

PREHOSPENKONFERENS  
22-23 april 2010

Boras, Sweden, April 22, 2010


## Ambulance Transport Safety Trends: Separating Fact from Fiction

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CEO, Objective Safety  
New York, USA



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### Webinar Basics



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use white board tools to mark your location...  
- pick up the 'blue pen tool' and choose your color



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Today's Webinar is recorded!  
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**all comments typed in the text box**



is available for viewing via a public access link on  
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### 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?

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### Outline

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

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### Who am I?

- Nadine Levick MD, MPH
- Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Harlem, Maimonides, Brookdale & Australia – Royal Melbourne, Royal Childrens Hospitals, Royal Australian Flying Doctor Service)
- Chair, National Academies Subcommittee TRB EMS Transport Safety, USA
- Founder of EMS Safety Foundation
- Recipient, International Society of Automotive Engineers, Women's Leadership Award for EMS Safety



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### Where am I really from? ...Yes, it IS that big!



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**Things can go wrong –**  
 but when there are sound safety policies and technologies in place, and the system is well prepared, you can minimize harm



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**From birds to volcanoes...**

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**The Iceland Volcano Eruption of 2010 (Eyjafjallajökull Volcano)**



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Today's Handout

TRB Summit

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**So, what are the facts?**


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**And how to determine what is fiction??**

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**Sweden a world leader in ambulance safety testing**

Turberl 1980, VTI, Sweden



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**1876 - European Ambulance**



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### Emergency Medical Services (EMS)

**An important and unique transport system**

- Public safety, public health and emergency service
- Is there to save lives

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### Very Important Principle

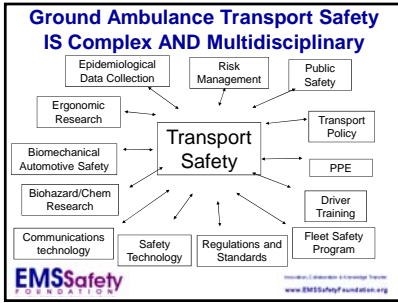
Ambulance transport safety is part of a SYSTEM, the overall balance of risk involves the safety of all occupants and the public

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### EMS Transport Safety

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

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- ### The Public Health Paradigm
1. Define the problem
  2. Measure its magnitude
  3. Understand the key determinants:
    - a. Biologic etiology: host /agent/vector
    - b. Environmental & biomechanic influences
    - c. Social/behavioral practices of at risk pop.
  4. Develop intervention/prevention strategies
  5. Set policy/priorities
  6. Implement and evaluate
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### New Safety Platforms

- Ambulance Safety Information Portal – Objective Safety Website
  - [www.objectivesafety.net](http://www.objectivesafety.net)
- The EMS Safety Foundation
  - [www.EMSsafetyfoundation.org](http://www.EMSsafetyfoundation.org)
- The EMS Safety Subcommittee of the National Academies Transportation Research Board
  - [www.trb.org](http://www.trb.org) &
  - <http://www.objectivesafety.net/TRBSubcommittee.htm>



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### Transport related aspects -

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



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### Real world answers to real world questions -

- What features will enhance safety of my new vehicle purchase?
- What color scheme do I want on my vehicle to make it safest?
- Do I need a helmet, and if so which one?
- What policies offer the safest system?
- How do I get my team to address safety issues?
- What data should I collect when something goes wrong, and how to analyze it?



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### The Ostrich Syndrome?



