North Shore LIJ July 10, 2013, Long Island , NY
David Restuccio Memorial Lecture

The Ride of your life?

Ambulance Transport Safety Essentials

Nadine Levick, MD MPH
Research Director, EMS Safety Foundation
CEO, Objective Safety, New York, USA
Chair, TRB, EMS Subcommittee, National Academies

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August 27, 2012 - NYC

2 dead when ambulance and SUV collide on Staten Island's Hylan Boulevard

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Paramedic David Restuccio killed

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Friday September 7, 2012

NYC Funeral of Paramedic David Restuccio

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What are we going to cover today?

- Key principles of ambulance transport safety
- Ambulance safety research and data
- National and Regional Standards and Guidelines
- How to make your ambulance transport environment safer right now
- Future goals for Ambulance transport safety

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Goals and Learning Objectives

- Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance transport adverse events
- Identify and explore factors related to ambulance crashes and identify potential mechanisms of injury to EMS transport providers, patients and the public and expose safety myths
- Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers and the public during transport

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Emergency Medical Service

- What are the transport and other 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 and share with our international colleagues

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Safety Dimensions

- Safe systems – CRM / transport system safety
- Fleet an operations management
- Vehicle safety
- Scene safety
- Patient Handling
- Risk perception
- Health and wellness

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Your electronic 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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Who am I?

- Nadine Levick MD, MPH
- Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Columbia SUNY & 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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Jump start

A RoboRoo Series II kangaroo tests dummy is used in New South Wales, Australia, to help automobile designers study a unique Australian road safety issue — traffic accidents with kangaroos.

ASSOCIATED PRESS

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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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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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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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You may not like all I have to say...

"The first commandment is: Thou shalt not shoot the messenger."

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A lot is now possible and for less!

- Driver behavior
- Vehicle behavior
- Roadside ITS
- Fuel consumption/Economics
- Resource modeling

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Goals

- Cheaper
- Better
- Safer

EMS Transport Safety

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

In the USA 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

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

April 2, 2013

Patient ejected in Ga. ambulance crash

The patient in the back of the ambulance was thrown from the vehicle by the impact

June 6, 2013

Georgia EMTs and Patient Killed in Crash Involving Semi

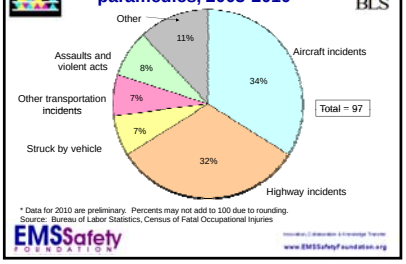
Coffee County EMTs and a 56-year old patient killed in collision

NEWS TECHNOLOGY

WE'RE SPENDING OVER $8 BILLION THIS YEAR ON ENERGY PROJECTS THAT MOVE AMERICA FORWARD.

Mercedes-Benz adds QR codes to save car crash victims

Fatal injuries among EMTs and paramedics, 2003-2010*



* Data for 2010 are preliminary. Percents may not add to 100 due to rounding.
Source: Bureau of Labor Statistics, Census of Fatal Occupational Injuries

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Science behind Policy

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

  Richard P. Feynman 1988

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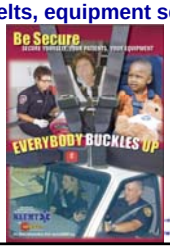
Patients must be in the over the shoulder harness, medics restrained in seat belts, equipment secured



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Policies to protect you too!

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Policy makes a difference…

Organizational policy and other factors associated with emergency

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DOH NYS, 2012

Advisory on patient care in a moving ambulance

www.EMSSafetyFoundation.org/2012-04_NYSAdvisory_on_Patient_Care_in_a_Moving_Ambulance.pdf

Policy

Whenever possible, EMS providers should perform patient care skills when they are appropriately restrained in a moving vehicle or done when the vehicle is stopped. As long as it is safe and appropriate to do so, the ambulance should be pulled off the road and stopped for the duration of necessary interventions and procedures. As a matter of safety, EMS providers should plan their patient care so that essential interventions are performed prior to beginning transport and have ready access to patient care equipment that might be expected to be used during a transport while maintaining provider safety restraints.

