Interact 2010

October 22, 2010, Winnipeg, Manitoba

Ambulance Transport Safety -

Are You on the Ride of Your Life?

and

Why the Sprinter Rocks!

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

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A tragic time for EMS in Canada

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October 19th, 2010

Tofino | Ucluelet | Port Alberni | Nanaimo | Oceanside

Ambulance Crash Claims Two Lives

By Karen Green The Canadian Press TOFINO, B.C. -- An ambulance making an early morning trip down a twisting, steep highway winding around a mountain lake skidded off the road and plunged into the water, killing the two attendants on board Tuesday.

B.J. Chute, spokesman for the province's paramedics union, confirmed the two members -- one male and one female -- were killed after their vehicle crashed into Kennedy Lake in the early morning.

Police, fire and highway maintenance officials were down onto the scene of Tuesday's crash. (Karen Green Photo)

Rescue teams were working to retrieve the bodies.

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CUPE Local 873

Ambulance Paramedics President's Statement on Tragic Accident Involving Paramedics - Canada

CUPE Local 873 (Ambulance Paramedics) President John Strohmaier today issued the following statement upon learning of the tragic deaths of two ambulance paramedics earlier today.

It is with deep sadness that I must confirm the loss in the line of duty of two paramedics during a motor vehicle crash early this morning. The paramedics were returning to their home base of Tofino, B.C. after transferring a patient to Port Alberni hospital. Both paramedics were long-serving members of the Ambulance Paramedics of BC and the BC Ambulance Service, providing many years of life-saving service to their community.

Our hearts and minds are solely with the paramedics' families at this time. We will do our utmost to support them in any way we can, as well as to support the thousands of paramedics throughout B.C. who are severely shaken by this terrible loss of their colleagues and friends.

We will work closely with the investigators from the RCMP and Worksafe B.C. to determine the facts of this tragedy, and that anything learned will guide us in ensuring this never happens again.

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British Columbia

Dead paramedics were 'wonderful, warm people'

AMBULANCE CRASH

PORT ALBERNI

TOFINO

KENNEDY LAKE

UCLUELET

Photos

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October 18, 2010

An ambulance lies on its side after a crash with an SUV in Cooper City, Fla. Three paramedics and one patient were inside the vehicle at the time.

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October 15, 2010

GALAX, Va. -- Five people, including four people in an ambulance, were injured late Friday Oct 15 in a crash at the intersection of East Stuart Drive and Cranberry Road

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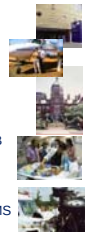
Who am I?

- Nadine Levick MD, MPH
- Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Harlem, Maimonidies, 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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What I hope to cover today

- Ambulance transport safety "is part of a system"
- Patient safety...and provider and public safety too?
- "It's an unsafe system...why?"
- Issues with Ambulance manufacturing
- Need for measurement for safer performance
- Creating a 'culture of safety' thru awareness, training, design, technology and incentive.

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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?
- What can we learn from international colleagues

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Outline

I. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public

II. Highlight unacceptable mythology and challenges to advancing EMS transport safety

III. 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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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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Your Interactive Handout awaits you online at…

- www.objectivesafety.net

This WILL be FAST!!
No need to take any notes – all text slides will be awaiting you in your online Handout

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http://www.objectivesafety.net

Your Handout and Additional Resources

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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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Ontario EMS Occupant Safety

30 August 2010

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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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Tragedy you don't want to be involved in

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Patient Safety UK- A routine concept…

But Patient Safety is just one part of this system

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EMS Transport Safety

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

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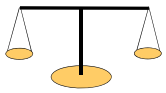
Balance of concerns and risk during transport



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

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Some odd USA and also Canadian facts

- Ambulances are generally not built by the automotive industry
- Intelligent Transportation Systems (ITS), transportation safety engineering is 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

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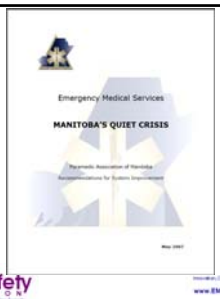

Ambulance transport a serious transport safety problem…

- 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

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

ESC – Does your ambulance have it??

- Transport Canada announced that effective August 31, 2011, automakers must install Electronic Stability Control (ESC) technology in Canadian vehicles.
- ESC helps drivers stay in control when they need to swerve or brake suddenly to avoid an obstacle or turn corners on slippery roads.
- Vehicles equipped with ESC are involved in fewer severe collisions caused by loss of control, resulting in significantly fewer deaths and injuries

So

- What's important
- What's not important

- What's going to save your life
- What might take your life

- What's going to hurt you
- What's going to protect you

- What is factual
- What is garbage

- What is new
- What is not new

Some new dimensions

- Vehicles – smarter, sleeker, safer – CHEAPER!
- Operations – new technology tools
- Interdisciplinary infrastructure – new global platforms

Systems safety of:

- Getting you, your patient and equipment in and out of the vehicle
- Providing patient care inside the vehicle
- Occupant protection in crash and near miss situations

Safety Performance

- Measurement
- Outcomes
- Technical expertise

What is a safe speed and how do we identify that?

What is a survivable impact ?

12 mph (20 km/hr)?

What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

~ 30 mph - survivable

What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

~ 60 mph – not survivable

A survivable impact??