### and what is killing EMS ?

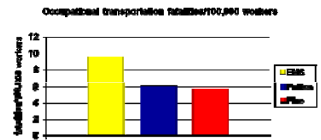
- EMS personnel fatalities\*
- 74% transportation related
    - 1/5 of ground transport fatalities were struck by moving vehicles
  - 11% were cardiovascular
  - 9% were homicide
  - 4% needle sticks, electrocution, drowning and other

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



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### 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



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### Predictable risks

- Fatal crashes more often at intersections, & with another vehicle (p < 0.001)
- 70% of fatal crashes EMS crashes during Emergency Use\*
- 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#
- More likely to crash at an intersection with traffic lights (37% vs 18% p=0.001) & more people & injuries/crash than similar sized vehicles##

\*Gavin CA, Pinalto RG, Kuviv EM, *Prehosp Emerg Care* 2001 Jul-Sep;5(3):261-9

\*\*Bledsoe, Zankovych, Levick, L. *Millr Ann Acad Press* 2003

\*\*\*Maguire, Hunting, Smith, Levick, *Annals Emerg Med* Dec 2002

#MOSBY 2003

##Ray AM, Kagan OF, *Prehosp Emerg Care* 2005 Dec; 9:412-415



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### Ambulance transport a serious USA transport safety problem...

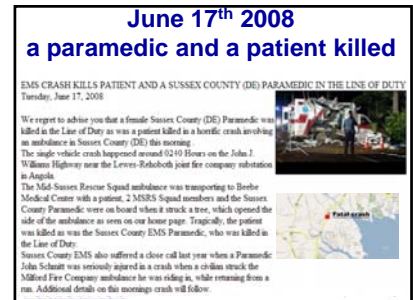
- the most lethal vehicle on the road both per mile travelled and per vehicle
- is exempt from federal commercial fleet safety oversight (FMCSA)
- 2/3 fatalities not in the ambulance
- Exempt from most FMVSS standards



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January 10, 2008







### August 2009 – Impaired...

**EMS RESPONDER**

Home News Training Multimedia News Guide Forum Helpdesk Events

Published: Thursday, August 13, 2009  
 Modified: August 13, 2009 8:05:00 AM EDT

**Kentucky EMT Indicted on Murder Charges after Crash**

By Andy Hawk, EMSKY  
 Story first published 8/13/09

LOUISVILLE, Ky. —

A Louisville EMT who was driving an ambulance involved in a fatal crash has been indicted on several criminal charges, including murder and operating a motor vehicle under the influence of alcohol.

Sammy Brewer, 36, was behind the wheel when that crash took place in April 2008. The subject made the ambulance, Volvo H3000, SC, out of her rig from the wreck.

Only HAWK was there April 30 when Brewer appeared in court to face a no proof of insurance charge after she was involved in an unrelated non-injury accident in her own vehicle.

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### October 22, 2009, TN Patient and Provider killed, Attendant Critical

Substantively, 1997 truck collides on I-40, ambulance

An accident on Interstate 40 this afternoon killed an adult before 7 p.m., a Rural/Metro ambulance attendant and driver, a Tennessee Department of Transportation spokesman says. The ambulance driver, David Chen, a firefighter at Vanderbilt Medical Center, where he died.

The elderly patient died at the scene, her name has not been released.

Healthcare firefighter and Rural/Metro employee Brian Johnson, 51, was in the rear of the ambulance assisting the patient when the crash occurred. He was transported to Vanderbilt Medical Center where he is in critical condition, MedStar said.

TODAY vehicle driver Robert Green, 40, of Columbia was transported to Vanderbilt Medical Center where he is in stable condition, MedStar said.

As of 5:45 p.m., traffic on the northbound lanes of I-40 was moving, but southbound traffic was moving slowly, MedStar said. There were also significant delays on I-40.

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### December 2009

NV 1

Wagon drifts, rolls over

Emergency Skills Reduction in Bradford

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### January 14, 2010

WARREN COUNTY, N.J. NEWS

Warren County News for Education, Transportation, and Events

Emergency Skills Reduction in Bradford

**Ambulance accident on Route 519 in White Township claims patient in back - UPDATE**

By Christine Thomas, Staff  
 January 14, 2010, 12:00 PM

White Township, where the ambulance accident occurred.

