Cambridge EMS Safety Seminar,
Pro EMS, Boston, July 25th, 2007

AMBULANCE SAFETY

EMS - Is it Safe???!!!

What you should know if you DRIVE or RIDE in an Ambulance

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

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……

Friday July 20th 2007… The worst ambulance crash in USA history

Five Killed in Crash of Ambulance and Semi

July 21, 2007 08:20 AM EDT

VAN WERT, OHIO (AP) -- The Ohio State Highway Patrol continues to investigate the crash of an ambulance that killed five people Friday night, including three emergency medical technicians. Troopers say the ambulance was broadsided by a semitrailer in Crane Township, about 65 miles southwest of Toledo.

The ambulance, with four Antwerp Emergency Medical Services workers aboard, was taking two victims from an earlier car crash to a hospital. Troopers say it was broadsided by a tractor-trailer at the intersection of County Road 176 and County Road 87. The ambulance then burst into flames.

The Highway Patrol says three EMS workers were killed. They were identified as 64-year-old Sammy Smith, 31-year-old Heidi McDougall and 25-year-old Kelly Rager. The two patients were also killed. They were identified as 64-year-old Robert Wells 60-year-old Armelda Wells of Hicksville.

Another emergency medical technician, Matt McDougall, and the truck driver, Gerald Chapman, Jr. of Indiana, were both taken to the hospital. It's not yet clear whether they suffered any injuries.

Authorities have not said who had the right of way at the rural intersection nor have they said if the ambulance's emergency siren and lights were turned on.

Antwerp fire chief says, 'They were doing what they loved...'

Lisa Nicely
July 22, 2007

Email To A Friend
Printer Friendly
Comments

By LISA NICELY
nicely@times24-news.com

ANTWERP - They were heroes until the end.

Emergency personnel throughout the region are also shocked and mourning their own.

"That's one of our worst scenarios when it's one of our own," said Con Shuherk of the Payne Fire Department.

"Everyone is a brotherhood," said Friend. "Everybody looks after everybody."

Randy Shaffer, director of Paulding County Emergency Management Agency, said the accident has had a deep impact.

"It has affected every emergency personnel in the county," he said. "We know it could happen at any time. We read about it in our newsletter. We just don't think it's going to happen to us."

Shaffer said when a call came in that an ambulance was involved in an accident Friday, "I think every squad in the county activated."

Thursday July 5th ……

NEWS CENTER

Paramedic Killed In Turner Ambulance Crash

Web Editor: Maureen O'Brien, Managing Editor
Created: 7/6/2007 9:45:07 AM
Updated: 7/6/2007 1:07:23 PM

FLANDERS (AP/WS) CENTER, - The Med-Care paramedic was killed when the ambulance collided with a pickup truck on Route 4 in Turner at about 3:00 A.M. Thursday.

The Androscoggin County Sheriff's Department says the Med-Care ambulance had its emergency lights on when the pickup truck crossed in front of it.

The ambulance driver, 40-year-old Arlene Greenleaf of Bethel, and the driver of the pickup, 29-year old Christopher Boulin of Turner, were both injured and were taken to Central Maine Medical Center, as was the patient being carried in the ambulance.

The paramedic who died has been identified as 48-year old Allan Parsons of Wilton.

A section of Route 4 was closed to traffic for about five hours.

General passers-by stopped to help the injured. Sheriff's investigators would like to speak with them. If you were on the scene of the crash, you are asked to call Detective Sgt. William Dagne at 1-800-452-8757, or 784-7301, ext. 214.

AMBULANCE CRASH LOG

AMR ambulance collision traps paramedic - Newton, Massachusetts

Jun 27, 2007 - 11:16:02 AM

An AMR ambulance on its way to an emergency call last night collided with a Jeep at Parker Street and Wheeler Road, authorities said.

Firefighters used the Jaws of Life for more than an hour to free a female paramedic who was trapped in the crushed ambulance, according to police.

That woman and the ambulance driver, also a paramedic, were taken to Beth Israel Deaconess Medical Center in Boston for treatment of injuries not considered life-threatening, authorities said.

The Jeep driver, a 21-year-old Newton woman, was taken to St. Elizabeth's Hospital in Brighton. Her injuries were also not considered life-threatening. The 5:20 p.m. accident is being investigated by the Police Department Traffic Bureau.

The ambulance was on its way to a call about a 72-year-old man who had hurt his head in a fall. His condition could not be determined last night.

A tragic emergency health care intervention outcome

Rollover Crash Kills Medical Technician

It does happen….