A serious problem…

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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- Transport Medicine

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- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

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A "Fleet" to many in Emergency Medical care means….

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Safe Systems Approach

Source: Road Safety Branch, Infrastructure and Surface Transport Policy, Department of Infrastructure, Transport, Regional Development and Local Government, Australia.

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Key Elements to Safety

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

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Firstly!

- An accident ?
- or a predictable and preventable event

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A tragic emergency health care intervention outcome

It does happen….

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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

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Negative impact on system performance…

- BUT an EMS crash can kill all those involved AND wipe out a rural EMS system AND negatively impact a regions response capacity……

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Ambulance Transport Safety

- Emergency care, public heath, public safety, and patient transportation.
- Important Principle:
  Ambulance transport safety is part of a system, the overall balance of risk involves the safety of all occupants and the public
- All get home safely

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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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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 AND Canada there are more safety standards for moving cattle than for moving patients

Absence of standards and oversight

- Challenges in identifying best practice
- Myriad of unregulated commercial products
- No safety performance standards
- Absent national safety oversight

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- What we need to consider, where is the 'bang for buck' in ambulance transport safety:

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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 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

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The Emergency Department (ED)

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An ambulance is not an ED /ICU on wheels

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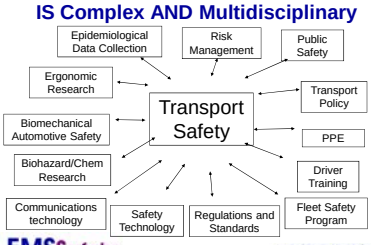
Ground Ambulance Transport Safety IS Complex AND Multidisciplinary



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Do we ask vehicle builders to write cardiac arrest protocols…? Vehicle design and safety is not what we are trained to do!!!!

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Would we….?

Seeing that we are health care providers – lets look at it this way –

- Would we use medical equipment that was built by folks who were not technically qualified or trained biomedical engineers and who just said – "this device is safe"?
- Or would we expect them to be qualified in this field and that their products were tested in a meaningful way to ensure that they were safe?

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April 14th, 2008

Ambulance worker loses arm in accident - West Nyack, New York

An emergency service worker lost her right arm today after the ambulance in which she was a passenger crashed into a truck parked along Route 59 near the flyover to the Palisades Center mall.

Bonnie Ames, 20, was taken by helicopter to the Westchester Medical Center in Valhalla where she underwent surgery.

"She's out of danger, but she lost her arm," Raymond Florida, director of **Rockland Paramedic Services** said early the evening.

"We used multiple units from the jaws of life to extricate her," West Nyack Fire Chief George Drescher said. "She appeared to be seriously injured."

The paramedic van driver, 19-year-old Scot
there to Westchester Medical Center, said

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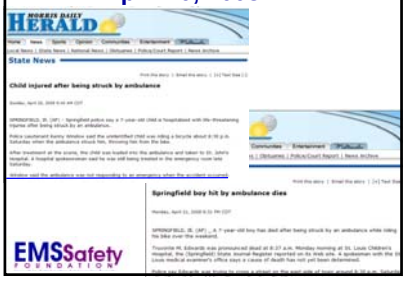
April 20, 2008..??



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June 17th 2008
a paramedic and a patient killed

EMS CRASH KILLS PATIENT AND A SUSSEX COUNTY (DE) PARAMEDIC IN THE LINE OF DUTY
Tuesday, June 17, 2008

We regret to advise you that a female Sussex County (DE) Paramedic was killed in the Line of Duty as was a patient killed in a horrific crash involving an ambulance in Sussex County (DE) this morning.
The single vehicle crash happened around 0240 Hours on the John J. Williams Highway near the Lewes-Rehoboth joint fire company substation in Angola.
The Mid-Sussex Rescue Squad ambulance was transporting to Beebe Medical Center with a patient. 2 MSRS Squad members and the Sussex County Paramedic were on board when it struck a tree, which opened the side of the ambulance as seen on our home page. Tragically, the patient was killed as was the Sussex County EMS Paramedic, who was killed in the Line of Duty.
Sussex County EMS also suffered a close call last year when a Paramedic John Schmitt was seriously injured in a crash when a civilian struck the Milford Fire Company ambulance he was riding in, while returning from a run. Additional details on this mornings crash will follow.

In this vehicle…

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October 31, 2008 - Kentucky

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April 30, 2009 - Tennessee

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August 2009 – Impaired…

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EMT Indicted On Murder Charges

Tammy Brewer Driving Ambulance Involved In Fatal 2008 Crash

By Andy Alcock/WLKY

POSTED: 11:36 am EDT August 13, 2009
UPDATED: 6:17 pm EDT August 13, 2009

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

Tammy Brewer, 36, was behind the wheel when that crash took place in April 2008. The patient inside the ambulance, Vickie Whobrey, 54, died of her injuries from the wreck.

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

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December 2009

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January 14, 2010

February 1, 2010

Sept 16, 2010

- This IS a Transportation and Automotive Safety issue

Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

Important…

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

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

MedStar Ambulances Will No Longer "Run Hot" When Transporting Cardiac Arrest Patients (4/21/2010)

- "MedStar ambulances will no longer 'run hot' - when paramedics inside are giving chest compressions to patients in cardiac arrest, officials say." This "policy, which took effect Friday, will affect about 1,400 of the more than 100,000 calls to which MedStar responds annually in the 15 Tarrant County cities it serves."

