transport outcomes**



**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

## 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.....

## A tragic emergency health care intervention outcome



**Rollover Crash Kills Medical Technician**

A person died after falling from the ambulance during the rollover crash.

**It does happen....**

## New York.....

**WABC-TV - News York, NY**

**Ambulance Accident Injures Five**

NEW YORK - An ambulance collided with an SUV in Brooklyn Thursday evening, injuring at least five people. The accident occurred at the intersection of 60th and 3rd avenues in Bay Ridge, a historic residential neighborhood with a steep Charles Avenue climbing over 40 feet into a parkland.

The ambulance crew and several onlookers were taken to Lutheran Hospital with mostly back and neck injuries. One person was reported to have a serious head injury.

The driver of the ambulance had to be cut out of the cab of the vehicle by rescue workers.

## Major deal...



## This month....

**The Huntsville Times** • Subscribe • Today's Paper & More

**Ambulance suit gets \$3.1 million**

Merckandale teen killed in wreck with speeding vehicle

Tuesday, May 07, 2007

By **DAVID HOLEMAN**  
Times Staff Writer david.holeman@times.com

A federal jury awarded \$3.1 million in damages Friday to the family of a Madison County woman who was killed in a collision with a speeding ambulance from Tennessee in 2005.

A felony charge of manslaughter is still pending in Madison County Circuit Court against the ambulance driver, Charles Christopher Eaves of Tennessee.

Dianita Christine Browder, 18, of Marietta died in a two-vehicle crash Oct. 13 involving the ambulance owned by Lincoln County Medical Center Emergency Services. The vehicle occurred around 9:45 p.m. at U.S. 231431 and West Limestone Road, about seven miles north of Huntsville.

## Last month .....



▶ "Ambulance transport has a death toll...."

Carl Craigie EMT-P, Chief Platte Valley Ambulance

## ....May 25th 2007?

Original Message

Subject: Feasibility for an EMS Workforce Safety and Health Surveillance System, advances the NHTSA Office of EMS

Date: Fri, 25 May 2007 16:21:04 EDT

From: [David.Eaves@ajg.us](mailto:David.Eaves@ajg.us)

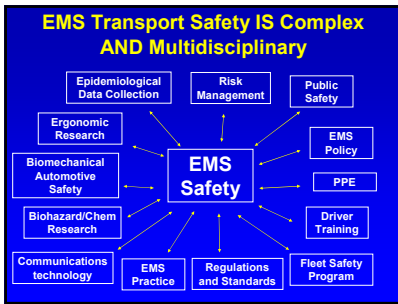
Crew: EMS Dispatchers

The National Highway Traffic Safety Administration (NHTSA) Office of Research and Development (ORD) is currently conducting a Feasibility Study for an EMS Workforce Safety and Health Surveillance System. This is the first report of a study funded by NHTSA's Office of Research and Development (ORD) and conducted in collaboration with Federal and national EMS stakeholder organizations. This report reviews the study and possible solutions, including some preliminary guidance recommendations of EMS workers exposure and duration.

The Feasibility study serves as a valuable supplement to ongoing national EMS workforce research. NHTSA continues to explore ways of affecting national EMS workforce. NHTSA will be the lead, Research and Development Administration (R&D), EMS for Children (EMS-C) program are included with the national EMS necessary to the EMS Workforce for the 21st Century program, designed by the Department of Highway Traffic and Transportation (DOT).

**Feasibility for an EMS Workforce Safety and Health Surveillance System**





### An interhospital transport ? "Do no harm...?"

Date last updated: Tuesday, January 25, 11:14:07  
 #10747867 | [Print this Article](#) | [Email this Article to a friend](#) | LexisNexis

**Pa. ambulance involved in crash; patient pronounced dead at scene**

By Elizabeth Evans  
 The York Dispatch (Harrisburg, Pa.)  
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An Adams County ambulance rushing a patient to York hospital collided with a car at the intersection of routes 30 and 674 in West Manchester Township at 9:47 this morning, and the patient was pronounced dead at the scene.

York County Deputy Coroner Claude Stahley said the patient, a woman, was being transported from Gettysburg hospital because she was suffering a "significant" heart condition.

He said he's still trying to determine whether she went into cardiac arrest and died prior to the crash, or whether she suffered a fatal heart attack because of or after the crash. Stahley said she suffered no significant traumatic crash-related injuries.