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

- "Ambulance transport has a death toll…. "

Carl Craigle EMT-P, Chief Platte Valley Ambulance

EMS Transport Safety

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

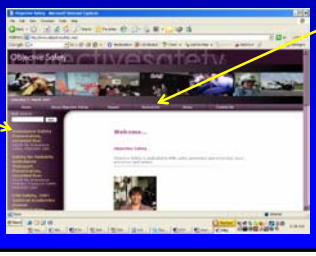
Key Elements to Safety

- Data Capture
- Vehicle Biomechanics and Crashworthiness
- Ergonomics and Biohazards
- Transportation Environment
- Safety Management – evaluation and analysis

What are the solutions?

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

http://www.objectivesafety.net



Case Studies

- Crash 1 – Transporting a psychiatric patient
- Crash 2 – Transporting a child
- Crash 3 – Enroute to a routine call
- Crash 4 – Transporting a pregnant woman
- Crash 5 – Transporting a trauma patient
  Crash 6 – Transporting a routine transport stable patient

News we don't want to see

Jan 22, 2007 6:39 am US/Eastern

Caught On Video: EMT Struck By Car

Lou Young
Reporting

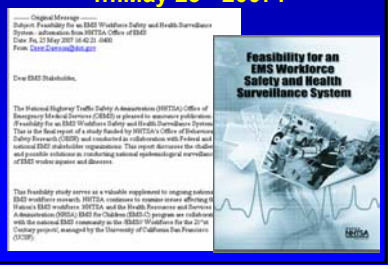
(CBS) BRONX The car hit 46 year-old Capt. Steven Quirindongo so violently it smashed the vehicle's windshield and sent him flying through the air.

Quirindongo, a 19-year veteran of the city's emergency medical services, was on the scene of a fire on Riverdale Avenue in the Bronx 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 (Quirindongo) was walking back to the ambulance he was struck by the civilian vehicle.

…..May 21st, 2007, Seattle

….May 25th 2007?

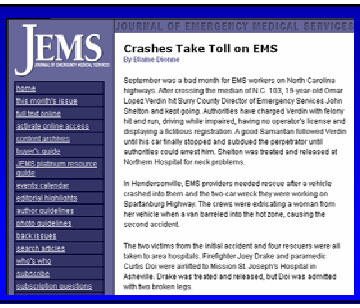


Help is on the way ??? November 24th 2008

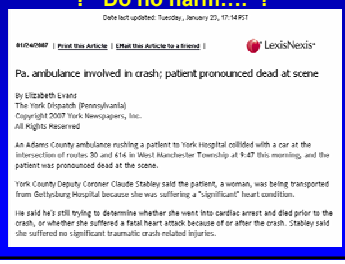
Some odd facts

- 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

Fatalities and funerals



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



Firstly!

- An accident ?
- or

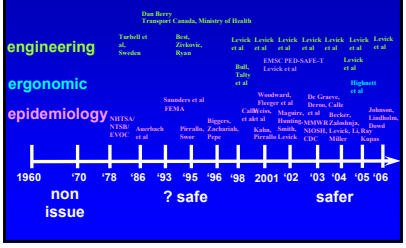
a predictable and preventable event

Best Practices?

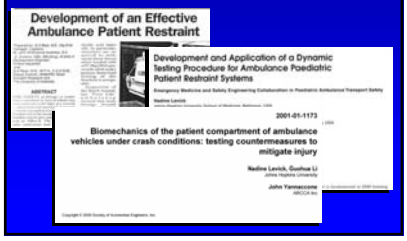
EMS Best Practice, Sept 2006

1970 to 2006

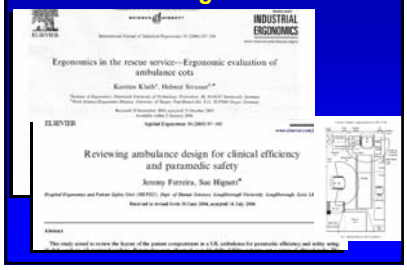
Ambulance Safety Research: A New Field



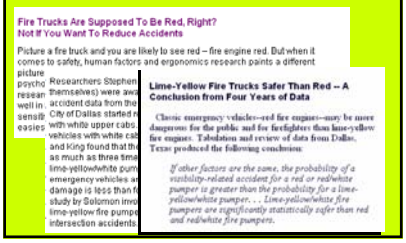
We should use the best safety practices demonstrated in engineering