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### February 17, 2010 NYC

Local News

**Ambulance crashes into car as gunfire erupts**

Published: February 17, 2010

Local News

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### April 5, 2010

<http://www.pocconorecord.com/apps/pbcs.dll/article?AID=20100405/NEWS/4050316>

Pocono Record

Wagon drifts, rolls over

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### Data...

- What is your transport safety record in your service?
- How can you improve if you don't have a meaningful measure of safety performance?
- Transport safety is not guesswork, it is a science

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### Haddon/Baker/Runyan Phase-Factor Matrix as applied to EMS Safety

FACTOR	Paramedic/ patient (post)	Vehicle	Environment (physical/regulatory)	Sociocultural	
PHASE					Effectiveness
pre-crash (pre-event)	driving history, driver education, speeding, winding road, lane	collision avoidance, anti lock brakes, vehicle weight, speed	terrain, elevation, road design, markings, & surface	EMS usage (scope & role), public/paramedic awareness, documentation from I & S	Cost benefit
crash (event)	seat belt, restraint use, child safety seat use	Non-hostile interior, restraint design, bumper & crumple zone design	collision speed, road side hardware	EMS system quality	Ethics
post-crash (post-event)	gender, severity, age, underlying morbidity	ease of extrication, burn resistant fabrics	EMS system quality, trauma care, radio management	rehabilitation, documentation and data collection	Social acceptability
					Societal need

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## 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

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## USA EMS transport safety data estimates

- ~ 50,000 vehicles
- ~ 9,000 crashes a year
- ~ One fatality each week  
– ~ 2/3 pedestrians or occupants of other car
- ~10 serious injuries each day
- Cost estimates > \$500 million annually

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## and what is an EMS crash?

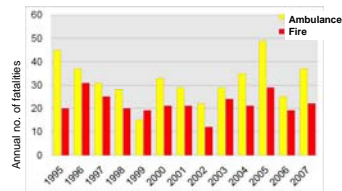
- Definition of an EMS crash
- Definition of Emergency Response Mode

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## USA Emergency Vehicles

Minimum Annual Fatalities 1995-2007



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FARS GES data 1995-2007  
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## FARS – A National Data Set?

Small numbers – but NO data captured from 20% of the nation in 10 years

Total Fatalities Per 100 Million Population  
1996-2006



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## Safety oversight of what and .... by whom

- Vehicle Safety
- Vehicle Design
- Transportation systems safety
- Safety Equipment Design
- Vehicle and Safety Equipment Testing and Standard development
- Safety policies

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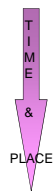
## In the USA there are more safety standards for moving cattle than for moving patients



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## 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



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## The Emergency Department (ED)



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An ambulance is not an ED /ICU on wheels



### The laws of physics prevail...

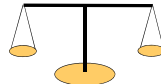
- and they don't care what your job title is or if you are a patient, a provider or a member of the public

### Science behind Policy

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

Richard P. Feynman 1988

### Balance of concerns and risk during transport



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

### Safety is Good Business



### Safety Management

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

### 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.....



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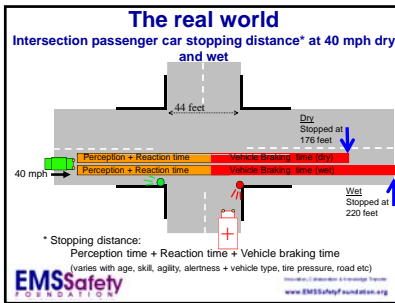


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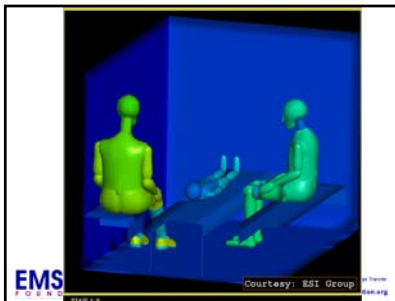
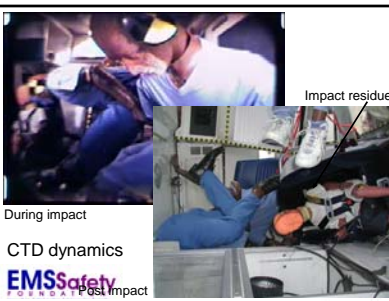
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**Testing the real world**