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Safety is Good Business

A problem

2007 Insurance data –

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

2003 Insurance data –

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

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Expensive….


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@times.com

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

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

Very Expensive


$24 Million Judgement Against AMR

AN ALAMEDA COUNTY, CALIFORNIA, JURY ORDERED AMERICAN MEDICAL RESPONSE (AMR) to pay nearly $24 million damages to a man who was permanently paralyzed after a traffic accident involving one of their ambulances.

On April 16, 2007, Louis Del Barba, 85, was driving his auto and making a turn when he was broadsided by the ambulance. The ambulance's speed was measured at 65 mph in a 35 mph zone. Experts agreed that such a speed, in rush hour conditions, was reckless and unsafe.

A press statement released yesterday by the plaintiff's lawyers stated:

Mr. Del Barba had the right of way and was wearing a shoulder and lap seat belt when the crash occurred. As a result of the accident, he received numerous traumatic injuries and is paralyzed completely, save for some movement of his head and left arm. He is constantly dependent on a ventilator.Doctors believe that he can return to his 110-year-old family home if there are funds to fit a room for medical care. The jury felt strongly that Mr.

EMS CANNOT Afford to keep paying out like this….

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Safety saves time, lives AND money Canada, Nova Scotia

- Since 2000 working towards a goal of zero loss ratio with insurance provider
- 10 million kilometers per year
- 150 emergency response ambulance units
- Collision claim history measured in dollars per 100,000 kilometers traveled:
  - 2000/2001 $ 1725.00
  - 2001/2002 $ 1049.00
  - 2002/2003 $ 751.00
  - 2003/2004 $ 416.00
  - 2004/2005 $ 229.00

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Ambulance accidents down

System put in place | Ambulance NB says safety program works

And very Predictable…

- Intersections are lethal environments

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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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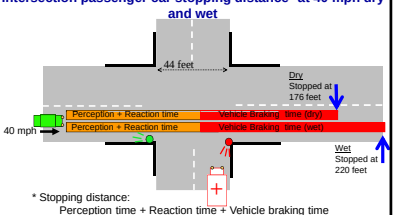
The real world

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)

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Dynamic Safety Testing

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

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Dynamic Sled Testing of Ambulance Pediatric Restraints

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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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Why do we do this?

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Testing the real world

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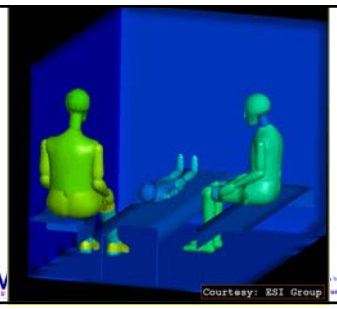
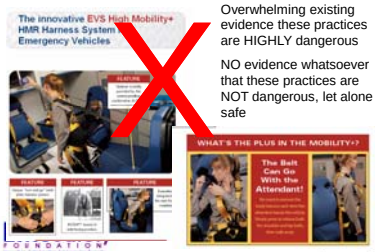
And this all takes place in 60 millisecs – the blink of an eye

CTD dynamics



A few key words about restraint systems…

Systems safety failure AND dangerous



Overwhelming existing evidence these practices are HIGHLY dangerous

NO evidence whatsoever that these practices are NOT dangerous, let alone safe

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

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

What do we know now??

- 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

Air EMS is a role model for safety initiatives and focus

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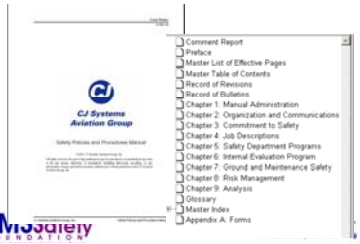
An Aviation Safety Plan



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Air Safety Approach

- Safety Program Planning
- Evaluating
- Analysis of Safety Performance
- Analysis of Safety Information and Data
- Analysis of Risk Profiles and Plans

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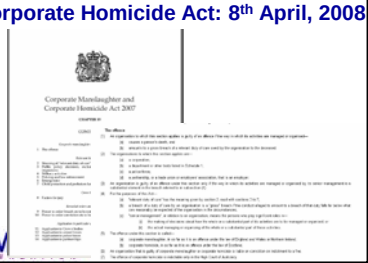
Canada - Corporate Manslaughter Corporate Homicide Act: 8th April, 2008



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

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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##

*Kahn CA, Pirralio RG, Kuhn EM, Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9
**Becker, Zaloshnja, 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;413-415

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Is response time really a meaningful measure of patient outcome??

- What are the confidence limits?
- What about demographics, population density?

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Jan 2010 - Evaluating Trauma Management Performance in Europe

Yongjun Shen, Elke Hermans, Da Ruan, Geert Wets, Tom Brijs and Koen Vanhoof

Data Envelopment Analysis

 # EMS Stations/
- 10,000 citizens
- 100 km rural road length
- 1000 km² area

 # Staff/

 # EMS Transportation Units/
- 10,000 citizens
- 100 km rural road length
- 1000 km² area

EMS response times/

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

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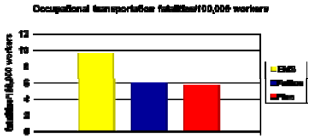
Occupational transportation fatalities..