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Pennsylvania Department of Health Operations 123– BLS– Adult/Peds Effective 07/01/11 Protocol 123

- EMS VEHICLE OPERATIONS/SAFETY
- EMMCO WEST REGIONAL PROTOCOL
- Criteria:
- A. All EMS operations, including incident responses and patient transports.

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EMS VEHICLE OPERATIONS/SAFETY EMMCO WEST REGIONAL PROTOCOL

- These guidelines provide general information and "best practice" guidelines related to the use of lights and sirens by EMS providers and EMS vehicle operators during incident response and patient transport. EMS agencies may use these guidelines to fulfill the agency's requirement for a policy regarding the use of lights and other warning devices as required by EMS Act regulation 28 § 1005.10 (l) or regions may use these guidelines in establishing regional treatment and transport protocols.

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Seat Belt and Restraint Use:

Seat belts or restraints will be securely fastened to the following individuals when the vehicle is in motion:

- 1) All EMS vehicle operators
- 2) All patients
- 3) All non-EMS passengers (cab and patient compartment)
- 4) All EMS practitioners (when patient care allows)
- 5) All infants and toddlers (these children should be transported in an age appropriate child seat if their condition allows). Children should not be placed in cab passenger seat with airbag.

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e. Avoid Distracted EMSVOs

- 1) Distracted driving is responsible for many MVCs, and EMS agencies should assure that policies reduce the risk of a distracted driving accident.
- a) EMSVOs should not view pagers, cell phone screens, text messages, or mobile data terminals or enter data into GPS devices while an EMS vehicle is in motion.

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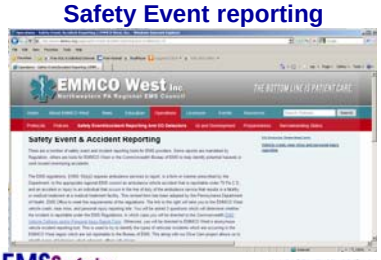
Safety Event reporting



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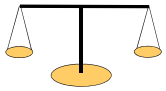
Balance of concerns and risk during transport



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

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Communicating risk

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Which image of October 26th communicates better risk perception

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October 28, 2012

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When is it safe to do what… ?

- What are your policies???
  - If your patient is pink, warm and talking?
  - Are you required to notify the driver if you are out of your seat belt?
  - Are 'routine procedures' putting you at risk?

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

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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…

Safe Systems Approach

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

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
- Public safety

Occupant Systems Safety

- Occupant Safety in EMS is driven by both operational and biomechanical systems.
- Systems Safety integrating these two issues is key
- There is interaction of occupants with the system, with each other and with available seating options and vehicle interior, equipment and operational tasks.

Safety Performance

- Measurement
- Outcomes
- Technical expertise

Some new dimensions

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

Safety of the…

- Provider
- Public
- Patient

Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

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

the EMS transport process

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

TIME & PLACE

The Emergency Department (ED)

An ambulance is <u>not</u> an ED /ICU on wheels

Firstly!

- An accident ?
- or
  a predictable and preventable event

A tragic emergency health care intervention outcome

Rollover Crash Kills Medical Technician

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

It does happen….

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

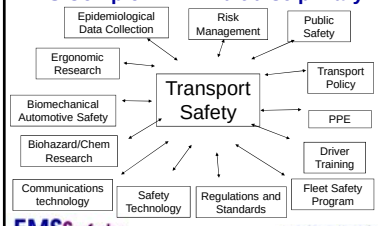
Negative impact on system performance…

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

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

Ground Ambulance Transport Safety IS Complex AND Multidisciplinary



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

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USA 1980's Then….

And NOW!…

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USA 1980's Then….

And now…

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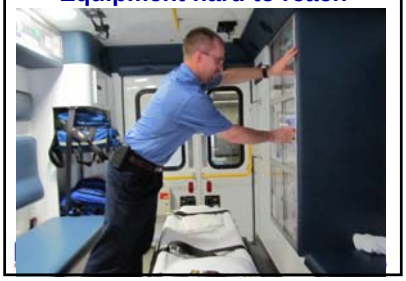
Equipment hard to reach



Innovation Now…

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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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- What we need to consider, where is the 'bang for buck' in ambulance transport safety
- Where is the low hanging fruit?