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**And this all takes place in 60 milliseconds – the blink of an eye**



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**Deceleration Sled test**  
(upon impact) 24 G, 30mph

Levick NR, et al. Development and Application of a Dynamic Testing Procedure for Ambulance Pediatric Restraint Systems, SAE Australasia 1998;58:2:45-51

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**PPE from the stationary environment can be highly hazardous in the automotive setting**

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**NOT new technical data...**

Richardson S.A., et al, Int. J. of Crash., 4:3, 239 – 259, 1999

Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

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Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

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**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 over both shoulders for sidefacing occupants are potentially lethal – and in **NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE**

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**What do we know???**

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

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**Creating a Safety Culture**

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

- Awareness
- Training
- Incentive

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**The inevitable bottom line...**

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**EMS RESPIREWAVE June 2007**

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### Golden Hour Summary

- This study suggests that in our current out-of-hospital and emergency care system time may be less crucial than once thought. Routine lights-and-sirens transport for trauma patients, with its inherent risks, may not be warranted. [Ann Emerg Med. 2010;55:247-248.]

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### Priorities..... Research papers in the past 30 years

- EMS Safety
  - 42 papers - on ambulance safety
  - 2 papers - on ambulance ergonomics
  - 1 paper - on stretcher ergonomics
- Computer Workstations
  - 30,000 papers - on ergonomics of computer workstations

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### We should use the best safety practices demonstrated in engineering

Development of an Effective Ambulance Patient Restraint

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

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

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SAE TECHNICAL PAPER SERIES 2008-01-2695

### Ambulance Vehicle Crashworthiness and Passive Safety Design: A Comparative Evaluation

Additionally there was a serious concern about a further system failure in the design of the SBCA vehicles. This was the seating design that included a seating configuration in the rear living seating position that could be modified to provide a small restraint system for use for a child. The concerns of the author address the safety of a child in that seating design. Finally, given that the modified seat did not offer lateral protection (as a standard child safety seat would offer) and that it also exposed the child to various head strike hazards in the event of a side or other impact. Carefully, seated a child patient be seated in that position that face these would be low, further increases in hazard. One that medical care access is not practical with a child seated in that manner with their back against the wall, and second, there was no safe way for an ambulance provider to provide medical care to a child patient in that position without putting both the child patient and the provider at risk. This is due to the provider having no

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### and in ergonomics

Ergonomics in the emergency services - Ergonomic evaluation of ambulance seats

Reviewing ambulance design for clinical efficiency and paramedic safety

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### Range of reach.. This is a well defined technical science

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### 'Workplace' Hazards

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### Ambulance Transport Safety Summit

October 29, 2009  
National Academies  
Transportation Research Board

<http://www.objectivesafety.net/TRBSummit2009.htm>

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### TRB Summit Focus

- *'Bridging the gap between what we do and what is known - Enhancing ambulance transport safety through shared knowledge of technical data'.*



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### October 29, 2009 TRB Summit



### What could you learn from the National Academies – right NOW and gratis

- The realm of burden and benefit
  - measuring the safety of the system
  - determining the economic, ethical and risk benefit challenges
- Transport System Management
  - fleet safety and oversight technologies and policies
  - operations management – dispatch, congestion routing, deployment of resources, benchmarking
- Vehicle safety
  - occupant protection design and testing
  - Vehicle performance safety
  - vehicle and personnel human factors issues
- Dissemination and Policy
  - Knowledge transfer
  - Standards, specifications and policy