- 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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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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So does it make sense ?

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

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Current accepted safety design and transport system technologies are being ignored, and worse…

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And…

This is in a setting where

- transport safety is the major and most costly adverse event in EMS
- And there have been all sorts of major technical and informational developments since Jan 2006

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New Information/Technical Developments Jan 2006- Jan 2010

- SAFETEA-LU, 2006 – EMS identified as one of the 4 E's
  - (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users)
- International Ergonomists Association (IEA) - publication June 2006
- Enhanced Safety of Vehicles (ESV) - publications June 2007, 2009
- American Society Safety Engineers (ASSE) - publications June 2006, 2007
- National Academies TRB – Inaugural EMS Safety address, Jan 2007
- NEMSAC established – April 2007
- AMD Engineering Public Comments, July 2007
- KKK-F, August 2007
- OSHA September 11, 2007 EMS safety in Federal Register
- State Strategic Highway Safety Plans, October 2007
- Sporadic State EMS Council Transport Safety Policies
- APHA EMS Safety technical abstracts - Nov 2007, 2008, 2009
- EMS Safety Foundation established – Dec 2007
- National Academies TRB – Inaugural EMS Safety Subcommittee meeting Jan 2008
- National Academies TRB– first EMS Safety Publication Jan 2008
- Transportation Safety Advancement Group (TSAG) – Feb 2008
- Society for Automotive Engineers (SAE) – publications Oct 2007, 2008, 2009
- Worker visibility Act - Nov 2008
- SAE Ambulance Standards development – April 2009
- NFPA Ambulance Standards Committee – June 2009
- National Academies TRB EMS Safety Summits – Nov 2008, Oct 2009

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A challenge we know now…

- …is that there is a major problem with the present approach and what is being done currently
- and many practices are in conflict with, or not supported by, existing technical engineering science

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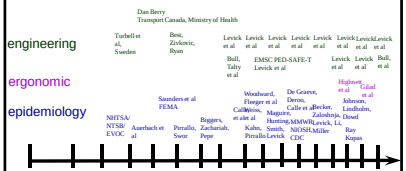
Ambulance Safety Research: A New Field



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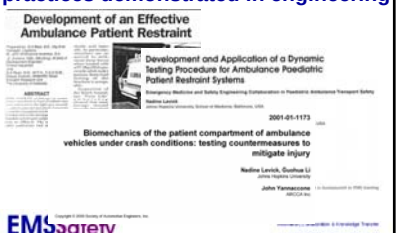
We should use the best safety practices demonstrated in engineering



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…in automotive safety engineering

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and in ergonomics

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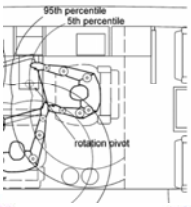
Range of reach.. This is a well defined technical science



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A challenge we know now…

- …is that there is a major problem with the present approach and what is being done currently
- and many practices are in conflict with, or not supported by, existing technical engineering science

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Nascar Safety Expert

- On ambulance patient compartment

"It is a death vault"

Tom Gideon,
Head of Safety, GM Nascar

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and who's life was he racing to save?

Rollover Crash Kills Medical Technician

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

It does happen….

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But what about head protection?

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New EMS helmet prototypes

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VEHICLE DESIGN and SAFETY

PASSIVE SAFETY: Crashworthiness
- Vehicle Structural Design
- Front and Rear Compartment Design
- Seating and Restrain Systems
- Occupant Containment
- Impact Friendly Surfaces

ACTIVE SAFETY
- ESC (Electronic Stability Control)
- ABS (Anti Skid Braking System)
- Advanced Safety Systems

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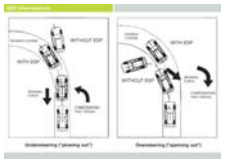
VEHICLE DESIGN and SAFETY

- ESC ELECTRONIC STABILITY CONTROL



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ESC: ELECTRONIC STABILITY CONTROL

- **Electronic stability control** systems are second only to seat belts in terms of the potential for saving lives and reducing injuries… is a major step forward for global auto safety.

Statement by Nicole Nason, Administrator, National Highway Traffic Safety Administration, On the Adoption of Electronic Stability Control as a Global Technical Regulation

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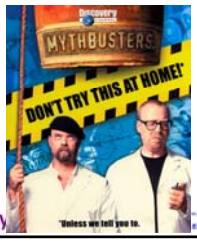
And now for some MYTH BUSTING



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

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Rash of "Safety Concept" vehicles….. Devoid of substantive automotive safety engineering input or testing

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Yet another potentially lethal example marketed as a 'safety innovation' YET outside of automotive safety practice

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Airbags in the back….?? Hazardous for this environment

Absent safety testing standards, any meaningful crash or injury mechanism data or effective occupant positioning – as per the automotive engineers, rear compartment airbags are likely to be highly hazardous

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Yes, the ride of your life….

- Sure… these vehicles all parade around the EMS and Fire shows

  BUT…
- NOT ONE of these vehicles has been to the automotive safety shows or scrutinized by the automotive safety industry

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Ambulance Vehicle Standards??