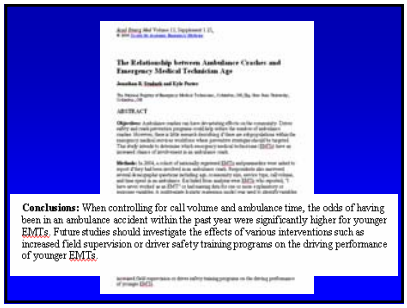
and in ergonomics



We've known for 10 years that red fire trucks are twice as likely as lime yellow trucks to crash at an intersection



NTSB 1979 Accident Report



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*

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 occupant 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##

**Kahn CA, Pirrallo RG, Kuhn EM, Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9*
***Becker, Zalusnisk, Levick, Li, Miller, Acc Anal Prev 2003*
****Maguire, Hunting, Smith, Levick, Annals Emerg Med Dec 2002*
#NIOSH, 2003
##Ray AM, Kupas DF, Prehosp Emerg Care 2005 Dec; 9:412-415
##NHTSA, 49 CFR Parts 571, 572 & 589 Docket no. 92-28, notice 7.

and what is killing EMS ?

EMS personnel fatalities*

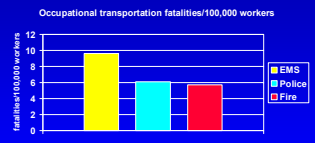
- 74% transportation related
  - 1/5 of ground transport fatalities were struck by moving vehicles
- 11% were cardiovascular
- 9% were homicide
- 4% needle sticks, electrocution, drowning and other

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

Occupational Health and Safety…..?

- This IS an Automotive Safety issue

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*

A few weeks ago….

The Huntsville Times

Ambulance suit gets $3.1 million

Meridianville teen killed in wreck with speeding vehicle

Tuesday, May 01, 2007

By DAVID HOLDEN

Times Staff Writer david.holden@htimes.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 Eakes of Tennessee.

Dianna Christine Bowden, 18, of Meridianville died in a two-vehicle crash Oct. 13 involving the ambulance owned by Lincoln County Medical Center Emergency Services. The wreck occurred around 9:45 p.m. at U.S. 231/431 and West Limestone Road, about seven miles north of Huntsville.

What do ambulance crashes really cost ?

- Loss of life and injury
- Negative impact on EMS system
- Collisions are the largest liability cost and exceeds malpractice or negligence
- Besides the direct financial costs of replacing a damaged ambulance and equipment, there are additional hidden costs incurred:
  - investigating the ambulance collision
  - litigation /settlement/lawsuit
  - medical/disability costs of injured EMTs
  - hiring of new employees to replace injured personnel
  - retraining and psychological counseling of personnel involved and others
  - increased insurance rates

June 2007

A problem

2007 Insurance data –

- 27 fold more likely to have a claim based on transport than related to medical care

EMS Injuries*

- Higher than the injury rate for any private industry published by DOL
- 34.6 injuries/100 fulltime workers per year
- 1.5 x that of fire fighters
- 5.8 x that of health services personnel
- 7 x the national average

** Maguire, Hunting, Guidotti & Smith, Occupational Injuries among Emergency Medical Services Personnel, Prehospitial and Emergency Care Oct/Dec 2005*

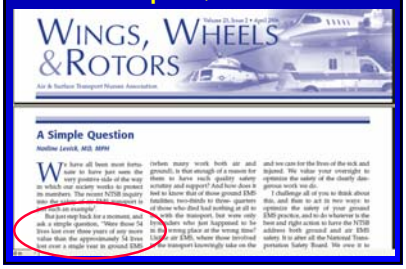
USA EMS

- EMS Systems - >15,000
- Personnel - ~1 million
  (~30% F/T 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

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

Air & Surface Transport Nurses Association

A Simple Question

Nadine Levick, MD, MPH

Unique workplace

- In vehicles
- At roadside and other emergency scenes

The 'workplace' IS a vehicle

- EMT's often in vulnerable positions during transport.
  - Bench seat
  - Captains chair
  - Standing or kneeling

View of Ambulance interior from Rear

The 'workplace' is also a crash scene

the EMS transport process

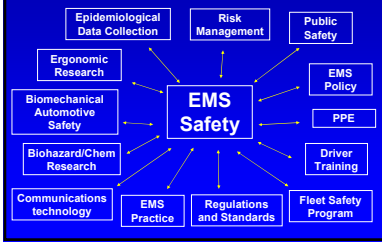
- communications/dispatch
- the patient
- restraining device/seat
- transporting device/gurney
- paramedics/transport nurses, doctors & family
- patient monitoring equipment
- clinical care & interventions
- protective equipment
- the vehicle
- the driver/driving skill
- other road users
- the road

TIME & PLACE

The Emergency Department (ED)

An ambulance is not an ED /ICU on wheels

EMS Transport Safety IS Complex AND Multidisciplinary



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

*FARS/BTS 2004-5

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 Tillie Fong, Rocky Mountain News
July 25, 2006

STORY TOOLS

Email this story | Print

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

Chris Larusso, 22, of Westminster, 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 Goodland, Kan. - were killed.

