**EMS - The Cutting Edge on Safety Issues**

*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

<table>
<thead>
<tr>
<th>Goals and Learning Objectives</th>
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<tbody>
<tr>
<td>Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance transport adverse events</td>
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<tr>
<td>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</td>
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<td>Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers and the public during transport</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Emergency Medical Service</th>
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<tr>
<td>What are the transport and other safety issues that pertain to this important public service and public safety industry?</td>
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<tr>
<td>What do we know of the risks and hazards and how can we measure these?</td>
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<tr>
<td>How can the safety of this transport system be optimized?</td>
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<tr>
<td>What can we learn from and share with our international colleagues</td>
</tr>
</tbody>
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"The Chinese word for 'crisis' (危機) is made up of the words 'danger' (危) and 'opportunity' (機)"

**In a nutshell...**
- Understanding of the dangers in Ambulance Transport
- Overview of the opportunities to enhance safety
EMS Safety timeline

- Didn’t know it was an issue — 60’s-70’s
- Knew it was an issue — but didn’t really know what to do — 80’s-90’s
- Safety technical data rolls out — past 10 years
- Change and adoption challenges — we are here now

Safety Dimensions

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

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

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

How do you use an eTag for the first time?

Get Microsoft Tag App on your smartphone (free from your App store, it reads ALL eTags)
open Tag App and scan the eTag

http://www.objectivesafety.net
Your Handout and Additional Resources

www.objectivesafety.net/PDFHO.htm
form will open directly on your phone
EMS Safety Foundation

- Established in 2008 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

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

EMS Safety Foundation Ambulance Vehicle & Ergonomics Workshop

EMS Safety Foundation Ambulance Innovation Workshop and Design Clinic

  Session A
  Vehicle Safety and Occupant Protection
  Gene Lukianov

  Session B
  Hands-on human factors operational safety and task analysis
  Chris Fitzgerald
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

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.
Emergency Medical Services (EMS)
An important and unique transport system
- Public safety, public health and emergency service
- Is there to save lives

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

A lot is now possible and for less!
- Driver behavior
- Vehicle behavior
- Roadside ITS
- Fuel consumption/Economics
- Resource modeling

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

**Neonatal transport crash**

- Single vehicle collision, ran off the road
- Clear weather daytime
- No patient on board
- Non emergency
- All occupants wearing seat belts
- No intrusion
- Most other injuries minor
- Doctor killed with closed head injury

**July 10, 2013**


**July 21, 2013**

Doctor killed in Ambulance Crash Being Remembered

Deadly Ambulance Crash?

Deadly Ambulance Crash?

In recognition of the doctor's contributions to the EMS field, a commemorative ceremony was held to honor his memory. The event was attended by family, friends, and colleagues who shared their memories of the doctor's impactful work.

Other EMS officials say wound care is essential to ensure that each injured patient receives appropriate treatment. In the case of a doctor killed in an ambulance crash, the driver's timely intervention could have made a significant difference in the outcome.

In addition to the doctor's tragic loss, the crash highlighted the need for improved safety measures within the EMS system. Steps are being taken to enhance safety protocols, with a focus on reducing the risk of accidents and ensuring the well-being of both patients and providers.

The incident also served as a reminder of the dedicated efforts of EMS professionals and the critical role they play in health care. Despite the challenges, the community remains committed to upholding high standards of safety and ensuring the continued safety of those in their care.
But what about head protection?

New EMS helmet prototypes
Head protection @ EMS Expo 2012

Based on what is identified to date
- Choice of vehicle – ESC
- Crashworthiness of vehicle
- Layout of vehicle
- Monitoring of driver performance
- Securing of equipment
- Number of occupants
- Skill set of occupants
- Seating position of occupants
- Head protection

July 18, 2013
Utah Medic to Stand Trial for Traffic Death
OGDEN, Utah, July 18 — The seemingly overlapping state statutes that entangle when an ambulance driver is accused of causing a fatal traffic accident will be aired out for a 3rd District Court jury.

Sean Noel Stephens-Apalonia is charged with negligent homicide in the death more than a year ago of a motorist struck by his North Davis Fire District ambulance.

Arline H. Logan, 88, was killed in the collision July 6, 2012, in the intersection of U.S. 89 and Summit Drive. Located in North Ogden, it’s just east of Ogden Regional Medical Center.

April 2, 2013
Patient ejected in 911 ambulance crash
The patient in the back of the ambulance was thrown out the vehicle by the impact.

Your work environment!!