- KKK?
- AMD?
- FMVSS?
- CMVSS?
- NFPA?
- SAE…?
- ASTM…?
- International
  - ASA
  - CEN

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October 2008 JEMS Article "Rig Safety – 911"

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

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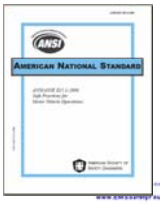
American National Standard ANSI/ASSE Z15.1-2006

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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What KKK-A-1822F, AMD and FMVSS state and don't state…

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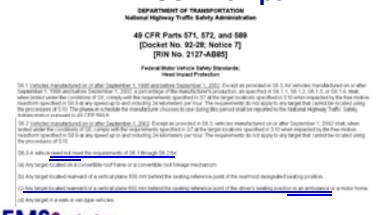
USA Ambulances: FMVSS Exempt


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

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DOT NHTSA, FMVSS 49 CFR Parts 571, 572 & 589 Docket no. 92-28; notice 7

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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

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

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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

http://www.ntea.com/WorkArea/showcontent.aspx?id=1350

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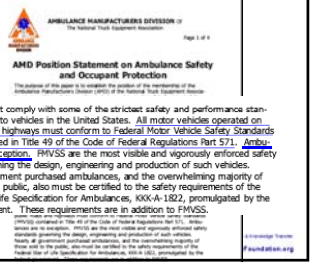
Propaganda that kills…



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.

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Occupant protection……?? July 2007

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May 13, 2010..

May 13, 2010

Email Print Comment Register Bookmark RSS What's This

2 killed in Iowa ambulance crash

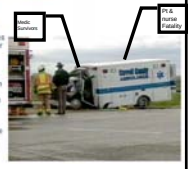
2 dead and 3 injured in collision Thursday

KCCI.com

IOONE, Iowa -- A paramedic with significant injuries ought to save her patient and an ambulance driver in Thursday following a crash in Boone County.

lescue crews arriving on the scene said the aramedic, Wendy Baker, told them her co-worker n the back of the ambulance was dead. Baker then ontinued to move back and forth treating the atient in the back of the ambulance as well as the river.

'She was working so hard I had to physically emove her from the ambulance scene because she didn't want to give up her patients," said Boone County Deputy Brian Pontius. "I don't even know ver name."



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KKK/AMD – 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.

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KKK Specification and AMD Standards both default to the FMVSS for safety – however..

- FMVSS has a specific exemption for ambulance vehicles once you are 600mm or 2 feet positioned rearward of the driver
- KKK require a **'national test lab'** to conduct AMD 'tests' BUT NOT an automotive test lab!
- No dynamic impact tests AT ALL
- No crashworthiness tests

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Ridiculous current 2009 USA ambulance '*safety testing*' !?!? – Is NOT consistent with accepted automotive safety practice…

No 'a'… then NO 'F' !!!!!

- $F = ma$

where F – force
m – mass
a – acceleration

Sir Isaac Newton (1642-1727), Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy) published in 1687. http://en.wikipedia.org/wiki/Newton's_laws_of_motion

Yes a "nationally recognized testing lab" – BUT - NOT an automotive/occupant safety crash test lab!!

FMVSS exempt……

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Visibility and lighting issues

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Hmm…

It isn't like this in the rest of the world

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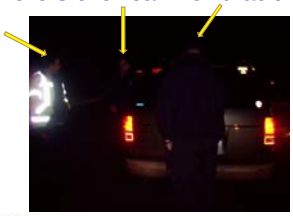
Day visibility

Night visibility

Here's the real world at 6 ft…



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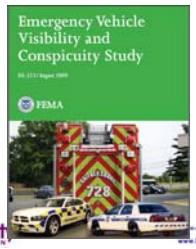
August 2009 – Visibility review



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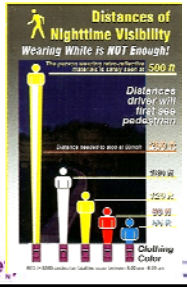

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Policy and practice ignorant of existing technical safety data

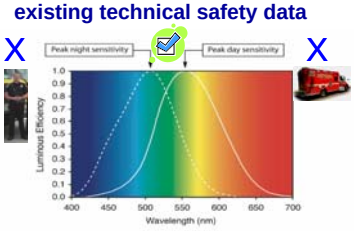

Figure 1. The scotopic (dashed line) and photopic (solid line) luminous efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

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

" The multicolored (patterned) ambulance while distinctive, may suffer decreased conspicuity because of the effects of camouflage" *De Lorenzo & Eilers Annals EM 1991*

Where is it…?.

Camouflage….

Color-blindness affects 10% of the population

- As seen with normal vision

- As seen with color blind vision

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

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

Muskoka EMS - Canada

Old design

New design

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Muskoka EMS - Canada

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But whatever color …. If you run a red light someone will be killed

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Resource availability and allocation technologies

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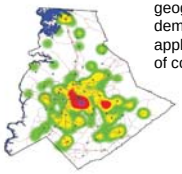
- VSSM (Visual System Status Management) provides a geographic view of call demand through the application of varying shades of color to indicate call density



http://www.zolldata.com/pdf/rescuenet/ZOLL_Dispatch.pdf

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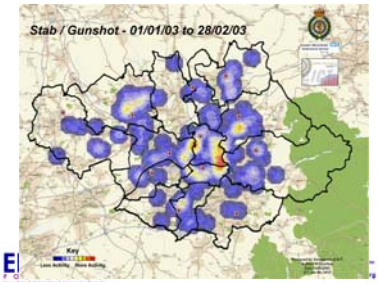

Innovation

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Safety concepts out there now

- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies – ITS
- New platforms for interdisciplinary exchange
- New Safety Standards

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Transport performance

- Driver training?
- Real time safety performance outcomes?

