

Medical Transport Leadership Institute
Oglebay West Virginia, May 1, 2007

Where is the State of the Art of Ground Operations Safety?



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

A tragic emergency health care intervention outcome



It does happen....

Last Week



A few weeks ago in New York



Major deal...



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.....

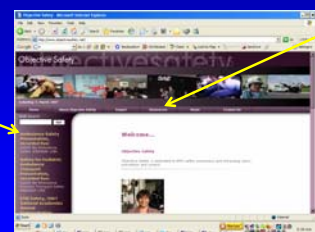
Objectives

1. Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance crashes.
2. Explore factors related to ambulance crashes and identify potential mechanisms of injury to patients and transport providers
3. Explain new transport safety technologies and innovations, and describe the new concepts that are underdevelopment.
4. Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers during transport

Your Interactive Handout awaits you online...

▶ www.objectivesafety.net

<http://www.objectivesafety.net>



Last month....

EMERGENCY | Read this Article | Email this Article to a friend |

2 dead in Michigan ambulance crash

The Associated Press

GRANDIA TOWNSHIP, Mich. (AP) — An ambulance carrying two people was involved in a crash on a snowy road on Tuesday, killing two people, state police said.

The truck was stopped at Township waiting for staff General Hospital near-end. Investigators found no evidence.

Ambulance patient Carrie Cornell, died at the scene member, Ryan Peterson,



Some recent adverse outcomes



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

A few weeks ago...

The News On 6 at Ten with Terry Hood and Scott Thompson

EMT Dies After Latimer County Ambulance Crash

By Elizabeth Evans
The York Dispatch (Pennsylvania)
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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 414 in West Manchester Township at 9:47 this morning, and the patient was pronounced dead at the scene.

York County deputy Coroner Claude Stabley 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. Stabley said she suffered no significant traumatic crash-related injuries.

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

Date last updated: Tuesday, January 23, 10:14 PST

#1047067 | Read 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 (Pennsylvania)
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August 16th ...

Heartland NEWS LOCAL 12

Deadly Ambulance Accident

By: CJ Cassidy

ADAMS COUNTY, Pa. — Driver error, dangerous intersection, or both? The deadly crash happened Sunday morning.

Adams County Deputy Coroner Claude Stabley 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. Stabley said she suffered no significant traumatic crash-related injuries.

August 22, 2005....

Daily American Republic

Ambulance driver in fatal crash is charged

ESSENTE, Mo. (AP) — An ambulance driver from Missouri is charged Tuesday with two counts of involuntary manslaughter for an accident that killed a patient in the ambulance and the driver of the other vehicle.

The accident happened Tuesday on Missouri 164 near Zionsville in Dallas County.

Patrick Whelan, 23, of Taylor Street was driving an ambulance for Taylor Third Regional Medical Center. The Missouri State Highway Patrol said Whelan failed to stop at a stop sign and struck a 1992 Buick driven by Dorothy Wardell, 64, of Haverhill.

The ambulance's siren and emergency lights were not on, the patrol report said.

Wardell and a patient in the ambulance, Wilbur Jacobs, 66, of Wrayport, were killed.

Whelan suffered minor injuries. He is co-defendant in the ambulance, James Stephens, 41, of Franklin, Mo., was taken to a hospital in Haverhill, Mo., with serious injuries.

Bond for Whelan was set at \$10,000.

Firstly!

▶ An accident ?

▶ or a predictable and preventable event

An 'Accident'.... ?

August 17, 2009 9:16 pm EDT

Ambulance Accident Sends Seven To Hospital

Neighbors Huger Accident: 782 Cases People To Show Down

Call breaking news alerts

It was a busy night for the ambulance crew on the way to a hospital when it was involved in a terrible accident and sent several people to the hospital, on CBS 24 radio.

When a station carrying two people slammed into an ambulance at 11:28 and 11:30 Tuesday afternoon, neighbors came running out of their houses.

"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 saw the car crash in a street light pole and the ambulance turned over, leaving all seven people involved in the accident badly hurt.

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

EMS Best Practice, Sept 2006

Q: What are emergency services leaders to do to their own organizations to prevent ambulance safety?

Full back air vehicle safety credits, proper air equipment - oxygen cylinders, defibrillators, call phones, there is a chance for air failure on the ground and air-crews have trained aircrew life-threatening injuries. A call phone in the back of the vehicle per hour can kill you.

Personnel Not Buckling up

EMS is a heavily regulated and heavily funded profession, and it is not surprising that a survey of more than 200 EMS providers' Current Emergency Medicine. The survey did not identify the correct method of person did not observe the correct method of despite the fact that most recommendations are in the accompanying text articles.