A patient, Kelsey Schilchenmayer, 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 Beza, 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

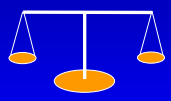
What's missing

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?

Balance of concerns and risk during transport



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

Case Study 1

- Transporting a psychiatric patient

An 'Accident'…. ?

Ambulance Accident Sends Seven To Hospital

Neighbors Hope Accident Will Cause People To Slow Down

› Get breaking news alerts

Katie McCall
Reporting

(CBS2 CHICAGO) An ambulance on the way to a hospital was involved in a terrible accident and sent several people to the hospital, as CBS 2's Katie McCall reports.

When a sedan carrying two people slammed into an ambulance at 111th and Tilman Sunday afternoon, neighbors came running out of their homes.

"I heard a bang. It sounded like thunder," said neighbor Kay Lynch.

Five people were in the ambulance which was carrying a patient to Christ Hospital when police say the car struck it. A street light was also hit and the ambulance turned over, leaving all seven people involved in the accident badly hurt.

"I heard a bang. It sounded like thunder," said neighbor Kay Lynch.

So….

- On their way TO the hospital
- With a patient who was not in cardiac arrest or in a life threatening situation
- All 5 in the ambulance critically injured

Case Study 2

- Transporting a child

EMS Injuries

- James Woodman
  - is a paramedic who, on literally his first day as a paramedic, suffered a severe TBI when the ambulance he was riding in (in the back) was t-boned and rolled onto its side. He remains in a persistent vegetative state in an ECF in Colorado. His father describes that when each week he visits him, tells him the news of the week, and goes home, knowing inside that he has been talking to himself.
- It is assumed that when the ambulance rolled onto its side, the lifepack 10 struck James in the head.....

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

This is about you and your safety

- What safety practices do you use??
  - Seat belts ?
  - EVOC training ?
  - Equipment lock down ?
  - Helmets ?
  - "Black Box" technology ?
  - Tiered dispatch ?

NAEMT July 2006 Position statement

The truck and bus industry is on the right track.... Where is EMS??

EMS Transport 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

Background: USA Problems

- No reporting system or database specifically for identifying ambulance crash related injury
- No occupational and health safety standards to protect providers from injury
- Rear passenger compartment, > 60cm behind driver - exempt from Federal Motor Vehicle Safety Standards (FMVSS)

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-AB85]

Federal Motor Vehicle Safety Standards;
Head Impact Protection

S6.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 2002. Except as provided in S6.3, for vehicles manufactured on or after September 1, 1998 and before September 1, 2002, a percentage of the manufacturer's production, as specified in S6.1.1, S6.1.2, S6.1.3, or S6.1.4, shall, when tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S9 at any speed up to and including 24 kilometers per hour. The requirements do not apply to any target that cannot be located using the procedures of S10. The phase-in schedule the manufacturer chooses to use during this period shall be equivalent to the National Highway Traffic Safety Administration pursuant to 49 CFR 584.4.

S6.2 Vehicles manufactured on or after September 1, 2002. Except as provided in S6.3, vehicles manufactured on or after September 1, 2002 shall, when tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S9 at any speed up to and including 24 kilometers per hour. The requirements do not apply to any target that cannot be located using the procedures of S10.

S6.3 A vehicle need not meet the requirements of S6.1 through S6.2 for:

(a) Any target located on a convertible roof frame or a convertible roof linkage mechanism.

(b) Any target located rearward of a vertical plane 600 mm behind the seating reference point of the rearmost designated seating position.

(c) Any target located rearward of a vertical plane 600 mm behind the seating reference point of the driver's seating position in an ambulance or a motor home.

(d) Any target in a walk-in van-type vehicles.

AMBULANCE MANUFACTURERS DIVISION OF
The National Truck Equipment Association

Page 1 of 4

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-1822, promulgated by the federal government. These requirements are in addition to FMVSS.

Case 3

- Enroute to a routine call

FMVSS exempt……

Most trucks, SUVs do poorly in whiplash test

54 current models - or two-thirds of all the vehicles in the test - fail to adequately protect occupants in rear-end collisions.