And yes, this meets KKK or NFPA
June 6, 2013

Georgia EMTs and Patient Killed in Crash Involving Semi

NTSB: Pilot's texting contributed to copter crash

Paramedic David Restuccio killed

August 27, 2012 - NYC

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

NYC Funeral of Paramedic David Restuccio

Friday September 7, 2012
In this vehicle...

**April 30, 2009 - Tennessee**

![Image of an ambulance and paramedics](image1.png)

A paramedic and a patient killed in this vehicle, April 30, 2009, Tennessee.

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**June 17th 2008 a paramedic and a patient killed**

EMSS CRASH KILLS PATIENT AND A SUSSEX COUNTY (NJ) PARAMEDIC IN THE LINE OF DUTY

Tuesday, June 17, 2008

We regret to announce that a Sussex County (NJ) Paramedic was killed in the line of duty servicing a patient involved in a traffic crash involving an ambulance earlier today. The single-vehicle crash happened around 12:40 a.m. on the John A. Williams Highway near the Landing/Conestoga joint company intersection in Augusta.

The Sussex County Fire Regional, who was transporting to Jersey Medical Center, with a patient, NJEMS (State of New Jersey), and the Sussex County Paramedics who were involved in the crash, were taken to a nearby hospital for evaluation. Unfortunately, the patient and the paramedic were pronounced dead on scene.

The patient and the paramedic were identified as a medical student and a medical technician from Sussex County Paramedics, who worked in the area.

Sussex County EMS also suffered a殉职 during the crash.

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**Fatal injuries among EMTs and paramedics, 2003-2010**

<table>
<thead>
<tr>
<th>Cause of Injury</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft incidents</td>
<td>34%</td>
</tr>
<tr>
<td>Highway incidents</td>
<td>32%</td>
</tr>
<tr>
<td>Struck by vehicle</td>
<td>11%</td>
</tr>
<tr>
<td>Other transportation incidents</td>
<td>11%</td>
</tr>
<tr>
<td>Assaults and violent acts</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
</tr>
</tbody>
</table>

*Data for 2010 are preliminary. Percents may not add to 100 due to rounding.

Science behind Policy

- “For successful technology, reality must take precedence over public relations, for Nature cannot be fooled.”
  
  Richard P. Feynman 1988

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

Policies to protect you too!

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 makes a difference...

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.
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.

EMS VEHICLE OPERATIONS/SAFETY
EMMCO WEST REGIONAL PROTOCOL

- All EMS vehicle operators
- All patients
- All non-EMS passengers (cab and patient compartment)
- All EMS practitioners (when patient care allows)
- 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.

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

- EMS vehicle operators
- Patients
- Non-EMS passengers (cab and patient compartment)
- EMS practitioners (when patient care allows)
- 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.

e. Avoid Distracted EMSVOs

- Distracted driving is responsible for many MVCs, and EMS agencies should assure that policies reduce the risk of a distracted driving accident.
- 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.

Safety Event reporting

Balance of concerns and risk during transport

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

Communicating risk
Which image of October 26th communicates better risk perception

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

October 28, 2012
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

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?

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

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

~ 12 mph (20 km/hr)
~ 30 mph - survivable
~ 60 mph - not survivable

A survivable impact??

A serious problem...

the EMS transport process
- communications/dispatch
- the patient
- restraining device/seat
- transporting device/gurney
- paramedics/transport nurses, doctors & family
- patient monitoring equipment
- clinical care & interventions
- protective equipment
- the vehicle
- the driver/driving skill
- other road users
- the road
The Emergency Department (ED)

An ambulance is not an ED /ICU on wheels

Firstly!

- An accident?
- or
- a predictable and preventable event

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......
A tragic emergency health care intervention outcome

But what about head protection?

It does happen….

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

‘Safety’ approaches being driven by manufacturers claims and sales rather than by science and data
Ambulance Transport Safety

- Emergency care, public health, 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

- Epidemiological Data Collection
- Risk Management
- Public Safety
- Transport Policy
- Ergonomic Research
- PPE
- Biomechanical Automotive Safety
- Driver Training
- Biohazard/Chem Research
- Communications technology
- Safety Technology
- Regulations and Standards
- Fleet Safety Program

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

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

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
#NIOSH, 2003
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 (e.g. racing cars) have a different safety paradigm
- Design of interventions to mitigate injury is predicated on a valid testing model
- Complex both engineering and public health issues

and 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


August 2009 – Impaired...

EMT Indicted On Murder Charges

Tammy Brewer Driving Ambulance involved in Fatal 2009 Crash

BY ANDREW MOUNT

POSTED: 11:34 am EDT August 16, 2009
MODIFIED: 1:07 am EDT August 16, 2009

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

Tammy Brewer, 30, was behind the wheel when that crash took place in April 2008. The patient inside the ambulance, Viola Winbush, 54, died of her injuries from the wreck.