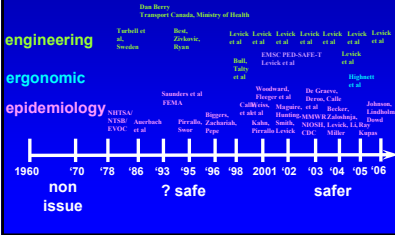
Other actions include:

- Evaluate and maintain vehicle inspection policies.
- Increase attention to policies and equipment to prevent on-scene EMS accidents.
- Use thorough and comprehensive driver education and training.
- Use real-time driver monitoring and feedback devices.
- The final step: Training of personnel to get to a ground vehicle in an emergency and to avoid the negative impact on EMS in hospitals and outside the vehicle, with a focus on behavioral performance, occupational sound and safety for other safety features.
- Implementation of the ANZCOR E.T. standard for safe vehicle practices, and
- Support collection of population-based injury data. (10)

1970 to 2007



Ambulance Safety Research: A New Field



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^{##}

[#]Walt CA, Pirolo RC, Kohn EM. *Prehospital Emergency Care* 2001; 46:569-573/201-9
^{**}Maguire, Hunting, Smith, Lewick, *Annals Emerg Med* Dec 2002
^{***}Maguire, Hunting, Smith, Lewick, *Annals Emerg Med* Dec 2002
^{##}Ray AM, Kubas DF. *Prehospital Emergency Care* 2005; Dec; 9:412-415
^{##}Ray AM, Kubas DF. *Prehospital Emergency Care* 2005; Dec; 9:412-415

and what is killing EMS ?

EMS personnel fatalities*

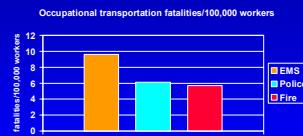
- ▶ 74% transportation related
 - ♦ 1/5 of ground transport fatalities were struck by moving vehicles
- ▶ 11% were cardiovascular
- ▶ 9% were homicide
- ▶ 4% needle sticks, electrocution, drowning and other

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

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

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



The Emergency Department (ED)



An ambulance is not an ED /ICU on wheels



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

*FARGATE 2004.6

Occupational Health and Safety.....?

▶ This IS an Automotive Safety issue

Paramedic charged in crash that killed 2

By Mike Fink, 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 Highlands, 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 Oodoland, Kan. - were killed.

A patient, Viktor Gutlichmayer, 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.

Balance of concerns and risk during transport



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

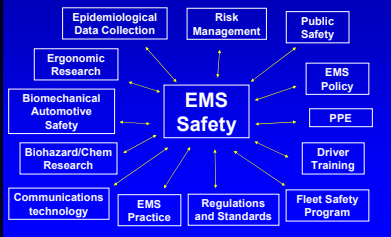
Benefit of Safety

- ▶ 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 ?

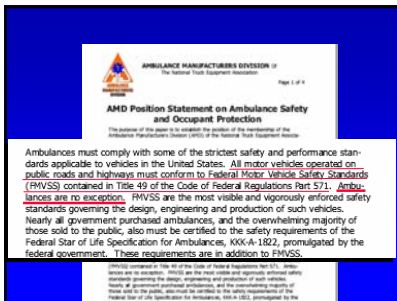
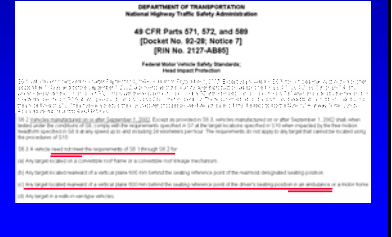
EMS Transport Safety IS Complex AND Multidisciplinary



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



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

and who's life was he racing to save?



NAEMT July 2006 Position statement

NAEMT
National Association of Emergency Medical Technicians

**National Association of Emergency Medical Technicians
Statement on Safety Restraint Use in Emergency Medical Services**

Statement
The National Association of Emergency Medical Technicians (NAEMT) strongly advocates the use of available safety restraint systems in ground ambulances to protect patients, patients, and all occupants of an emergency response vehicle.

Background
The NAEMT strongly advocates the inclusion of a National EMS Safety Study which can be used to provide information to EMS providers, patients, and all occupants of an emergency response vehicle.

Background
Emergency Medical Services (EMS) throughout the United States have shown to be a dangerous profession. Although there is a need to study the current state of practicing the job, there is a need to study the current state of the profession. It is generally accepted that the most likely cause of death of a member of the EMS community is due to motor vehicle crashes (MVCs). Each year there are an average of 10,000 fatalities nationwide in motor vehicle crashes. In an average 1000 ambulances per year.

Tips for Emergency Vehicle Operations

Alive on Arrival
Tips for Safe Emergency Vehicle Operations

ITSA

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



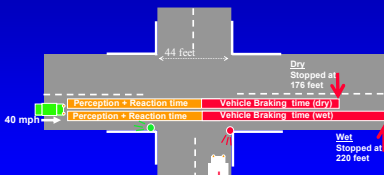
And very Predictable...

- ▶ Intersections are lethal environments

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 ...

EMS CLOSE CALLS
Firefighter's Close Calls.Com

THINK ZONE
EMS Close Calls.com

'Workplace' Hazards





Rollover Crash Kills Medical Technician
 Ambulance Driver 'Got Out and Aided Injured' Before Being Killed in Fatal Collision

It does happen....

But what about head protection?

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???