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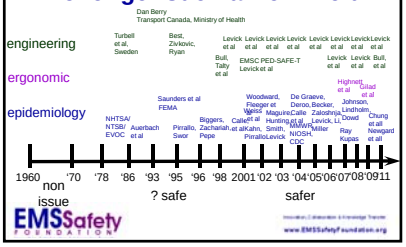
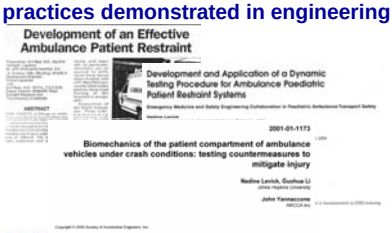
WE DO HAVE TECHNICAL DATA!!!

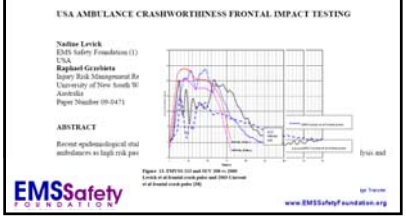
Ambulance Safety Research: No longer such a New Field



We should use the best safety practices demonstrated in engineering

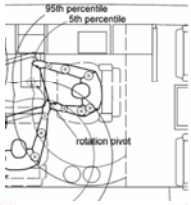


ESV July 2009



and in ergonomics

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



As well as epidemiological injury data August, 2011

http://www.ncbi.nlm.nih.gov/pubmed/21834620

TRB TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

2012 EMS Safety Systems, Strategies and Solutions Summit

- One Day event, 30 presentations
- Held in Washington DC, Keck Center
- Simulcast Live to EMS Today
- Live Webinar Access - globally
- Over 100 participants live across 3 continents
- Greater that 10,000 downloads of handouts within the first week!!

The 2012 TRB EMS Safety Summit

print this page & your smart phone will play the 8 sessions from the eTags! (even in B&W)

- Opening Address: A.J. Heightman
- Safety Developments Update – N. Levick
- Research needs assessment forms explained – E. Frazer

1: Data and Recent Initiatives
2: Transport, Human Factors - Bridging Diverse Disciplines
3: Testing and Standards
4: New systems safety technology solutions & telematics
5: Fleet management strategies
6: Innovative Vehicle Design
7: Operationalizing Safety
8: Panel: How to optimize the safety of your existing fleet

Wrap up – from Prof. Art Cooper

http://www.emssafetyfoundation.org/2012TRBSummitAgendawithLinks.pdf

Its out there NOW

- TRB 2012 Summit – addressed the key and interdisciplinary applied solutions issues, in one day – please seek that information out. www.objectivesafety.net/TRBSummit2012.htm
- There have been two prior 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

March 2012 EMSSF TRB Synopsis Webinar
http://www.emssafetyfoundation.org/Recorded2012March15ICTEPWebinarlogininfo.htm

Click here www.youtube.com/watch?v=avFiJ06bYcY or scan this eTag to see it on You Tube

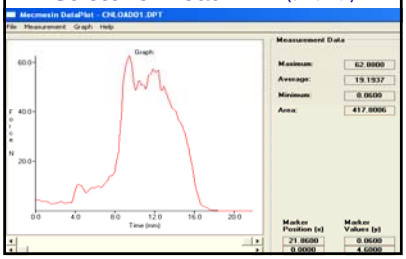
Talking increases crash risk 5x
Texting is COMPLETELY UNACCEPTABLE
23X increase in crash risk

The science of Stretcher lifting & loading

The impaired/distracted driver

- Impairment
  - Illness
  - Exhaustion
  - Substance
  - Emotion
  - Distraction
    - CELL PHONE !!!!! – (A MAJOR HAZARD)
    - Other technology

Stretcher Load - # 1 (CNLOAD01)



And what is the loading height of your ambulance??