September 25, 2012

EMT killed when ambulance, tractor trailer crash in front of hospital
Training... effectiveness...??

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
USA 1980’s Then….

And NOW!!...

Equipment hard to reach

Innovation Now…
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?

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

How Does Technical Information Translate at an Operational Level – Perspectives from the Lone Star State

James C. Swartz, CMTE
President & CEO
CareFlite

What is the problem?

1) How to match culture & processes of air and ground safety
2) Absence of data, appropriate regulation and/or best practices for ground operations

Lesson 1:
"Being responsible sometimes means pissing people off... By procrastinating on the difficult choices, by trying not to get anyone mad, and by treating everyone equally "nicely" regardless of their contributions, you’ll simply ensure that the only people you’ll wind up angering are the most creative and productive people in the organization."

A Leadership Primer from General (Ret.) Colin Powell, Former Secretary of State

Incremental Steps
Always Forward
Safer today than yesterday
System, Vehicles, Operations, Culture
**Sprinter Ambulances to be ordered in First Quarter 2009**
- Use better specs from other countries (but don't tell anyone...)
- CareFlite will order 30 Sprinters for delivery over 36 months (cooperative buying available through EMS Safety Foundation)
- 10 Boxes to Remount (cultural limitations & competitive pressures)
- Top priorities: forward facing seats, essential items within reach, no squad bench

**Progress requires overcoming cultural, manufacturing and regulatory resistance...**

"We can't do that, we've never done that, all the medics will quit, no one does that, there isn't enough room, the hospital teams will hate it..."

If not for safety, then do it for the fuel cost savings...

**WE DO HAVE TECHNICAL DATA!!!**

**Ambulance Safety Research: No longer such a New Field**

![Graph showing timeline of non-safe and safer years](image)

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

**ESV July 2009**

**USA AMBULANCE CRASHWORTHINESS FRONTAL IMPACT TESTING**

*Abstract*:

It is believed that unaltered ambulances are at risk of injury...
As well as epidemiological injury data
August, 2011

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
TRB 2012 Summit – addressed the key and interdisciplinary applied solutions issues, in one day – please seek that information out. [www.objectivesafety.net/TRBSummit2012.htm](http://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](http://www.trb.org), and for the Summit archives: [www.objectivesafety.net/TRBSummit2008.htm](http://www.objectivesafety.net/TRBSummit2008.htm) [www.objectivesafety.net/TRBSummit2009.htm](http://www.objectivesafety.net/TRBSummit2009.htm)

Telematics

Communication Technology trends

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

The impaired/distracted driver

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

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

Nov 2011, Hand Held Cell Phone Ban

Dec 2011, New FMCSA Hours of Service
DOT HOS Rules
- Limits established for on-duty hours
- Establishes minimum levels of off-duty time: 8 hours if on duty less than 12 hours FRA or if over 12 hours then 10 hour off-duty time
- Commercial airline pilot can fly up to 100 hrs/month
- Adopts 60/70 hour weekly maximum for truck drivers, 10 hour off-duty time

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

Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)

Linda D. Dodge
ITS Joint Program Office, US DOT
EMS Subcommittee of the TRB ANB10(5)
EMS Transport Safety Summit
February 29th, 2012

Overview
- USDOT ITS Program Background
- Traffic Incident Management & ITS
- Mobility Program
- NG9-1-1 Status
- R.E.S.C.U.M.E. Status and Plans

ITS Research Program

Policy
- Deployment Strategies
- Financing & Investment Models
- Operations & Governance
- Institutional Issues

Technology
- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Standardization
- Test Environments

Applications
- Safety
  - V2V
  - V2I
- Mobility
- Environment

Operations & Governance

Real Time Data Capture & Management
- Dynamic Mobility Applications
- Environment
- AERIS
- Road Weather Applications

Harmonization of International Standards & Architecture
Next Generation 911 Initiative

Long Term Goal:
To enable the general public to make a 911 “call” (any real-time communication - voice, text, or video) from any wired, wireless, or Internet Protocol (IP)-based device, to the PSAP, and enable data sharing with the emergency communication network.