It isn't like this outside of the USA

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

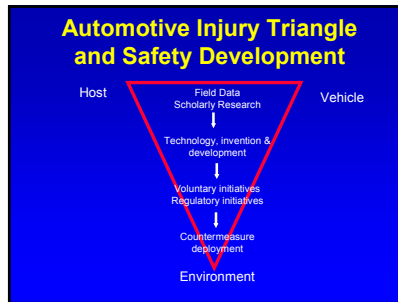
Safety leadership... from the IAFIC and USFA



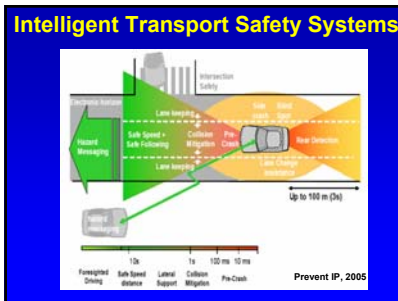
IAFIC NEWS ALERT FOR IMMEDIATE RELEASE
 Contact: IAFIC Communications Department
 International Association of Fire Chiefs
 703/273-0911
www.iafic.org

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


Fairfax, Va., October 20, 2006... The International Association of Fire Chiefs (IAFIC) 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 related responding and returning to emergency.



- ## 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



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



VRBC9300 - Backup Camera

Backup Camera

- Complete with all accessories. Nothing else to buy.
- 135° Horizontal Camera Viewing Angle
- 80° 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

Event Education - Antidote

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

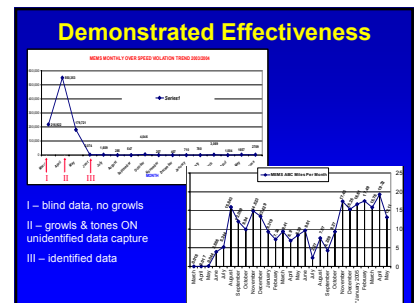


How to modify the risk-taking behaviour of emergency medical services drivers?

Dr. Steven A. Davis MD, CAEP, FAHA, Yorkville, ON, England, UK

... (text partially obscured) ...

- ## Purpose of 'Black box' Program
- ▶ Enhance Safety
 - ▶ Improve Driver Performance
 - ▶ Save Maintenance Dollars
 - ▶ Aid Accident / Incident Investigation



A key to safe ambulance transport



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??

Dynamic Safety Testing

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

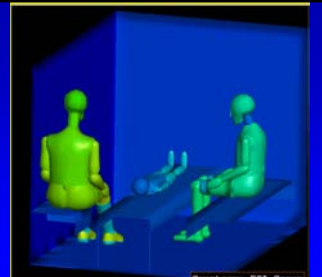
If we know this – and its published....



Why do we do this?



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



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???



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

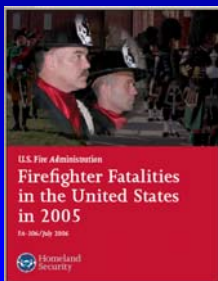
An excellent model



<http://www.EveryoneGoesHome.com>

16 Firefighter Life Safety Initiatives www.EveryoneGoesHome.com

1. Define and advocate the need for a cultural change relating to safety, incorporating leadership, management, supervision, accountability and personal responsibility.
2. Enhance the personal and organizational accountability for health and safety.
3. Focus greater attention on the integration of risk management with incident management at all levels, including strategic, tactical, and planning responsibilities.
4. All must be empowered to stop unsafe practices.
5. Develop and implement national standards for training, qualifications, and certification based on the duties expected to perform.
6. Develop and implement national performance related medical and physical fitness standards.
7. Create a national research agenda and data collection system.
8. Utilize available technology to produce higher levels of health and safety.
9. Thoroughly investigate all fatalities, injuries, and near misses.
10. Grant programs support the implementation of safe practices and/or mandate safe practices as an eligibility requirement.
11. Develop national standards for emergency response policies and procedures.
12. Develop national protocols for response to violent incidents.
13. Must have access to counseling and psychological support.
14. Public education must receive more resources and be championed.
15. Advocacy for the enforcement of codes and the installation of home fire sprinklers.
16. Safety must be a primary consideration in the design of apparatus and equipment.



USA design initiatives



New Australian vehicles



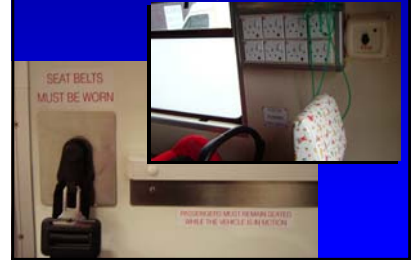
High speed crash, rolled and the occupants (patient and medics) had only minor scratches



UK Ambulance vehicles



Clear safety message



Sweden initiatives



Norway initiatives



Other successful models



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
- ▶ Enhanced cross disciplinary collaboration in development of safety initiatives now exist
- ▶ EMS is still way behind the state of the art in vehicle safety and occupant protection

Thank you!
Any Questions??

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