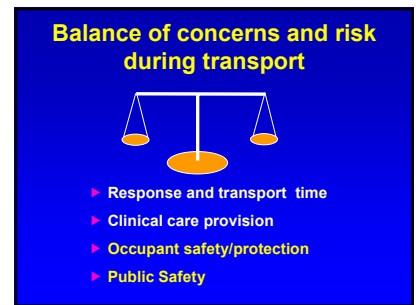


### Firstly!

▶ **An accident ?**

▶ or a predictable and preventable event

- ### 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
  - ▶ scene safety
  - ▶ the vehicle
  - ▶ the driver/driving skill
  - ▶ other road users
  - ▶ the road
- TIME  
↓  
PLACE





**UPS and Laundry trucks have very similar design and even more stringent safety requirements to EMS vehicles BUT very different cargo.....**

**People are passengers and NOT packages or parcels**

**The first and only published scientific text on ambulance crashes (1995) ...and by an optometrist**

The image shows the cover of a book titled "Emergency Vehicle Accidents: Prevention and Recognition" and a page showing its Table of Contents. The book is the first and only published scientific text on ambulance crashes, written by an optometrist.

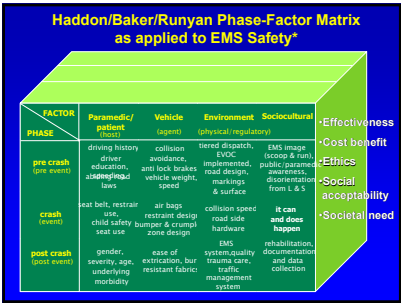
**The first and only technical symposium 2001**

The image is a poster for the SAE International Military and Emergency Vehicles Safety symposium, held from September 11-12, 2001, in Santa Monica, California. The poster features a globe and various images of vehicles. A red circle highlights the date and location information.

- 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

- 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





It does happen....

## But what about head protection?



## Attitudes to Head Protection in EMS

Would You Consider Wearing a Helmet PRE-PRESENTATION



Would you consider wearing a helmet POST



Levick NR, Gurigan M, A Solution to Head Injury Protection for Emergency Medical Service Providers, International Association for Ergonomics (IAE), July 2006

## Role of a head protective device

- ▶ A simple, immediate and inexpensive adjunct – a protective device -
- To protect occupants from hazardous interiors
- As vehicle crashworthiness design advances
- As driver training advances
- For when equipment becomes unsecured
- As EMS Safety Standards are developed, for both EMS vehicles and EMS occupational safety

## New EMS helmet prototypes for 2006-2007



Hmm...



## So why is it...

- ▶ That the EMS providers -
- Were wearing navy blue – one of the most difficult colors to see at night
- Had no head protection, when all other emergency personnel at the scene did
- Had no protective clothing, when other emergency personnel at the scene did???

## EMS Best Practice, Sept 2006



## Goals

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





## FMVSS exempt.....

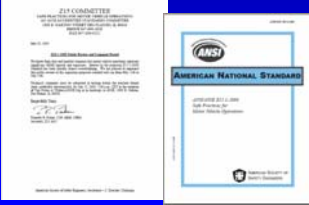


## ASTM F 1086 - 94



12.6 Safety—EMS system should ensure that standards for safety of rescuers, providers, patients, and bystanders are developed and enforced.

## 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

## Z15 Incident Rates

- ▶ Incident rate based on number of vehicles operated:  
Incident rate =  $\frac{\text{Number of incidents} \times 100}{\text{Number of vehicles}}$
- ▶ Incident rate based on vehicle mileage:  
Incident rate =  $\frac{\text{Number of incidents} \times 1,000,000}{\text{Vehicle mileage}}$
- ▶ Injury incident rate based on vehicle mileage:  
Injury incident rates, the most frequently used indicator of incident severity, are useful for tracking events that have the potential to affect medical or operational performance of the operating unit.  
Injury incident rate =  $\frac{\text{Number of incidents with injury} \times 1,000,000}{\text{Vehicle mileage}}$
- ▶ Incident rates based on service activity:  
Motor vehicle operations that pose injury risks other than those associated with driving should also use the service activity as the basis of a safety performance rate. The number of deliveries, stops, or loads should be considered as appropriate indicators of performance.  
Incidents per 10,000 transports =  $\frac{\text{Number of incidents} \times 10,000}{\text{Number of transports}}$
- ▶ Vehicle injury rates based on work hours:  
Vehicle incidents per 200,000 hours =  $\frac{\text{Number of incidents} \times 200,000}{\text{Number of hours worked}}$

## Legal Perspectives on Z.15

### ANSI Z15.1 Standard: A Tool for Preventing Motor Vehicle Injuries and Minimizing Legal Liability

By Adele L. Abrams, Esq., CMAA  
Law Office of Adele L. Abrams P.C.