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### Its out there NOW

- TRB 2009 Summit – addressed the key and interdisciplinary issues, in one day – please seek that information out.
- There have been two TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise
- See [www.trb.org](http://www.trb.org), and for the Summit archives: [www.objectivesafety.net/TRBSummit2008.htm](http://www.objectivesafety.net/TRBSummit2008.htm) [www.objectivesafety.net/TRBSummit2009.htm](http://www.objectivesafety.net/TRBSummit2009.htm)



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### 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]
  - [Fleet vehicles - ASSE/ANSI Z15 ]
- USA Other
  - Purchase Specification: KKK
  - "Standards" - NTEA – AMD, ASTM F 20, NFPA (devel)
  - Guideline: EMSC Dos and Donts, and (ASTNA, CAAS and CAMTS)



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### October 2008 JEMS Article "Rig Safety – 911"

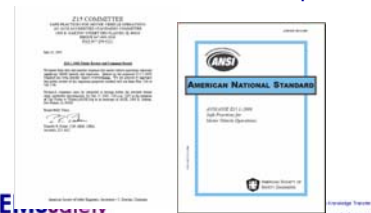


<http://www.objectivesafety.net/JEMSRigSafety911.pdf>



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### American National Standard ANSI/ASSE Z15.1-2006 Safe Practices for Fleet Motor Vehicle Operations



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### 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



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### Australia & New Zealand Ambulance restraint standard AS/NZS 4535:1999

- "Restraint systems shall apply to all equipment and people carried in an ambulance..."
- Dynamic Testing - 50th & 95th percentile manikins
- 24G in Forward and Rearward
- 10G in Transverse



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### Common European Community (CEN) EN 1789:1999/A1:2007

European Committee for Standardization  
Medical vehicles and their equipment - Road Ambulances

- “Without exception, all persons, medical devices, equipment, and objects normally carried on the road ambulance shall be maintained to prevent them from becoming a projectile when subject to a force...”
- 50th percentile manikins - 10 G in Forward, Rearward, Transverse, & Vertical directions

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### ISO – 39001

#### Road-traffic Safety management systems

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### USA KKK ambulance purchase specifications

#### GSA:KKK-A-1822F, Aug 2007

- Specifications for the purchase of a Star of Life Ambulance
- Static Pull test
- 2200 Lbs. static stretcher test in longitudinal, lateral & vertical
- No dynamic test for vehicle, occupants or equipment
- No automotive test manikin
- Voluntary

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www.ntea.com/WorkArea/downloadasset.aspx?id=1352  
www.EMSSafetyFoundation.org

### USA Ambulance Manufacturing Division (AMD)

#### Ambulance Standards – August 2007

- No dynamic or impact test
- No automotive test manikin
- Mandates NO ‘crumple zone’
- No impact tested anchorages for occupant restraint or equipment
- Internal, not independent

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http://www.ntea.com/WorkArea/showcontent.aspx?id=1350  
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### 2010 USA ambulance ‘safety testing’ !?!? – Is NOT consistent with accepted automotive safety practice...

#### AMBULANCE TEST RECORD BROKEN

36,000 lbs	55,000 lbs on ROOF	55,000 lbs on SIDE
------------	--------------------	--------------------

THAT WAS THEN      THIS IS NOW...

In 2000, shattered industry records by testing and certifying the modular body to more than double the 150% curb weight Federal Standard. In addition, they performed a body side test that had never been seen before. Now has broken that record with a 55,000 body test on the top and side of the module. The ambulance body is now certified to a 500% curb weight level!

INDUSTRY LEADING SAFETY INNOVATION

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### No ‘a’... then NO ‘F’ !!!!!

- $F = ma$

where    F – force  
          m – mass  
          a – acceleration

Sir Isaac Newton (1642-1727), Philosophiæ Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy), published in 1687. [http://en.ck12.org/wiki/Newton's\\_Laws\\_of\\_Motion](http://en.ck12.org/wiki/Newton's_Laws_of_Motion)

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### News we don't want to see

Jan 22, 2007 8:39 am US/Eastern

## Caught On Video: EMT Struck By Car

Ken Young Reporting

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

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

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

### Day visibility



### Night visibility



### Distances of Nighttime Visibility

Wearing White is NOT Enough!