July 3 2007: 10:17 AM EDT

NEW YORK (CNNMoney.com) -- Two-thirds of pickups, vans and sport-utility vehicles don't provide acceptable protection against whiplash in rear-end collisions, according to tests by the Insurance Institute for Highway Safety (IIHS).

Some 54 models were rated "marginal" or "poor" by the Institute in tests that involved measurements of seats and head restraints and, in some cases, simulated rear-end collisions.

Vehicle seats and head restraints are first measured to determine if the headrest, because of its shape and angle, is likely to provide adequate protection.

IIHS: Top Safety Picks

Seats that are deemed likely to provide good protection are then tested in a simulated crash. The seat is attached to a moving platform that is struck from behind at 20 miles per hour. The Institute then measures impact forces on a crash test dummy riding in the seat.

Twenty-one current models - or 24 percent of those tested - earned the best possible rating of "Good." Twelve models earned an "Acceptable" rating, the second-best rating.

"In stop-and-go commuter traffic, you're more likely to get in a rear-end collision than any other crash type," says IIHS's David Zuby. "It's not a major feat of engineering to design seats and head restraints that afford good protection in these common crashes."

Video

CNN's Greg Hunter reports on the latest testing of seats and head restraints in SUV's.

Play video

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Case 4

- Transporting a pregnant woman

JEMS.com

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Colorado ambulance safety thrust in spotlight

News Report

Page Last Updated: Tuesday, May 16, 17:20 PST

05/16/2006 | Print Report | Email Report to a friend |

Colorado ambulance safety thrust in spotlight

A pair of ambulance crashes in little more than a week have left three people dead in Colorado. State health officials plan to make ambulance safety a key issue in the coming weeks. JEMS is highlighting a series of news stories about the incidents and an article from the November 2002 issue of JEMS that details a common-sense approach to staying safe while riding in an ambulance.

Full Story

Predictable

DENVERPOST.com

Article Launched: 05/11/2006 01:00:00 AM MDT

Denver & the West

Ambulance driver had citations

The Hyra/Metro operator who hit the left rear of a tractor-trailer as he was trying to pass has been cited four times since 2003 for speeding and other violations.

By Felica Lambrug
Denver Post Staff Writer

The driver of the ambulance that crashed near Sterling on Tuesday, killing two people and seriously injuring a pregnant woman on board, has a history of driving violations, records show.

Christopher M. Larusso has been cited four times in Adams County and Denver since 2003 for speeding, driving too close to another vehicle, not wearing a seat belt and other safety violations.

The 22-year-old Westminster man was found guilty on three of those violations; he was not wearing a seat belt in September, and in July he was

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 Donts
    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

Occupant protection……??

KKK – static 'safety testing'

- Ignorant of automotive safety principles – and specifies -
  - No structural damage to any load bearing or supporting members, i.e., torn or broken material, broken welds, popped or sheared body rivets, bolts, and/or fasteners, shall be evident during the application of the force and after the release of the force.

F = ma

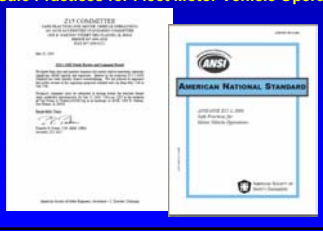
where F – force
m – mass
a – acceleration

Bottom line

- The AMD should consider revising the standard comprehensively to reflect current accepted automotive safety practice, given the current vehicle crashworthiness and occupant protection knowledge and published literature.

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 = Number of incidents x 100 / Number of vehicles
- Incident rate based on vehicle mileage:
  Incident rate = Number of incidents x 1,000,000 / 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 financial or operational performance of the operating unit.
  Injury incident rate = Number of incidents with injury x 1,000,000 / 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 = Number of incidents x 10,000 / Number of transports
- Vehicle injury rates based on work hours:
  Vehicle incidents per 200,000 hours = Number of incidents x 200,000 / 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., CMSP
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.[1]

Employers 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.

And 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)

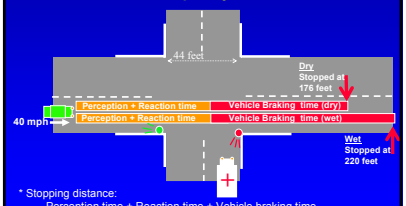
**Comparison of Crashes Involving Ambulances with those of similar sized vehicles – Adam Ray, Douglas Kupas, PEC Dec 2005;9:412-415*

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…..