Motor vehicle crashes that occur on American roadways have historically been the leading cause of occupational fatalities in this country. In the decade between 1992 and 2001, more than 13,000 civilian workers died in such incidents – accounting for 22 percent of all injury-related deaths. According to the Occupational Safety and Health Administration (OSHA), every 12 minutes someone dies in a motor vehicle crash, every 10 seconds an injury occurs and every 5 seconds a crash occurs.<sup>1</sup> Employees whose workers are involved in such crashes have tremendous liability exposure, especially if the individuals injured or killed are third parties (non-employees), where no worker's compensation liability shield exists as an exclusive legal remedy. They bear not only the worker's compensation costs for their employees, and the potential damage awards from third party tort claims, but also the costs of equipment replacement and the indirect costs of workforce disruption and lost productivity associated with such incidents.

## EMS Transport Safety

- ▶ 'patient safety'
- AND also
- ▶ 'provider' and 'public safety'

## NAEMT July 2006 Position Statement



## Innovation

## What's new

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

## If we know this – and its published....



## Why do we do this?



## Patients must be in the over the shoulder harness, medics restrained in seat belts, equipment secured

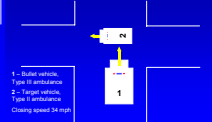


## Full Vehicle Crash Tests

### Test 1 – Right side impact



### Test 2- Frontal



## High speed crash, rolled and the occupants (patient and medics) had only minor scratches





## Protective devices/concepts

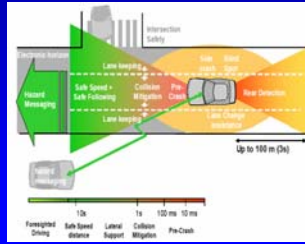
### To prevent a crash

- ▶ 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

## Intelligent Transport Safety Systems



## Vehicle visibility and conspicuity



## Protective Equipment

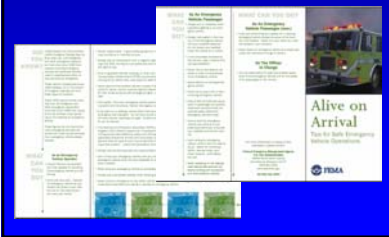


## Integration and Collaboration

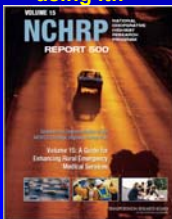
EMS Transport Safety Strategies - 2006-2007 New York State Strategic Highway Safety Plan



## Tips for Emergency Vehicle Operations



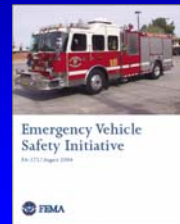
Transportation Research Board is an excellent resource... we should be using it!!



No need to reinvent the wheel...



## USFA Emergency Vehicle Safety Initiative



## March 2007 - FHWA



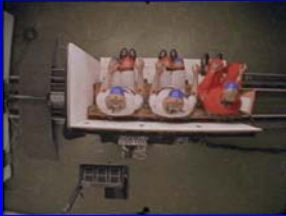
## 'Safety' approaches being driven by manufacturers claims and sales rather than by science and data



## Vehicle design and safety

- ▶ The principles of automotive safety involve a complex science, engineering technical skill, expertise, training and knowledge
- ▶ "Give the engineers a working list of our needs and let them tell us how it should be built to accomplish those tasks....."  
John Russell MD, Advisory Panel, EMS Safety Foundation, 2007

## The squad bench??



Richardson S.A., et al, *Int. J. of Crash*, 4:3, 239 – 259, 1999  
and those rock climbing harnesses??

## Being seated IN an automotive seat is what will protect you

- ▶ Anything that allows or encourages you to get up out of your seat will also encourage you to be injured or killed – it is potentially lethal to be out of your seat in any fashion
- ▶ 4 or 5 point harnesses for sidfacing occupants are potentially lethal – and is in **NO WAY SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE**

## Were we safer in the Cadillac???



## Safety Management

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

## Creating a Safety Culture

within a company must start with upper management's commitment to safety

- ▶ Awareness
- ▶ Training
- ▶ Incentive

## An excellent model



<http://www.EveryoneGoesHome.com>

## 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

## Future

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

## small changes can make a **BIG DIFFERENCE**

- ▶ **PREPARE – TEACH – REACH – RESPOND**
  - ♦ **Look** at your own safety record
  - ♦ **Teach** safety and hazard awareness
  - ♦ **Reach** out with safety information to all your EMS providers
  - ♦ **Respond** with the best safety practices

## Conclusion

- ▶ EMS transport has serious hazards and safety issues
- ▶ Major advances in EMS safety research, infrastructure and practice over the past 5 years
- ▶ Development of substantive EMS safety standards is a necessity and a reality
- ▶ Multidisciplinary safety issue that EMS cannot solve internally
- ▶ Failure to transfer knowledge from transportation and automotive safety is unacceptable and dangerous
- ▶ EMS is still way behind the state of the art in vehicle, transportation and occupational safety

## 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