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

USA Ambulance Standards & Testing

- KKK A 1822F: Purchasing Guideline
  - "Minimum Specification and performance parameters"
- AMD-001-025: Manufacturing Guideline
- ASTM F2020-02a: Standard Practice
- **NFPA 1917 Standard for Automotive Ambulances: 2013 Edition**

Ambulance Standards and Testing

- Interrelated – mostly paraphrasing each other's requirements
- Self certified

NFPA 1917
Standard for Automotive Ambulances: 2013 Edition

International Ambulance Design Safety and Occupant Protection Standards

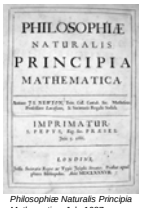
In existence since 1999

- Australia – ASA
- Europe - CEN

AMD ambulance '*safety testing*' ? – Is NOT consistent with accepted automotive safety practice…

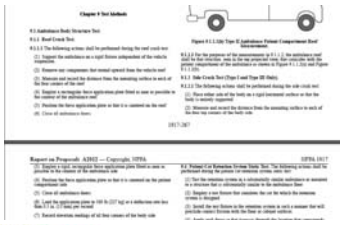
Yes a "nationally recognized testing lab" – BUT - NOT an automotive/occupant safety crash test lab!!

The Laws of Physics Prevail..



Philosophiæ Naturalis Principia Mathematica, July 1687

NFPA 1917 - Test Methods



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

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

USA EMS

- EMS Systems - >19,000
- Personnel - ~1 million
  (~30% F/T professional & 70% volunteer)
- Vehicles - ~80,000
  (Type I, Type II, Type III, Freightliners, ?motorcycles)
- Transports - ~30 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

- ~ 80,000 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

*FARS/BTS 2007

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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, Pirrallo 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; 9:412-415

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EMS Transport General Concerns

- Consequences can be predictable & likely preventable
- Costs of these adverse events are high in loss of life, financial burden and negative impact on delivery of EMS care
- Other high speed vehicles (eg. racing cars) have a different safety paradigm
- Design of interventions to mitigate injury is predicated on a valid testing model
- Complex both engineering and public health issues

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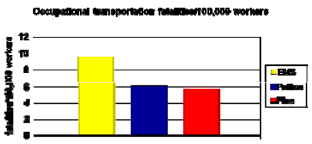
USA Occupational transportation fatalities..



- 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 ?

USA 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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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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August 2009 – Impaired…


EMS RESPONDER

Kentucky EMT Indicted on Murder Charges after Crash

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EMT Indicted On Murder Charges

Tammy Brewer Driving Ambulance Involved In Fatal 2008 Crash

By Andy Alcock/WLKY

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.

September 25, 2012

EMT killed when ambulance, tractor trailer crash in front of hospital

Training… effectiveness…??

EMT charged with colleague's death in ambulance crash

A few key words about restraint systems…

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

Testing the real world

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

Impact residue

During impact

CTD dynamics

Post impact

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

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

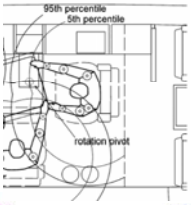
Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

Beware some provider restraint systems are dangerous

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

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



'Workplace' Hazards

Bigger is not necessarily better……

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

It does happen….

Rollover Crash Kills Medical Technician

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

But what about head protection?

New EMS helmet prototypes

Head protection @ EMS Expo 2012

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

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

October 2008 JEMS Article "Rig Safety – 911"

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

Ambulance Vehicle Standards??

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

Transporting kids?

Basically…

- DON'T put child in the front seat
- DON'T put the child on the rear facing captains chair

- Just about anywhere else is OK!
- Use a child seat when medically appropriate and size fits, well secured

NASEMSO MRAVD initiative http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/AmbulanceVehicleDesignProject.asp

August 1, 2012
NASEMSO - Model Rules for Ambulance Vehicle Design (MRAVD)

Golden Hour – not so hot

- March 2010 Annals EM

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.]

April 2010, Resuscitation – Going fast can hurt your patient clinically!

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/

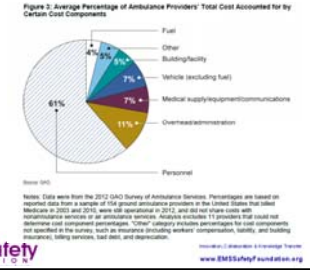
GAO-13-6
http://www.gao.gov/assets/650/649018.pdf

GAO-13-6

GAO findings

- Transports for all Medicare fee-for-service beneficiaries grew 33% 2004 to 2010
- Transports nationwide grew most in super-rural areas (41%) relative to urban & rural areas
- 59% increase in basic life support (BLS) nonemergency transports
- BLS nonemergency transports in super-rural areas grew the most—by 82%

Cost components



Safety is Good Business

What are the solutions?

