September 10, 2013
Strategies and Solutions for Ambulance Transport Safety Systems

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

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

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 Service Safety
- 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

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
- Better
- Safer
- Cheaper

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

EMS Safety Crisis
“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

Your electronic handout/resource link

How do you use a QR code for the first time?
Get any Tag reader App on your smartphone, open Tag App and scan the QR code

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

Expo 2012 – a booth

Expo 2013 – iNDEMO 1.0
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

Automotive engineers addressing EMS Safety Foundation 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

Neonatal transport crash
July 10, 2013
- 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

Doctor killed in ambulance crash being investigated
Head protection @ EMS Expo 2012

A System of Safety
Safe Systems Approach

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

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?

12 mph (20 km/hr)?

What is a survivable impact?

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

~ 30 mph - survivable

~ 60 mph - not survivable

A survivable impact??

A serious problem...

July 18, 2013

Two injured in Wayne County ambulance crash

September 7, 2013

April 2, 2013
Your work environment!!

And yes, this meets KKK or NFPA

June 6, 2013

Fatalities among EMTs and paramedics, 2003-2010*

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent</th>
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<tr>
<td>Highway incidents</td>
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<tr>
<td>Struck by vehicle</td>
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<tr>
<td>Other transportation incidents</td>
<td>8%</td>
</tr>
<tr>
<td>Assaults and violent acts</td>
<td>34%</td>
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<tr>
<td>Aircraft incidents</td>
<td>11%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

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

Source: Bureau of Labor Statistics, Census of Fatal Occupational Injuries

Paramedic David Restuccio killed

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

Policy makes a difference…

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

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

EMS VEHICLE OPERATIONS/SAFETY
EMMCO WEST REGIONAL PROTOCOL

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.

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.
2) 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.

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.

Avoid Distracted EMSVOs
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.

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.
Safety Event reporting

Balance of concerns and risk during transport
- Response and transport time
- Clinical care provision
- Occupant safety/protection
- Public Safety

Communicating risk

October 28, 2012

Which image of October 26th communicates better risk perception

The Emergency Department (ED)

An ambulance is not an ED/ICU on wheels

The EMS transport process
- communications/dispatch
- the patient
- restraining device/seating
- 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
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

‘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

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
- Ergonomic Research
- Biomechanical Automotive Safety
- Communications Technology
- Safety Technology
- Regulations and Standards
- Fleet Safety Program
- Driver Training

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, Firefighters, ?motorcycles)
- Transports - ~30 million
  (to Emergency Deps ~ 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

- Fatals 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)²
- 62% of fatally injured EMS rear occupants unrestrained
- > 70% of fatal occupant injuries
- More likely to crash at an intersection with traffic lights (17% vs 5%, p<0.001) & more people & injuries/crash than similar sized vehicle²

USA Occupational transportation fatalities...

- WE HAVE A BIG PROBLEM HERE

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

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

August 2009 – Impaired...

September 25, 2012

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

USA 1980's Then....
And now...
What we need to consider, where is the ‘bang for buck’ in ambulance transport safety
Where is the low hanging fruit?

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

Progress requires overcoming cultural, manufacturing and regulatory resistance…
“...We can’t do this, we’ve never done that, all the wurde will kick us, our union does this… That’s not…www.inbox.com, the impalas aren’t there…”
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

How Does Technical Information Translate at an Operational Level – Perspectives from the Lone Star State
James C. Swartz, CMTE
President & CEO
CareFlite

EMS Safety Foundation: Innovation, Collaboration, Knowledge Transfer

SprinterAmbulances to be ordered in First Quarter 2009
- CareFlite will order 30 Sprinters for delivery over 36 months (cooperative buying available through EMS Safety Foundation)
- Top priorities: forward facing seats, essential items within reach, no squad bench

EMS Safety Foundation: Innovation, Collaboration, Knowledge Transfer

Incremental Steps
Always Forward
Safer today than yesterday
System, Vehicles, Operations, Culture

EMS Safety Foundation: Innovation, Collaboration, Knowledge Transfer

What Does the Current Technical Information Tell Us About Safer Ambulances?

- More Learns into the Western Technical Information about Safer Ambulances
- How Was it Developed?
- How was it validated?
- What is the evidence, the published results?

EMS Safety Foundation: Innovation, Collaboration, Knowledge Transfer

The problem, forward facing seats, essential items within reach, no squad bench...

EMS Safety Foundation: Innovation, Collaboration, Knowledge Transfer

Ambulance Safety Research: No longer such a New Field
We should use the best safety practices demonstrated in engineering and in ergonomics.

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


The 2012 TRB EMS Safety Summit

1: Data and Recent Initiatives
2: Safety Developments Update – N. Levick
3: New systems safety technology solutions & telematics
4: Fleet management strategies
5: Innovative Vehicle Design
6: Operationalizing Safety
7: Panel: How to optimize the safety of your existing fleet Wrap up – from Prof. Art Cooper

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 than 10,000 downloads of handouts within the first week!!