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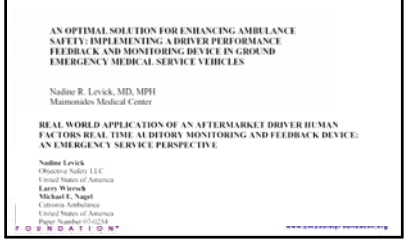
What about changing driver behavior in the real world??


AN OPTIMAL SOLUTION FOR ENHANCING AMBULANCE SAFETY: IMPLEMENTING A DRIVER PERFORMANCE FEEDBACK AND MONITORING DEVICE IN GROUND EMERGENCY MEDICAL SERVICE VEHICLES

Nadine R. Levick, MD, MPH
Maimonides Medical Center

REAL WORLD APPLICATION OF AN AFTERMARKET DRIVER HUMAN FACTORS REAL TIME AUDITORY MONITORING AND FEEDBACK DEVICE: AN EMERGENCY SERVICE PERSPECTIVE

Nadine Levick
Objective Safety LLC
United States of America
Laura Wiersch
Michael E. Nagel
Cetronia Ambulance
United States of America
Paper Number 07-0234

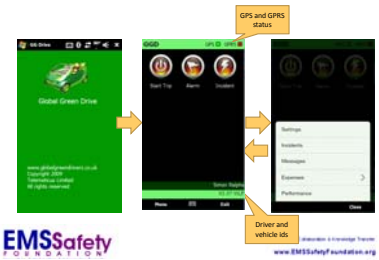
Invehicle technologies to enhance transport safety

- Aftermarket in vehicle electronic e-safety devices with monitoring and feedback

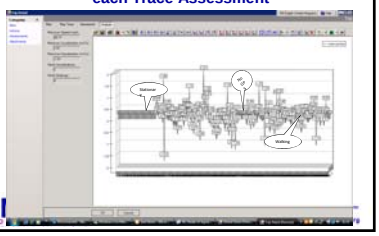
Human Interface approaches -

- Hardware fitted to the vehicle
- Non hardware App Driven cellular technology

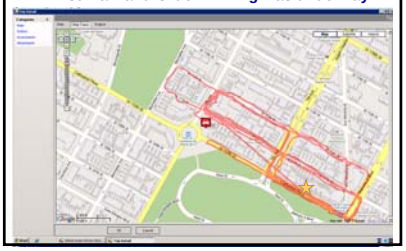
GGD views



The analysed system data that sits behind each Trace Assessment



Realtime mapping from London for 2.5hr of a trip of attempting to park in NYC after a snow storm and whilst 'Law and Order' filming was underway



GGD Smartphone views

Driver's Individual performance against company set performance targets in the system

- Needle points to individual driver performance against targets
- Green area represents the difference between standard and stretch targets
- Goals can be varied by region, market, team as required
- Performance is updated and presented in real time.

How did the UK pilot drivers perform??

Name	Total distance (Miles)	Total number of trips	Distance per Trip	All Breaking <-0.0	Harsh breaking <-4.0	Severe Harsh breaking <-4.4	Breaking/ 1,000 Mile	Harsh breaking/ 1,000 Mile	Severe HB/1,000 Mile	Break/Trip	Harsh breaking/ 100 Trips
Driver 9	11,972	194	62	16,066	25	16	1341.96	2.09	1.34	83	12.89
Driver 2	12912	394	33	5,217	19	7	404.04	1.47	0.54	13	4.82
Driver 11	7,433	136	55	5,164	7	5	694.74	0.94	0.67	38	5.15
Driver 10	5,733	96	60	2,169	5	1	378.34	0.87	0.17	23	5.21
Driver 6	6939	261	27	9,254	6	3	1333.62	0.86	0.43	35	2.30
Driver 8	2,365	47	50	768	2	1	324.74	0.85	0.42	16	4.26
Driver 1	9179	144	64	9,972	7	3	1086.39	0.76	0.33	69	4.86
Driver 13	7,337	321	23	2,000	5	4	272.59	0.68	0.55	6	1.56
Driver 4	7,556	164	46	1,463	4	1	193.62	0.53	0.13	9	2.44
Driver 3	9,479	231	41	2,394	5	2	252.56	0.53	0.21	10	2.16
Driver 12	5,497	63	87	1,516	1	1	275.79	0.18	0.18	24	1.59

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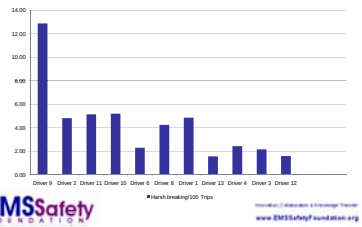
Harsh Braking per 100 trips



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TRB TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

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, and for the Summit archives: www.objectivesafety.net/TRBSummit2008.htm www.objectivesafety.net/TRBSummit2009.htm

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Independent Technical Expertise

- The "kitchen design" is completely unacceptable and a failure in health care delivery, occupant protection and ergonomics.
- Independent technical expertise must be here and involved

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What the independent technically expert occupant protection and automotive safety engineers say about our current ambulances and 'safety' approaches:

- "The rear compartment Death Vault"
- "The Kitchen Design must go"
- "The Kill, Kill, Kill (KKK) spec"
- "The organ donor harness system"

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International approaches

- The state of the art non-USA vehicles have NO squad bench nor the after market structural vehicle modifications that can potentially decrease crashworthiness integrity that were seen in study vehicles.