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

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EMS SAFETY COURSE

National Association of Emergency Medical Technicians

NAEMT

NAEMT Safety Course

- Crew Resource Management
- Emergency Vehicle Safety
- Scene Operations
- Patient Handling
- Provider, Patient & Bystander Safety
- Personal Health

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Are you self insured???

Very Scary insurance data – the $10 million dollar EMT

Year	Payroll $million	Modified Premium $1,000	Incurred Indemnity $1,000	Incurred Medical $1,000	Total Claims #
2003	14.1	540	885	9,925	93
2002	12.6	547	266	255	78
2001	11.3	454	88	128	55
2000	10.6	420	63	194	89
1999	10.1	405	115	117	56
1998	9.6	411	13	30	51

Workers Compensation Rate increased by 27 %

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A problem

2011 Insurance data –

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

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 davidholden@htimes.com

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

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

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

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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.

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EMS CANNOT Afford to keep paying out like this….

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And very Predictable…

- Intersections are lethal environments

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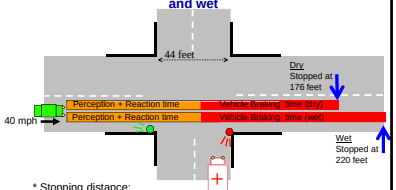
So.. The real world for an EMS vehicle approaching a red light

- 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…..

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)

- Transport Medicine

Key elements to safety

- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

Impact biomechanics

- Crashworthiness
- Vehicle design
- Occupant protection

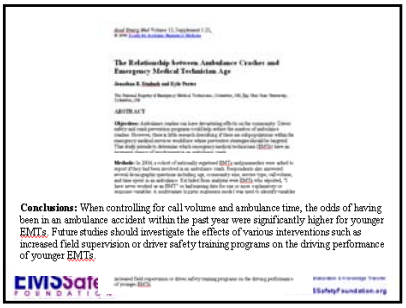
Transport Ergonomics

- Operational tasks
- Human factors analysis
- Range of reach
- Patient loading and unloading

A “Fleet” to many in Emergency Medical care means….

Fleet safety

- Operational policies – dispatch, safety
- Fleet mix
- Vehicle selection – safety, ESC, loading height
- Driver performance and monitoring
- Scene safety
- Visibility and conspicuity
- Safety measurement and management



The Relationship between Ambulance Crashes and Emergency Medical Technician Age

Conclusions: When controlling for call volume and ambulance time, the odds of having been in an ambulance accident within the past year were significantly higher for younger EMTs. Future studies should investigate the effects of various interventions such as increased field supervision or driver safety training programs on the driving performance of younger EMTs.

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

Rules/Policies Addressing Known Hazards

- Federal Motor Carrier Safety Administration (FMCSA)
  - Cell phone use – November 2011
  - Hours of Service – December 2011

Federal Motor Carrier Safety Administration - FMCSA

- http://www.fmcsa.dot.gov/

Nov 2011, Hand Held Cell Phone Ban

http://www.fmcsa.dot.gov/aboutfmcsa/news-releases/2011/Secretary-LaHood-Announces-Step-towards-Safer-Highways.aspx

U.S. Transportation Secretary LaHood Announces Final Rule That Bans Hand-Held Cell Phone Use by Drivers of Buses and Large Trucks

Dec 2011, New FMCSA Hours of Service

http://www.fmcsa.dot.gov/rules-regulations/topics/hos/index.htm

Hours of Service Regulations

Safe Practices for Motor Vehicle Operations

ASSE/ANSI Z15.1 2012

https://www.asse.org/cartpage.php?link=Z15_1_2012&utm_source=ASSE+Members&utm_campaign=b4472c203c-Z15_5_12_125_11_2012&utm_medium=email

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

Newly Revised ANSI/ASSE Z15.1-2012 Standard is now available.

- ANSI/ASSE Z15.1-2012 Revised Standard is now available. " Safe Practices for Motor Vehicle Operations"
- These practices are designed for use by those having the responsibility for the administration and operation of motor vehicles as a part of organizational operations.

New Safety Data

- TRB 2012
- 2011 National EMS Assessment
- 2011 NFPA
- TZD EMS
- NCHRP 17-51
- FARS/MMUCC
- NEMSIS
- BLS

Increasing focus

- TRB - ANB10(5)
- RITA/ITS/DOT
- Traffic Records Forum
- DHS/NIST/NIOSH
- TIMS
- ASSE
- SAE
- EMS Safety Foundation

A lot is now possible and for less!