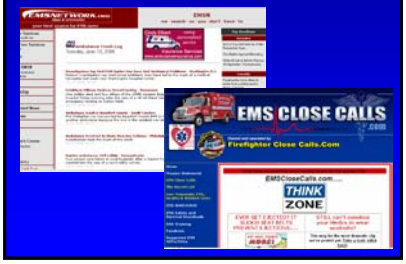
The real world

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



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

Increasing awareness …



What do we know now??

- Intersection crashes are the most lethal
- There are documented hazards, some which can be avoided
- Occupant and equipment restraint with standard belts is effective. (Over the shoulder harnesses for patients should be used, with the gurney in the upright position where medically feasible)
- Some vehicle design features are beneficial - automotive grade padding in head strike areas, seats that can slide toward the patient
- Electronic Driver monitoring/feedback systems appear to be highly effective
- Head protection??

Case Study 5

- Transporting a trauma patient

The 'accident' scenario…

- There were three personnel in the back of the ambulance plus the patient.
- The patient being treated had a self inflicted laceration with an arterial bleed to an upper extremity.
- The ambulance was traveling lights and sirens and moving slowly through an intersection when they were involved in a T-bone collision.
- They were struck on the passenger side of the vehicle near the rear of the box.

At the time of the 'accident'…

- The paramedic with the serious head injury was seated and un-restrained on the bench seat over the rear wheel well on the impact side of the vehicle.
- At the time of impact, the paramedic with the head injury had just finished starting an IV and he was discarding his needle in a wall mounted sharps container.
- A second Paramedic was standing at the head of the patient involved in an unknown activity. An EMT was standing near the front of the bench seat, holding direct pressure and elevating the patients arm upright.

The tip of the iceberg of the 'accident' outcome..

- The second paramedic and the EMT received minor soft tissue injuries only.
- The paramedic with the head injury was intubated for a short time and then extubated later that same evening.
- He is back to work after a couple of months off the job. He is not working as a paramedic yet, but he is back on the line as a chiefs aid until his doctor gives him permission to return to active duty status. He has been dealing with memory problems and the need to sleep for longer hours than normal.

Case Study 6

- Transporting a routine stable patient

Rollover Crash Kills Medical Technician

Ambulance Runs Off I-66 and Rolls Over, Injuring Two Employees and a Patient

It does happen….

But what about head protection?

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

Problems

- No Standards
- Unique safety and hazard protection needs
- A number of <u>less than appropriate</u> devices out there

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???

It isn't like this outside of the USA

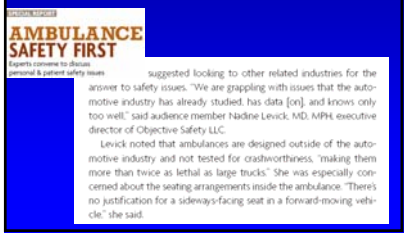
The difference having data makes?

Innovation

What's new

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

Last months JEMS



SPECIAL REPORT

AMBULANCE SAFETY FIRST

Experts convene to discuss personal & patient safety issues

suggested looking to other related industries for the answer to safety issues. "We are grappling with issues that the automotive industry has already studied, has data [on], and knows only too well," said audience member Nadine Levick, MD, MPH, executive director of Objective Safety LLC.

Levick noted that ambulances are designed outside of the automotive industry and not tested for crashworthiness, "making them more than twice as lethal as large trucks." She was especially concerned about the seating arrangements inside the ambulance. "There's no justification for a sideways-facing seat in a forward-moving vehicle," she said.

Safety at the scene

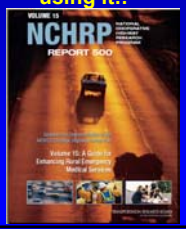
eg: Scandinavia Innovation in Vehicles, and Equipment

This looks cool AND SAFE!

Not rocket science..

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

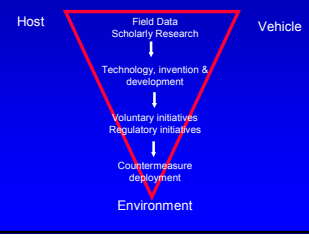
March 2007 - FHWA

Ambulance Driver Safety - Australia

Fleet Driver Training..