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The EMS Safety Foundation

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2010 Rettmobil Delegation

The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational and International

- Innovation
- Collaboration
- Knowledge transfer

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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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Automotive engineers addressing EMS Safety Foundation Workshops

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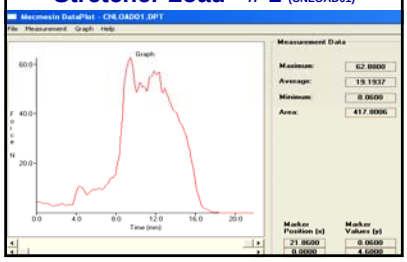
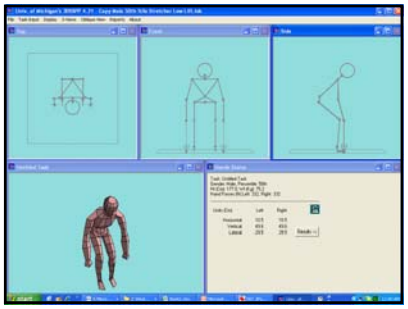
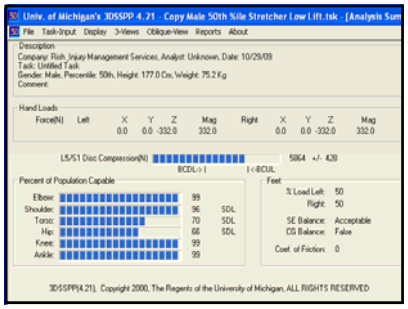
The science of Stretcher lifting & loading

Stretcher Load - # 1 (CNLOAD01)







EMS Safety Foundation Delegation
seeking out International Innovation

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RETTmobil is -

- A major European Emergency Rescue Congress, Trade show and Symposium
- Held in Fulda, Germany
- Established in 2001
- Attended by ~ 20,000 attendees
- Brainchild of Prof Peter Sefrin

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EMS Responder Rettmobil 2010 Delegation

http://www.emsresponder.com/web/online/Safety/Live-From-RETTmobil/25$13137

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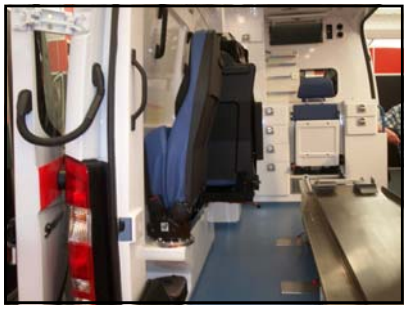

Vehicle Occupant Safety design

European design

Safety technology is a key focus

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Safe and Ergonomic design

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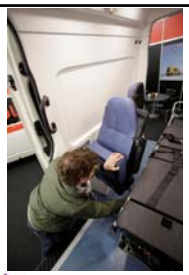
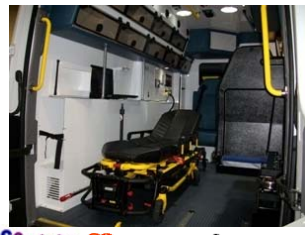


Flexibility to manage two patients

Patient Transferring Slides

Texas - Careflite's new vehicle

Careflite's new vehicle



Size matters…. Less than 27 inches will save your back!!!!

Which of these two vehicles would you want?

Sprinter v Ford Transit crash test

http://www.youtube.com/watch?v=C3kN6WF5vAA&feature=related

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

Accessibility

Best-in-class interior compartment accessibility of any full size van

- 20 inch side step (lowest height in the segment)
- 27 inch load floor (lowest height in the segment)
- 18 3/4 inch rear bumper step pad height

Some Sprinter Features

- Premium CDI turbo Diesel engine with SCR technology to meet the EPA / CARB 2010 emission standards.
- Best in class cargo capacity
- Best in class wall-to-wall turning diameter
- Best in class available payload capability
- Superior safety standard with ABS, ASR, BAS, ESP and 3-point seat belts on all passenger seats
- Most versatile commercial van on the market

Load Adaptive Electronic Stability Program (ESP)

ADAPTIVE ESP uses the steering angle and the wheel speed to calculate the direction in which the driver intents to steer.

If ESP detects wheelspin, severe understeer (plowing), or oversteer (fishtailing), ESP stops individual wheels and reduces engine power to correct the aforementioned driving conditions and stabilizes the vehicle.

If the vehicle is determined to be moving in a different direction, ADAPTIVE ESP reacts immediately.

By selective braking of each wheel, ADAPTIVE ESP "steers" the vehicle in the desired direction. ADAPTIVE ESP is able to increase directional stability under extreme driving situations.

A warning light in the instrument cluster lights when ADAPTIVE ESP and ASR interventions are in progress.