THE PERFECT LIGHTING: RETRO-REFLECTIVE

5000 ft

Distance driver with first-acc. pedestrian

300 ft

100 ft

80 ft

33 ft

Challenging Color

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### Policy and practice ignorant of existing technical safety data

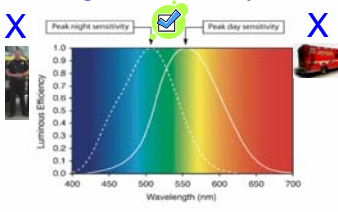


Figure 1. The scotopic (dashed line) and photopic (solid line) luminous efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

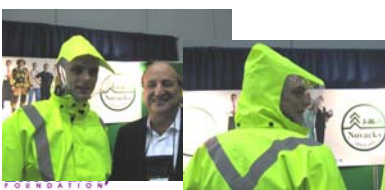
### Impressive high visibility clothing and gear



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### This addresses some very real risks, very creatively – and currently ONLY available in London Ontario!



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### Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

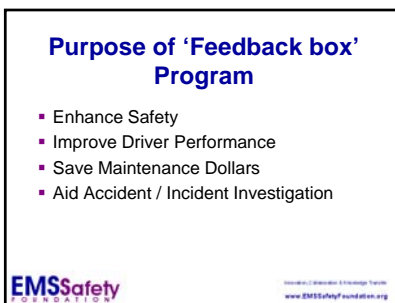
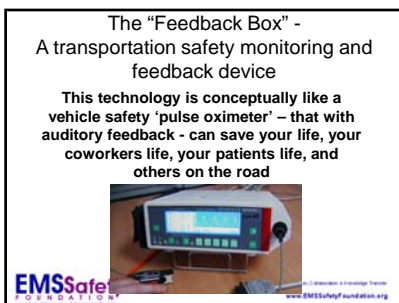
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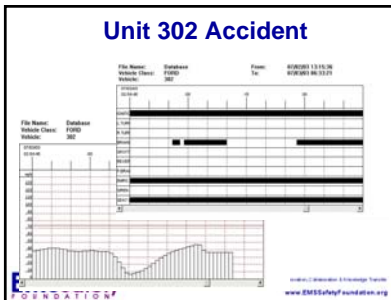
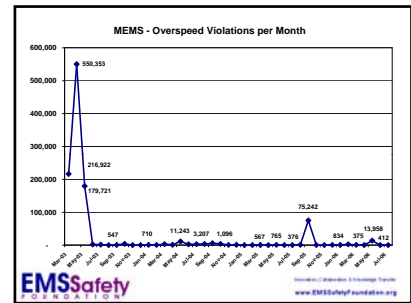
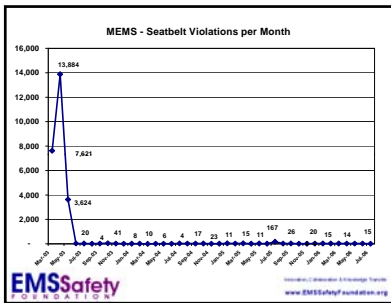
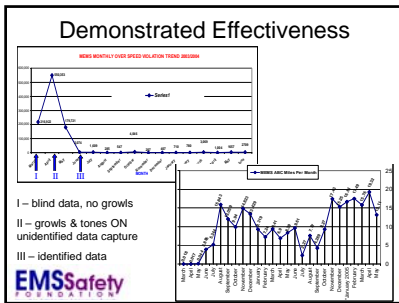
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- Having access to that technical knowledge supports changes to improve safety practice