Opening Address: A.J. Heightman
Safety Developments Update – N. Levick
Research needs assessment forms explained – E. Frazer
1: Data and Recent Initiatives
2: Safety Developments Update – N. Levick
3: New systems safety technology solutions & telematics
4: Fleet management strategies
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7: Panel: How to optimize the safety of your existing fleet Wrap up – from Prof. Art Cooper

Print this page & your smart phone will play the 8 sessions from the stage (even in B&W)
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

Telematics

Communication Technology trends

Smartphone navigation devices

A lot is now possible and for less!

• 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/

Nov 2011, Hand Held Cell Phone Ban

Dec 2011, New FMCSA Hours of Service
http://www.fmcsa.dot.gov/index-regulations/topics/hos/index.htm
**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
- Marvils
- Telematics
- 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

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Linda D. Dodge
ITJ Joint Program Office, US DOT
EMS Subcommittee of the TRB AMB10(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**
- Application
- Harmonization of International Standards & Architecture
- Human Factors
- Pilot Mobility
- Real Time Data Capture & Management
- Dynamic Applications
- Environment Applications
- Road Weather Applications

**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 communications 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**
Linda Dodge
Chief of Staff and ITS Public Safety Program Manager
ITS JPO, USDOT
202.366.8034
linda.dodge@dot.gov
http://www.its.dot.gov/

**Model Inventory of Emergency Care Elements “MIECE”**
- (some of these MIECE care center road map might appear)
  - Green: High-level emergency care resources
  - Yellow: Advanced-level emergency care resources
  - Red: Critical level of emergency care resources
Talking increases crash risk 5x
Texting is COMPLETELY UNACCEPTABLE
23X increase in crash risk

The impaired/distracted driver
- Impairment
  - Illness
  - Exhaustion
  - Substance
  - Emotion
  - Distraction
- CELL PHONE !!!!!! – (A MAJOR HAZARD)
- Other technology

The science of Stretcher lifting & loading

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

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..

NFPA 1917 - Test Methods

Summary

- New Resources
- New Data
- New Relationships

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

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

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

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

Systems safety failure AND dangerous

NOT new technical data...

Beware some provider restraint systems are dangerous

Overwhelming existing evidence these practices are HIGHLY dangerous


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

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

Bigger is not necessarily better……

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

October 2008 JEMS Article
“Rig Safety – 911”

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

Transporting kids?

Basic Ally...
- 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
August 1, 2012
NASEMSO - 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.


Golden Hour Summary

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

April 2010 – Resuscitation

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.


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

GAO-13-6

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%

GAO findings

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

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

Are you self insured???

Very Scary insurance data – the $10 million dollar EMT

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<tr>
<th>Year</th>
<th>Payroll</th>
<th>Modified Premium</th>
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</tbody>
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Workers Compensation Rate increased by 27%
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)

Key elements to safety
- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

Impact biomechanics
- Crashworthiness
- Vehicle design
- Occupant protection

Transport Medicine

A “Fleet” to many in Emergency Medicine care means....

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

### Z15.1 Technical Brief

[http://asse.us2.list-manage.com/track/click?u=c607f19210bc178f7ceb6d716&id=a311862ffc&ct=4007d740a6](http://asse.us2.list-manage.com/track/click?u=c607f19210bc178f7ceb6d716&id=a311862ffc&ct=4007d740a6)

### 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.

### Increasing focus

- TRB - ANB10(S)
- 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

### New Safety Data

- TRB 2012
- 2011 National EMS Assessment
- 2011 NFPA
- TZD EMS
- NCHRP 17-51
- FARS/MMUCC
- NEMSIS
- BLS
Fleet Management technologies
- ACETech/Femo
- 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

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

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

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

EMS Safety Foundation Delegate
AJ Heightman – Rettmobil 2013

EMS Safety Foundation Delegate
Scott Cravens – Rettmobil 2013
The newest Oslo Ambulance

Based on technically sound scientific principles

User friendly
- All necessary equipment should be reach from the seats without losing 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

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.

The Motorcycle Medic

Ambulance Sparing

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

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.

Vehicles equipped with ESC are involved in fewer severe collisions caused by loss of control, resulting in significantly fewer deaths and injuries.

Areas of need

- Crashworthy vehicles
- Improvement in use of occupant restraint systems
- Improvement in use of equipment restraint systems
- Policies to minimize transport risks
EMS Safety Foundation’s
Live @Rettmobil 2013
on YouTube!!
Click here
https://www.youtube.com/watch?v=kjw9PyIIR0

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

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
- 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

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

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

Expo 2013 – INDEMO 1.0

Ambulance Safety Innovation Design Module 1.0
See us @booth 567 or online www.INDEMO.info

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

Your electronic handout/resource link
- Or if you are < 30 years www.objectivesafety.net/PDFHO.htm
Thank you!
Any Questions??
Electronic handout and resources available online
http://www.objectivesafety.net