Dynamics of Fleet Safety - NSC

Automotive Injury Triangle and Safety Development



Protective devices/concepts

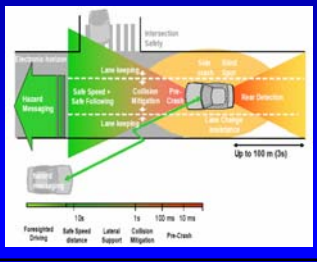
To prevent a crash

- 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



The "Black Box"

Driver behavior monitoring and feedback device

Purpose of 'Black box' Program

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

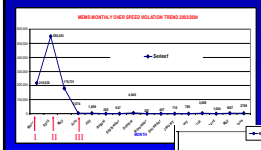
The "Black Box" - A transportation safety monitoring and feedback device

This technology is conceptually like a vehicle safety 'pulse oximeter' – that with auditory feedback - can save your life, your coworkers life, your patients life, and others on the road

How the Device Works

- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has individual key "fob"
- Data collected every second
  - including: vehicle speed and performance, driver behaviors and emergency mode
- Auditory feedback of warning 'growls', and penalty tones
- Data downloaded automatically every day

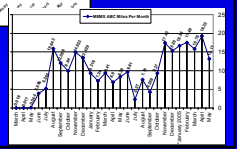
Demonstrated Effectiveness



I – blind data, no growls

II – growls & tones ON unidentified data capture

III – identified data



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

The jury is out on

- Opticon
- Simulators

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Active Projects

(all due early 2007)

- 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

The Crash Event - Crash Testing

- An introduction
- What one needs to know
- What do the tests really mean
- And, what tests are meaningful

Dynamic Safety Testing

- requires sophisticated, expensive equipment
- measurably demonstrates forces generated during collision
- accepted international standard for vehicle restraint systems

If we know this – and its published….

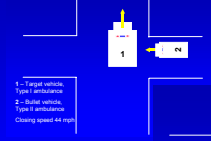
Why do we do this?

Choose the Best Option

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

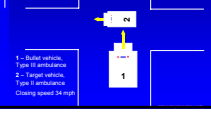
Full Vehicle Crash Tests

Test 1 – Right side impact

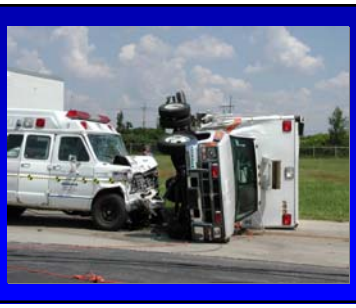


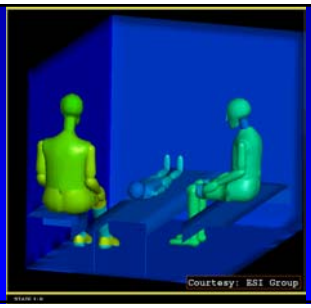
1 – Target vehicle, Type I ambulance
2 – Bullet vehicle, Type II ambulance
Closing speed 44 mph

Test 2- Frontal



1 – Bullet vehicle, Type III ambulance
2 – Target vehicle, Type II ambulance
Closing speed 34 mph





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

Major events for innovation sharing

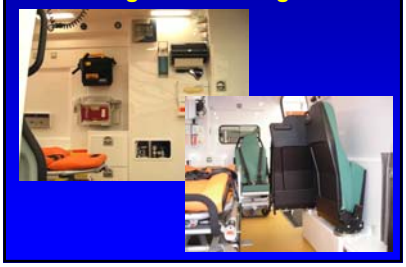
– but regional and often language isolation

Vehicle Occupant Safety design

2007 European design

Safety technology is a key focus

Ergonomic design



Securing equipment

Ergonomic layout and equipment

Policy Changes

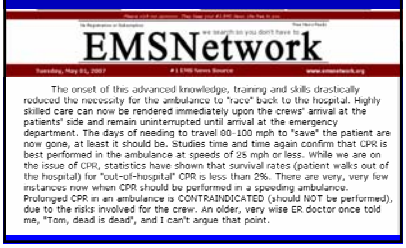
Safety leadership… from the IAFC and USFA

IAFC NEWS ALERT
FOR IMMEDIATE RELEASE
Contact: IAFC Communications Department
International Association of Fire Chiefs
703/273-0911
www.iafc.org

The IAFC and the USFA Develop Model Policy and Procedures Guide for Emergency Vehicle Safety

Fairfax, Va., October 20, 2006… The International Association of Fire Chiefs (IAFC) and the Department of Homeland Security's United States Fire Administration (USFA) announce the release of a *Guide to Model Policies and Procedures for Emergency Vehicle Safety*. This innovative, web-based educational program is aimed at reducing the impact of vehicle related incidents on the fire service and the communities they protect. The guide provides in-depth information for developing policies and procedures required to support the safe and effective operation of all fire and emergency vehicles, as well as privately-owned vehicles, which are the leading cause of volunteer firefighter on-duty fatalities responding and returning to emergencies.

CPR?