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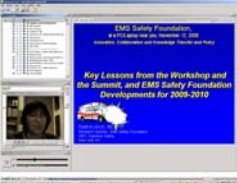
- ### Feedback box Summary
- The system works
  - Objectively improved performance
  - No increase in response times
  - At fault accidents reduced
  - Accepted into the culture
- However:
- The system requires monitoring
  - Must be reinforced by management
  - Must be incentives for good performance
  - Must be consequences for poor performance
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- ### Extensive Indirect cost savings
- Fewer out of service vehicles
  - Improved transport times
  - Decreased administrative lost in managing unsafe behaviors
  - Decreased legal burden
  - Automatic system wide data
  - Insurance benefits
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- ### 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
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**The EMS Safety Foundation**  
November 2009 Webinar for Public Access  
[www.EMSSafetyFoundation.org](http://www.EMSSafetyFoundation.org) and [www.objectivesafety.net](http://www.objectivesafety.net)



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**The EMS Safety Foundation:**  
**A practical and functional model**

Interdisciplinary and Operational

- Innovation
- Collaboration
- Knowledge transfer

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**Mission**

- This is a team of like minded innovators across EMS Medical Transport and a number of technical disciplines, who share the common mission of enhancing the safety of EMS delivery for all involved.

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**R & D**  
**“Ripoff and Duplicate”**

- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

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**EMS Safety Foundation Delegation**  
**seeking out International Innovation**



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**Safe and Ergonomic design**



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**Loading Patients Without**  
**Breaking EMT Backs**



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**Ergonomic layout and equipment**



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### Flexibility to manage two patients

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### EMS Safety Foundation Ambulance Vehicle & Ergonomics Workshop, October 2009

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### Important...

- Ergonomics and automotive safety issues are interrelated
- Crashworthiness priorities override the ergonomic issues

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### Automotive engineers addressing EMS Safety Foundation Workshop

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### VEHICLE DESIGN and SAFETY

- ESC ELECTRONIC STABILITY CONTROL

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### Passive Safety-Seat Structure

Structural Enhancement

From U.S. Patent 7,328,938

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### Passive Safety- Vehicle design

Fold-in ridges on subframe

Front axle module

- A main feature in a front-end crash is the "disconnectable" front axle, which releases additional deformation zones in the longitudinal frame member when a particular force level is reached.
- On a frontal crash, transmission and engine will be pushed underneath front occupants.

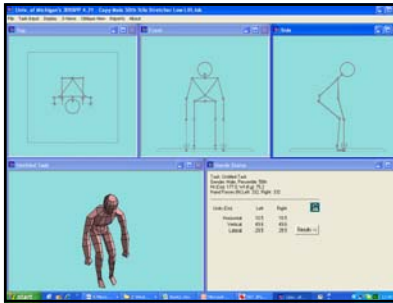
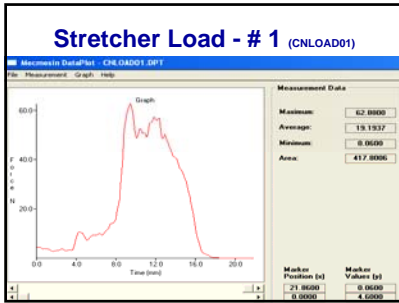
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### Ergonomist Chris Fitzgerald addressing the Workshop

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### Stretcher lifting & loading

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### Univ. of Michigan's 3DSSPP 4.21 - Copy Male 50th %ile Stretcher Low Lift task - [Analysis Sum]

Company: Risk Injury Management Services, Analyst: Unknown, Date: 10/29/09  
 Task: Unified Lark  
 Gender: Male, Percentile: 50th, Height: 177.0 Cm, Weight: 75.2 Kg  
 Comment:

Hand Loads	Force(N)	Left	X	Y	Z	Mag	Right	X	Y	Z	Mag
	0.0	0.0	-332.0			332.0	0.0	0.0	-332.0		332.0

L5/S1 Disc Compression(N): 5864 +/- 420  
 BCDL> | (-BCDL

Percent of Population Capable	Elbow	Shoulder	Torso	Hip	Knee	Ankle	% Load Left	% Load Right	SE Balance	CG Balance	Coef of Friction
	99	96	70	66	99		50	50	Acceptable	False	0