- Driver behavior
- Vehicle behavior
- Roadside ITS
- Fuel consumption/Economics
- Resource modeling

Fleet Management technologies

- ACETech/Ferno
- FleetEyes – Intermedix
- Zoll rescuenet and roadsafety fleet management systems
- Marvlis
- Telematicus
- Optima
- Northrop Grumman

Spectrum of dimensions

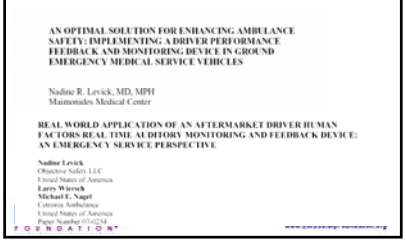
- CAD
- Resource allocation
- Fleet performance –
  - – Monitoring: System that gives management data of vehicle efficiency and use
  - – Feedback: Directly to drivers at the wheel
- Public Alerts

Telematics

Transport performance

- Driver training?
- Real time safety performance outcomes?

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
Larry Wiersch
Michael E. Nagel
Cetronia Ambulance
United States of America
Paper Number 05-0234

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

- This IS a Transportation and Automotive Safety issue

Creating a Safety Culture

within a company safety must have leadership and support of upper management

- Awareness
- Training
- Incentive

Key elements to transport safety policies

- Vehicle/Fleet Safety
- Occupant protection
- Driver performance monitoring and feedback
- Hours of service
- Driver/provider wellness and fitness
- Driver/provider impairment
- Public safety

Oslo Norway mass shooting EMS response July 2011

Oak Creek, Wisconsin mass shooting EMS response July 2012

August 5th, 2012 - Mars

What MUST we do?

- We MUST stop pretending that this is not an automotive safety occupant protection impact engineering issue
- We MUST stop writing 'consensus' policies on disciplines we are not trained in
- We MUST reach out to the technical experts in this field
- We MUST engage the existing technical and safety transport arenas with EMS transport

Which of these two vehicles would you want?

Sprinter v Ford Transit crash test

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

Innovation

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

Interdisciplinary Innovation Consortium

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Innovation, Collaboration & Knowledge Transfer
www.EMSSafetyFoundation.org

The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational and International

- Innovation
- Collaboration
- Knowledge transfer

R & D "Ripoff and Duplicate"

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

Background:

- EMS Safety Foundation has been established to fill a gap in
  - technical knowledge transfer
  - practical interdisciplinary R & D
  - evaluation and implementation of system safety enhancements for EMS and Medical Transport
- It is a not-for-profit institute

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 by promoting and advancing EMS safety innovation, collaboration, research, knowledge transfer, education and safety information dissemination

In a nutshell

- EMS Safety Foundation is a not-for-profit multidisciplinary virtual think – tank and test bed for safety innovation and knowledge transfer
- It is a virtual network integrating the end users and the technical experts
- A tool to enhance the safety of delivery of EMS services

- Innovation
- Collaboration
- Knowledge transfer

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Innovation, Collaboration & Knowledge Transfer
www.EMSSafetyFoundation.org

EMS Safety Foundation Rettmobil 2013 Delegation's Special Participants

So What is RETTmobil??

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
- Over 460 exhibitors, 19 Countries!

Birds eye view

- **Advisory Board and Technical Expert Panel**
  - EMS Safety Foundation, Director of Human Factors and Ergonomics
  - Chris Fitzgerald, Injury and Risk Management

AJ
Heightman
JEMS Editor

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Scott
Cravens
EMS World
Editor

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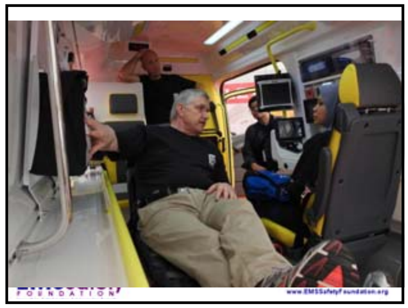
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The newest Oslo Ambulance

Based on technically sound scientific principles

User friendly

- All necessary equipment should be reach from the seats without loosing the seat belt