EMSNetwork

The onset of this advanced knowledge, training and skills drastically reduced the necessity for the ambulance to "race" back to the hospital. Highly skilled care can now be rendered immediately upon the crews' arrival at the patients' side and remain uninterrupted until arrival at the emergency department. The days of needing to travel 80-100 mph to "save" the patient are now gone, at least it should be. Studies time and time again confirm that CPR is best performed in the ambulance at speeds of 25 mph or less. While we are on the issue of CPR, statistics have shown that survival rates (patient walks out of the hospital) for "out-of-hospital" CPR is less than 2%. There are very, very few instances now when CPR should be performed in a speeding ambulance. Prolonged CPR in an ambulance is CONTRAINDICATED (should NOT be performed), due to the risks involved for the crew. An older, very wise ER doctor once told me, "Tom, dead is dead", and I can't argue that point.

New York too…

Date: Tuesday, March 20, 2007 11:29 AM
To: bobb_hoffman@metro.com; Debbie Jones; Eric K. Gonzalez; kfoster@web.org; Gessner, George ; martin@dhs.nyc.gov; rbrown@dotechnosafety.net ; dafonty@aol.com
Subject: Minutes of 3/5/07, McEvoy Article & Thursday Agenda
Attach: EMSSafetyCultureFlag-wch4-07.doc (31.3 KB) ; Site_Up_AHEMSCultureofSafety_Dec_2006 (2).doc (45.4 KB)

I'd like to make several interim recommendations to the Ed & Training Committee. Please let me know your thoughts on them:
- Create a 1 day preconference workshop on EMS Safety for Vital Signs 2007
- Request BEMS to begin a formal tracking of EMS injuries
-Request SEMAC to consider creating a list of necessary EMS interventions. EMS providers would only be unbelled in the back to perform these tasks
My EMS Leadership Class and NCC colleagues came up with the following list:
Airway Management (Suction, Manual Management, OPA/NPA/BAD insertion-specially excluding placement of an ET tube)
Ventilation of Patient (including application of CPAP)
Administration of Medication
Hemorrhage Control
Chest Compressions
Childbirth (only until you can pull over) or childbirth complications
IV/IO Insertion for Medication Administration or Necessary Fluid Bolus
Facing/Multi-Function Patch Application
Control of Restrained Patient
Patient Position for Pain Control
The difficulty in this list is trying to regulate "good clinical judgment", but I'd like to get people to thinking about risk vs. benefit

Integration and Collaboration

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

New York State
Strategic Highway Safety Plan
2006-2007

VISION

New York's safety community will continue to work to ensure that its customers – those who live, work and travel in New York State - have a safe, efficient, balanced and environmentally sound transportation system, and that safety is appropriately considered in all education, enforcement, engineering and emergency medical services activities in New York State in order to reduce fatal and injury crashes.

GOALS

Reduce motor vehicle fatalities from 1,410 in 2005 to 1,285 in 2011

Reduce the Fatal Crash Rate/100 Million VMT from 1.00 in 2004 to .90 in 2011

'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 sidefacing occupants are potentially lethal – and is in NO WAY SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE

Were we safer in the Cadillac???

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

EMS Risk/Hazards

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

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

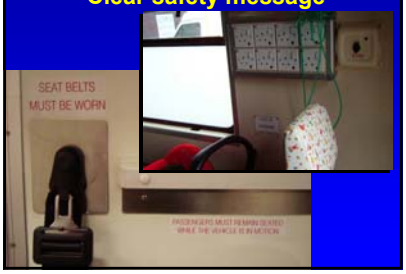
USA design initiatives

New Australian vehicles

Flexibility to manage two patients

UK Ambulance vehicles

Clear safety message



Sweden initiatives

Norway initiatives

Other successful models

Fleet Mix ?

So….

- Which vehicle do you want to be in ?
- Which vehicle is the best for efficient, and effective patient care?
- Which vehicle provides optimal risk management ?
- What is the optimal fleet mix?

Safety Enhancements Being Implemented

- EVOC
- Tiered dispatch
- Monitoring & Feedback devices
- Helmets
- Optimized ambulance vehicle design
- New Policies and Standards

Future

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

Important Principles !

1. A culture of safety
2. Drive cautiously
3. Wear your belts & restrain all occupants
4. Secure all equipment
5. Integrate scientific data into your policies and procedures

- Unrestrained occupants and equipment are a potential injury risk to all occupants

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

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

PREDICTABLE PREVENTABLE and NO ACCIDENT

Conclusion

- EMS transport has serious hazards and safety issues
- 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 safety standards is a necessity and a reality
- 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 safety and occupant protection

And….

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