The Ride of Your Life: Ambulance Safety
EMS Transport Safety System Strategies and Solutions

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

Who am I?
- Nadine Levick MD, MPH
  Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Harlem, Maimonides, Brookdale & Australia – Royal Melbourne, Royal Children 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

What is the scope of EMS?
- Emergency care, public health, public safety and patient transport
- Bridge between the community and the hospital
- Volunteer – Paid providers
- Urban – rural
- Disaster response
- Majority of transports NOT critical or life threatening

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

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

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

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

Your electronic handout/resource link

www.objectivesafety.net/PDFHO.htm

How do you use a QR code for the first time?
Get any Tag reader App on your smartphone (free from your App store)
open Tag App and scan the QR code
www.objectivesafety.net/PDFHO.htm

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

12 years ago

The EMS Safety Foundation: A practical and functional model
Interdisciplinary and Operational and International
  • Innovation
  • Collaboration
  • Knowledge transfer
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

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

Gene Lukianov
EMS Transport Safety
- ‘patient safety’
- AND also
- ‘provider’ and ‘public safety’
- AND very different from the hospital patient safety models

Safety of the...
- Provider
- Public
- Patient

Safety is a tool to save
- Lives
- Time
- Money
- must be evidenced based

Goals
- Safer
- Better
- Cheaper

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

USA 1980’s Then….
And NOW!...

USA 1980’s Then….
And now…
Equipment hard to reach

Innovation Now...

But avoid repeating old mistakes!

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?

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

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.

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

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

USA EMS work environment!!

And yes, this meets KKK or NFPA
Sept 16, 2010

In this vehicle…

June 17th 2008

a paramedic and a patient killed

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

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

April 30, 2009 - Tennessee

Tennessee

Doctor Killed in Ambulance Crash Bringing Remembered

Updated: July 12, 2014 06:04 PM EST

In Memoriam: 2013
July 21, 2013

But what about head protection?

New EMS helmet prototypes

Head protection @ EMS Expo 2013

WE DO HAVE TECHNICAL DATA!!!

Ambulance Safety Research:
No longer such a New Field

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

- EMS Safety
  - 40 papers - on ambulance safety
  - 2 papers - on ambulance ergonomics
  - 1 paper - on stretcher ergonomics

- Computer Workstations
  - 30,000 papers - on ergonomics of computer work stations

- Erectile Dysfunction
  - 100,000 papers - on Erectile Dysfunction

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
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

- Opening Address: A.J. Heightman
- Safety Developments Update – N. Levick
- Research needs assessment forms explained – E. Frazer
- Data and Recent Initiatives
- Transport, Human Factors - Bridging Diverse Disciplines
- Testing and Standards
- New systems safety technology solutions & telematics
- Fleet management strategies
- Innovative Vehicle Design
- Operationalizing Safety
- Panel: How to optimize the safety of your existing fleet
- Wrap up – from Prof. Art Cooper

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

Telematics

Communication Technology trends

- Rise and Fall of Gadgets

Smartphone navigation devices

January 2012, USA

Air EMS is a role model for safety initiatives and focus

- Smartphone penetration by age and income

Air EMS is a role model for safety initiatives and focus
An Aviation Safety Plan

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

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

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

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

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

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

EMS Expo 2013 – EMS Safety Foundation
INDEMO 1.0
Ambulance Safety
Innovation Design Module
Special Innovation Demonstration Project
EMS World Expo

- Strategies and Solutions for Ambulance Transport Safety Systems
  Session 110
  Tuesday, Sep 10 2013 - Handout:
  http://www.objectivesafety.net/2013EXPOLasVegasHO.pdf
- How to Design Your Next Ambulance
  Session 610
  Wednesday, Sep 11 2013 - Handout:
  http://www.objectivesafety.net/2013EXPOLasVegasHO.pdf

EMS Safety Foundation’s new demonstration Project:
Ambulance Safety INDEMO 1.0

- Ambulance Safety INDEMO 1.0, Innovation Design Module, a unique hands on model ambulance rear compartment that is configurable so you can get the feel of being in a cutting edge rig. Integrating innovations from around the world for the north American market.
- The future that you can have right now.