3DSSPP4.21, Copyright 2000, The Regents of the University of Michigan, ALL RIGHTS RESERVED

### Collaboration and Outcomes

- Interdisciplinary Collaboration is what is key – not orthopedic folks talking to cardiologists – BUT collaboration between the health care folks appropriate automotive and occupant protection engineers and transportation system design, ergonomists and industry standards that make sense – and
- Meaningful measures of outcome and performance

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Hi,  
 Thank you for a great experience at FallSafe!  
 Hello everyone!  
 What a great event and "eye opening" experience. The opportunity to see the vehicles and equipment up close was certainly valuable but even more valuable was the ability to discuss innovations and current practices among the group. I can't thank everyone enough for their willingness to share, especially the expert panel from the foundation (Chris, Gene, Ragh & Nadine). With everyone's help I have a much clearer understanding of what our goals should be and how to achieve them.  
 I hope every sponsor knows how much we appreciate their support and hospitality!  
 Mark Kessler, LP  
 Director Ground Services  
 CareFlite

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### Careflite's new vehicle

EMSSafety FOUNDATION CareFlite+

### Perspective from Norway

Ronald Rolfsen  
 Adviser  
 Oslo university hospital - Pre-hospital division / Ambulance department

Geir Vidhammer Engely  
 Asst. Section leader/Paramedic  
 Oslo university hospital - Pre-hospital division / Ambulance department

Norwegian Public Roads Administration Motor Vehicle and Driving License Inspectorate:  
 Liv Bråmark  
 Coordinator, Ambulance group  
 Stein Erichsrud  
 Senior Engineer

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### "Together for your safety"

#### Ambulance Investigation - Norway

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### "Together for your safety"

#### National analysis group

- National Health Authority  
 Licensing health professionals
- National Vehicle & Roads Administration  
 Approval and technical control of ambulances
- Paramedics from Oslo university hospital

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Statenus vegresen "Together for your safety"

### Ambulance investigation

- Accidents involving an ambulance with injury or death
- Accidents involving an ambulance with major damage to property
- Accidents where equipment inside the ambulance cause injury / danger of injury

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### Technical Collaboration is key

- We are NOT the experts in this science
- We cannot afford to play the silo game here, it is costing lives, time and money
- We MUST have a meaningful evidenced based approach to design, operations and policy
- We must be outcomes driven

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### What do we know???

- 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
- Head protection??
- Electronic Driver monitoring/feedback systems appear to be highly effective

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Access the following documents here at the Resources/documents tab at [www.objectivesafety.net](http://www.objectivesafety.net)

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

EMSSafety FOUNDATION Incident | Information | Knowledge Transfer  
www.EMSSafetyFoundation.org

### Tips for Emergency Vehicle Operations

EMSSafety FOUNDATION Incident | Information | Knowledge Transfer  
www.EMSSafetyFoundation.org

### USFA Emergency Vehicle Safety Initiative

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### Traffic Incident Management Systems (TIMS)

- Released April 2008
- FEMA, USFA, IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents

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### Risk/Hazards

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

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## What do we know works...

- Vehicle Operations Safety Policies
- Squad bench lap seat belts
- Patient over the shoulder belts
- Securing equipment
- Forward and rear facing seating
- Some electronic technical devices
- Safety awareness
- Cultural change

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## 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

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## 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

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PREDICTABLE  
PREVENTABLE  
and  
NO ACCIDENT

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## Be ready for..

- New Infrastructure
- New information
- New collaborations
- New events
- Innovation in safety technologies, strategies and policy
- Knowledge transfer
- Unacceptable mythology
- Challenges to advancing EMS transport safety

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## 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

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## 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

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Thank you!  
Any Questions??  
Electronic handout available online  
<http://www.objectivesafety.net>



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