Major Milestones:
- National architecture and high-level design for NG911 System
- Proof of Concept Demonstration
- Transition plan for NG9-1-1 implementation

For More Information

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http://www.its.dot.gov/

Model Inventory of Emergency Care Elements “MIECE”

Example of how a MIECE color-coded road map might appear:
- White - highest level of emergency care measures
- Red - next level of emergency care measures
- Blue - next level of emergency care measures

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

Ambulance Vehicle Standards??
- KKK?
- AMD?
- FMVSS?
- CMVSS?
- NFPA?
- SAE...?
- ASTM...?
- International
  - ASA
  - CEN

Ambulance Standards and Testing
- Interrelated – mostly paraphrasing each other’s requirements
- Self certified

October 2008 JEMS Article “Rig Safety – 911”
http://www.objectivesafety.net/JEMSRigSafety911.pdf

NFPA 1917 - Test Methods
International Ambulance Design Safety and Occupant Protection Standards

In existence since 1999
- Australia – ASA
- Europe - CEN

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

Summary
- New Resources
- New Data
- New Relationships

March 2012 EMSSF TRB Synopsis Webinar
http://www.emssafetyfoundation.org/Recorded2012
March1SICTEPWebinarlogininfo.htm

Click here www.youtube.com/watch?v=avFD66VYoY
or scan this eTag to see it on YouTube

AMD ambulance ‘safety testing’? – Is NOT consistent with accepted automotive safety practice...

Industries Leading Safety Innovation
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

A few key words about restraint systems...

Dynamic Sled Testing of Ambulance Pediatric Restraints (a resident research project)

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


Testing the real world
And this all takes place in 60 millisecs – the blink of an eye.

During impact

CTD dynamics

Impact residue

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

And now for some MYTH BUSTING

Overwhelming existing evidence these practices are HIGHLY dangerous

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

Systems safety failure AND dangerous
NOT new technical data…


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

Beware some provider restraint systems are dangerous


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

Dangerous manufacturer approaches- absent any meaningful injury data, task analysis or testing standards

“design features are focused on improving the safety of the patient compartment, and side roll protection in our ambulances helps reduce the threat of a fatal injury if a rollover occurs.”
Airbags ...??
Absent safety testing standards, any meaningful crash or injury mechanism data or effective occupant positioning – rear compartment airbags are likely to be hazardous

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

Transporting kids?

- 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

August 1, 2012
NASEMSON - Model Rules for Ambulance Vehicle Design (MRAVD)
Golden Hour – not so hot

- March 2010
- Annals EM

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.]

Golden Hour Summary

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

EMS response times/
- 100 km rural road length
- 1000 km² area

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???

EMS SAFETY COURSE
National Association of Emergency Medical Technicians

NAEMT Safety Course

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

NAEMT EMS Safety Course
For more information about the course, including how to find a class in your area or to sponsor a class call 1-800-346-2368 (1-800-34NAEMT) or email info@naemt.org
This IS a Transportation and Automotive Safety issue

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

Expensive….

Very Expensive

EMS CANNOT Afford to keep paying out like this….
And very Predictable...

- Intersections are lethal environments

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

- You think they heard you...
- You know they must have seen you...
- And maybe they did
- ...... But...
- There is NO way humanly possible that they could stop.....

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

- Perception + Reaction time + Vehicle Braking time (varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)

- Stopping distance: Perception time + Reaction time + Vehicle braking time

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

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

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 side-facing occupants are potentially lethal – and in NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE
Safe Practices for Motor Vehicle Operations
ASSE/ANSI Z15.1 2012

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.
- 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
- Marvis
- 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?

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

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
Which of these two vehicles would you want?
Sprinter v Ford Transit crash test
http://www.youtube.com/watch?v=C3kN6WF5vAA&feature=related

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

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
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

EMS Safety Foundation
Rettmobil 2013 Delegation’s Special Participants

Live from Rettmobil 2013
Public Access – www.EMSSafetyFoundation.org

https://www.youtube.com/watch?v=kjw9_Pyl9R0

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!

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

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.

Based on technically sound scientific principles.
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 is used every day, red every week and so on.
EMS Safety Foundation’s

Live @ Rettmobil 2013 on YouTube!!
Click here
https://www.youtube.com/watch?v=kJw9_PyIr0

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
NAEMSP 2012
Safety and Operational Innovation: Integrating Global Best Practice and Interdisciplinary Technical Expertise into Ambulance Design

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

Areas of need

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

The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational and International
- Innovation
- Collaboration
- Knowledge transfer

The ambulance response vehicle of the future?

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

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
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?
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

Risk/Hazards
- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

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

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

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

Future directions
- Meaningful Goals
- New policies
- New practices
- New standards
- New vehicles
- New technologies
**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

**Innovation**
- Collaboration
- Knowledge transfer

**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.

**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.

**Thank you! Any Questions??**
Electronic handout and resources available online
http://www.objectivesafety.net