Design models from Oslo fleet

EMS Safety Foundation’s new demonstration Project:
Ambulance Safety INDEMO 1.0

- Designs so that you can do your work with optimum safety and efficiency.
- Based on state of the art science, practice and input from the world’s leading experts in automotive safety and human factors. Meets NFPA, KKK and CEN – and designs that are cheaper, better, safer. Bring these gratis blueprints to your preferred manufacturer.

Innovation
Collaboration
Knowledge transfer

Ambulance Safety Innovation Design Module 1.0

www.INDEMO.info

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EMS Expo 2013 – EMS Safety Foundation
INDEMO 1.0
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Safer, Better, Cheaper!

www.INDEMO.info

YouTube video
http://www.youtube.com/watch?v=q0kPYOzgNyQ&feature=c4-overview&list=UUQj31V_yV1cvd
uWyBETc9ow
– taken as we were getting
set up at EMS Expo

NASEMSO Sept 2013

NASEMSO 2013 NIST handout
http://www.emssafetyfoundation.org/nis
57-Sept-2013-Handouts.pdf

NASEMSO 2013 NIOSH handout
http://www.emssafetyfoundation.org/nis
57-Sept-2013-NIOSH-Handouts-JG.pdf
For restraint systems – not vehicle design & not based on crashworthy vehicles

Again, for equipment anchors, NOT vehicle crashworthiness

Concepts

- Being creative is good
- Trying to advance design is good
- Doing it in conflict with what is demonstrated to be safe and functional is a major problem
- Doing it outside of known principles of automotive safety and occupant protection is at best dangerous

Anthropometry – Body Size

- Who are we designing for?
  - Patients
  - Paramedics and other occupants
- Need to accommodate full range of the population
  - Gender (to reflect workforce participation rates)
  - Body size
  - Functional task performance and biomechanics

How many Medics do you know with a 2 inch deep waist line??
Gender / Body Size

Major Issues
- The majority of medics in the USA could not get in or out of this contraption
- There is no evidence to support the use of all this cabinetry, most of which is both unreachable and an occupant protection hazard
- This environment is very unsafe from an automotive occupant protection
- The cost is prohibitive to build all this cabinetry

Clear benefit in building a configurable physical environment
- Computer models are good for conceptual sharing – we began with them
- Physical models can test and demonstrate real world accessibility, reach and comfort – rapidly and for a range of body sizes and shapes

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!!!!

Safety Performance
- Measurement
- Outcomes
- Technical expertise

Some new dimensions
- Vehicles – smarter, sleeker, safer – CHEAPER!
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- Interdisciplinary infrastructure – new global platforms
Safety of the…

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Data...

- What is your transport safety record in your service?
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- 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 = \( \frac{1}{2} mv^2 \) \( v^2 = 2as \)

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

A survivable impact??
A serious problem…

Fatal injuries among EMTs and paramedics, 2003-2010*

- Aircraft incidents: 11%
- Other transportation incidents: 7%
- Assaults and violent acts: 32%
- Struck by vehicle: 7%
- Highway incidents: 34%
- Other: 15%
- Total: 97%

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

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

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.

Policy makes a difference…

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 (i) or regions may use these guidelines in establishing regional treatment and transport protocols.
**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.
  - 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.

**Safety Event reporting**
- The EMS transport process
  - communications/dispatch
  - the patient
  - restraining device/seats
  - 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 region's response capacity......

'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

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 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
- ~ 3-5 pedestrians or occupants of other car
- ~10 serious injuries each day
- Cost estimates > $500 million annually

Ground Ambulance Transport Safety IS Complex AND Multidisciplinary

- Epidemiological Data Collection
- Biomechanical Research
- Ergonomic Research
- Public Safety
- Public Health
- Risk Management
- Safety Technology
- Transport Policy
- Policy
- Research
- Technology
- Driver Training
- Fleet Safety Program

Predictable risks

- Fatal crashes more often at intersections, & with another vehicle (p < 0.001)
- 70% of fatality 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

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

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

'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
 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

USA Occupational transportation fatalities...

WE HAVE A BIG PROBLEM HERE

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


and what is killing EMS ?