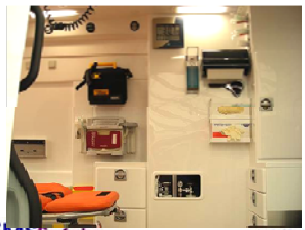
- The stretcher platform can be moved into 3 different positions

Vehicle Occupant Safety design

European design

Safety technology is a key focus

Safe and Ergonomic design



Patient Transferring Slides

Ergonomic layout and equipment

Flexibility to manage two patients

the result of the frequency analysis, green dots mark equipment used every time the ambulance is driven, orange

ESC – Does your ambulance have it??

- 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

Based on technically sound scientific principles and here at Expo

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NAEMSP 2012

Safety and Operational Innovation: Integrating Global Best Practice and Interdisciplinary Technical Expertise into Ambulance Design

http://www.emssafetyfoundation.org/NAEMSP2012poster.pdf

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The Motorcycle Medic

Ambulance Sparing

- **In almost ¼ (23.5%) of all motorcycle missions ambulance use was avoided!**

Nakstad AR, Bjelland B, Sandberg M. Medical emergency motorcycle – is it useful in a Scandinavian Emergency Medical Service? Scand J Trauma Resusc Emerg Med. 2009 17(1):9

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Areas of need

- Improvement in use of occupant restraint systems
- Improvement in use of equipment restraint systems
- Policies to minimize transport risks

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Live from Rettmobil 2013

Public Access – www.EMSSafetyFoundation.org

https://www.youtube.com/watch?v=kJw9_PyIIR0

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Live @Rettmobil 2013 on YouTube!!

Click here

https://www.youtube.com/watch?v=kJw9_PyIIR0

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The ambulance response vehicle of the future?

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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

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

Transport related aspects -

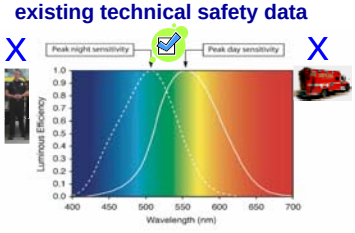
- dispatch of EMS/Medical transport vehicles
- transport policies and protocols
- vehicle fleets and vehicle design
- vehicle purchase standards
- Intelligent Transportation Systems (ITS) technology
- driver training
- driver performance monitoring
- roadside and road design
- integrated traffic safety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

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

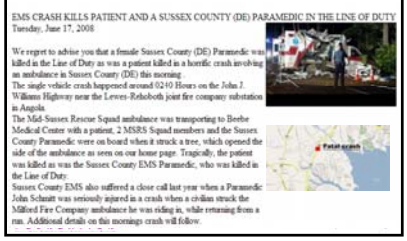
- Location
- Size
- Shape
- Speed
- Intended path

Policy and practice ignorant of existing technical safety data



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

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 Schnitt 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…

April 30, 2009 - Tennessee

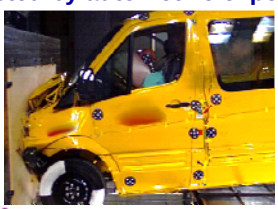
Caution!!!

- Just because it has been 'Tested' does not necessarily mean it has been crash tested – nor that it is crashworthy and/or going to protect you
- Even if it has been 'Crash tested' – it depends upon to which standard, whether or not it is actually safe under real world crash conditions
- Appropriate technical expertise is key!!

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?

Fleet Mix ?

What do we know works…

- Tiered dispatch
- Vehicle Operations Safety Policies
- Ideally, forward and rear facing seating
- If not, use squad bench lap seat belts
- Patient over the shoulder belts
- Securing equipment
- Fleet management electronic technical devices
- Safety awareness
- Cultural change

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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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Safety Management

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

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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 directions

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

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Key future focus

- Data and Recent Initiatives
- Transport Technical science
- Human Factors
- Bridging Diverse Disciplines
- Testing and Standards
- New systems safety technology solutions
- Fleet management strategies
- Innovative Vehicle Design
- Operationalizing Safety

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- Innovation
- Collaboration
- Knowledge transfer

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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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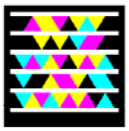
Your handouts etag page



for those not of the Y or @ generation!
- if you have a smart phone
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