Summary:

- Enhances active safety under severe driving situations
- Improves track-holding and directional stability by automatically adjusting for load weight.
- Adaptive ESP is standard on all Sprinter models.

Load Adaptive Electronic Stability Program (ESP)

Details and Technology

- The Electronic Stability Program (ESP®) comprises the following functions:

- **EBD** (electronic brake force distribution) – This system prevents the rear wheels from locking under braking.
- **ABS** (anti-lock braking system) – Prevents the wheels from locking and ensures steering control while severe braking.
- **ASR** (acceleration skid control) – Regulates wheel spin by intervening in Sthe engine management and by braking the spinning wheels. A deactivation switch allows engine intervention to be switched off at lower speeds to raise the slip threshold.
- **BAS** (Brake Assist) – If an emergency braking situation is detected, this system actively increases braking pressure up to the slip threshold.

Load adaptive Electronic Stability Program (ESP)

Details and Technology (cont.)

- **ROM** (Roll Over Mitigation) – This system helps to detect rollover tendencies during maneuvers with low road speed and high lateral acceleration.
- **RMI** (Roll Movement Intervention) – This system helps to detect rollover tendencies in dynamic maneuvers and in high-speed evasive maneuvers with a high lateral acceleration.
- **LAC** (Load Adaptive Control) – is an adaptive algorithm which calculates the vehicle mass and center of gravity using various parameters such as acceleration, speed and the accelerator position.
- **EUC** (Enhanced Understeering Control) – provides enhanced stability under heavy under steer, for example when driving quickly through tight-radius corners.

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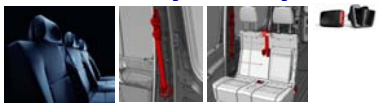
Passive Safety - SRS Systems



Seat belt technology (a most important passive safety feature)

- The Sprinter is equipped with a 3 point seat belt on every seat.
- Driver and front passenger seats are equipped with Emergency Tensioning Devices (ETDs) and belt force limiters.
- If a collision exceeds a preset threshold, the ETDs instantly remove slack from the seat belt. Belt force limiters reduce the peak seat-belt forces on the occupants.
- Depending on the crash severity in a collision, the electrical fuel pump and the stationary heater/heater booster are switched off. The driver and passenger doors are unlocked and the windows are opened by 2 inches.
- The hazard warning system is also switched on automatically.

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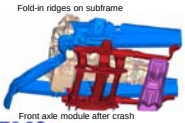
Safety first - Passive Safety

Fold-in ridges on subframe

Front axle module



Front axle module after crash

- 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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Manitoba's new fleet

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JOURNAL

Local News

IRHA selected to test new ambulance

New design smaller, more cost efficient, say health officials

Manitoba Health is looking to act on its original plan by implementing a pilot project, giving the RHA's a year to test out the Sprinter design to see if it could be a replacement to the current Fleet Mac ambulance design.

According to Christenson, the Sprinter design looks similar to delivery vans, and boasts a whole new set of safety and technology features such as GPS.

"It's a lot smaller, so that makes it a lot easier for paramedics to be strapped in but still be able to reach all the equipment needed to tend to a patient," said Christenson.

Christenson also explained that the new ambulances require less maintenance, and have an overall smoother and quieter ride. They also are lower to the ground and come equipped with new 'no-lift' stretchers, that eliminate nearly 95 per cent of strenuous lifting paramedics do to get patients in and out of the vehicle.

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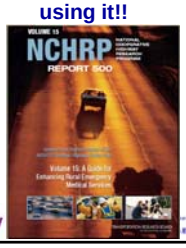
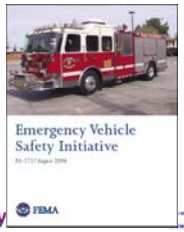
Transportation Research Board is an excellent resource… we should be using it!!



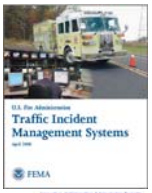
Tips for Emergency Vehicle Operations

USFA Emergency Vehicle Safety Initiative



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



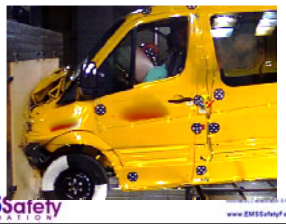
Collaboration and Outcomes

- 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

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

this vehicle is safety crash tested by automotive experts



Unlike this vehicle

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?

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Fleet Mix ?

Were we safer in the Cadillac???

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Is this acceptable…?

- There are ambulances rolling out of the show room on a daily basis – as we speak – being designed by health care providers and built by after market retrofitters, who are not at all governed as are other passenger vehicle manufacturers by the standards set by the society for automotive engineers

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So what do we need to do ??

- Reach out to the appropriate experts – they sure do want to help us
- STOP being philistines and be the scientists we are trained to be and at least seek a scientific approach
- Get your heads out of the sand – there is plenty of valid technical information – FMCSA, TRB, SAE
- Make policy and purchase decisions on technically sound data, not a marketing brochure
- HAVE MEANINGFUL AND TRANSLATABLE OUTCOME MEASURES FOR YOUR SERVICES SAFETY PERFORMANCE

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Risk/Hazards

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

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Goals

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

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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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Future

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

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Safety Management

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

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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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Conclusion

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

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And….

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

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Thank you!

Any Questions??

Electronic handout and resources available online

http://www.objectivesafety.net

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