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…

Lesson 1:

"Being responsible means knowing what you can’t... No ignoring the difficult choices, by saying you’ve got tougher luck, and by treating other unhappy "accidents" of that contribution, you’ll simply ensure that the only people you’ll wind up targeting are the most minor and predictable people in the organization."

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

Training… effectiveness…??

Incremental Steps

Always Forward

Safest today than yesterday

System, Vehicles, Operations, Culture
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


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
- 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

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 20th, 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

- Safety
- Mobility
- Environment

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

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/

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

Model Inventory of Emergency Care Elements "MIECE"

Examples of how a MIECE order could look may appear:

- Enhanced health care first data
- Enhanced first data for emergencies
- Enhanced data linked seamless emergency
- Enhanced data real-time emergency
- Enhanced data
- Enhanced data real-time emergency
- Enhanced data
- Enhanced data

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

Standard for Automotive Ambulances 2013 Edition

Self certified
International Ambulance Design
Safety and Occupant Protection Standards

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

Summary
- New Resources
- New Data
- New Relationships

March 2012 EMSSF TRB Synopsis Webinar
http://www.emssafetyfoundation.org/Recorded2012
March15ICTEPWebinarlogininfo.htm

Click here www.youtube.com/watch?v=avFjl06bYcY
or scan this eTag to see it on YouTube

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…

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


During Impact
CTD dynamics

Impact residue
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...

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

Beware some provider restraint systems are dangerous

‘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?

Basically...
- DON'T put child in the front seat
- DON'T put the child on the rear facing captain's chair
- Just about anywhere else is OK!
- Use a child seat when medically appropriate and size fits, well secured.

NASEMSO MRAVD initiative

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.

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

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%

GAO-13-6
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

Are you self insured???
Very Scary insurance data – the $10 million dollar EMT Year Payroll

<table>
<thead>
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<th>Year</th>
<th>Incurred Indemnity</th>
<th>Modified Premium</th>
<th>Medical</th>
<th>Total Claims</th>
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<td>1998</td>
<td>51</td>
<td>78</td>
<td>411</td>
<td>51</td>
</tr>
</tbody>
</table>

Workers Compensation Rate increased by 27%

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....

The Huntsville Times...
Ambulance suit gets $3.1 million

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

44 feet

Dry

Stopped at 176 feet

Perception + Reaction time Vehicle Braking time (dry)

40 mph

Wet

Stopped at 220 feet

Perception + Reaction time Vehicle Braking time (wet)

* Stopping distance:

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

The real world

The real world

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

Z15.1 Technical Brief
http://www.asse.org/manage.com/track/track?u=67f19210bc178f7c6e6b716&l=a311e6296&f=8007d740a6

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
- Marvils
- 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

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

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

- 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

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

How much chevron and what colors?

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

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

EMS Safety Foundation
Rettmobil 2013 Delegation’s Special Participants

So What is RETTmobil??
The newest Oslo Ambulance

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

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.

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.

The Motorcycle Medic

ESC – Does your ambulance have it??

The Motorcycle Medic

ESC – Does your ambulance have it??

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

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

ESC – Does your ambulance have it??

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

NAEMSP 2012
Safety and Operational Innovation: Integrating Global Best Practice and Interdisciplinary Technical Expertise into Ambulance Design
Areas of need
- Crashworthy vehicles
- Improvement in use of occupant restraint systems
- Improvement in use of equipment restraint systems
- Policies to minimize transport risks

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

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

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

Ambulance Safety Innovation Design Module 1.0

www.INDEMO.info

the future you can have right now!!!
Important Principles!

1. A system of safety
2. Drive cautiously
3. Wear your belts & restrain all occupants
4. Secure all equipment
5. Integrate scientific data into your policies and procedures
   - Unrestrained occupants and equipment are a potential injury risk to all occupants

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

PREDICTABLE PREVENTABLE and NO ACCIDENT

small changes can make a BIG DIFFERENCE

- PREPARE – TEACH – REACH – RESPOND
  - Look at your own safety record
  - Teach safety and hazard awareness
  - Reach out with safety information to all your EMS providers
  - Respond with the best safety practices

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

Thank you!

Any Questions??

Electronic handout and resources available online
http://www.objectivesafety.net

www.objectivesafety.net/PDFHO.htm