“Novos conceitos em segurança veicular”

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

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

Your Interactive Handout awaits you online at...

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

Seu handout eletronica-

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

Obrigada pelo convite para que eu fale no 26 aniversário do Jubileu de Prata aqui em Rio de Janeiro

Dr. if you are +30 years old
Outline

I. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public
II. Highlight unacceptable mythology and challenges to advancing EMS transport safety
III. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient transport

Who am I?

- Nadine Levick MD, MPH
- Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Harlem, Maimonides, Brookdale & Australia – Royal Melbourne, Royal Childrens Hospitals, Royal Australian Flying Doctor Service)
- Chair, National Academies Subcommittee TRB EMS Transport Safety, USA
- Founder of EMS Safety Foundation
- Recipient, International Society of Automotive Engineers, Women’s Leadership Award for EMS Safety

Where am I really from?

...Yes, it IS that big!

Here!

So....

Now who have we here?

Are you –
- Government EMS?
- Volunteer EMS?
- Hospital based EMS?
- Private EMS?
- Nurses?
- Physicians?
- Other?

What I hope to cover today

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

A que eu espera cobrir hoje

- " Da segurança de transporte da ambulância; é a parte de um sistema"
- Segurança paciente... e fornecedor e segurança pública demasiado?
- " It’s a system inseguro... porque?"
- Edições com fabricação da ambulância
- Necessidade para a medida para o desempenho mais seguro
- Criando um ‘cultura de safety’ com a consolidação, o treinamento, o projeto, a tecnologia e o incentivo.
Emergency Medical Service Transport

- What are the transport safety issues that pertain to this important public service and public safety industry?
- What do we know of the risks and hazards and how can we measure these?
- How can the safety of this transport system be optimized?
- What can we learn from international colleagues?

Unique workplace

- In vehicles
- At roadside and other emergency scenes

The ‘workplace’ IS a vehicle

- EMT’s often in vulnerable positions during transport:
  - Bench seat
  - Captain’s chair
  - Standing or kneeling

The ‘workplace’ is also a crash scene

“We want everyone to get home safely each day”

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

Safety Innovation

- New Fleets
- New Policies
- The Cloud and what it can do for EMS
- New Fleet management technologies
- New back strain monitoring
- Peds transport issues
- New Platforms
- New Safety Initiatives

The EMS Safety Foundation

www.EMSSafetyFoundation.org
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

Automotive engineers addressing EMS Safety Foundation Workshop

International approaches

The state of the art international non-USA vehicles have:
- NO squad bench
- NO after market structural vehicle modifications that can potentially decrease vehicle crashworthiness integrity

EMS Safety Foundation Delegation seeking out International Innovation

USA EMS in 1917

1960 to 2011

A passenger vehicle

A passenger vehicle – yes!

Europe, South America, Asia

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

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

A tragic emergency health care intervention outcome

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......

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

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 safer?
- 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?

Tragedy you don’t want to be involved in

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

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

Electronic Stability Control
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

1980’s Then…

And NOW!…

USA 1980’s Then…

And USA NOW!…

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

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

USA EMS transport safety data estimates

- ~50,000 vehicles
- ~9,000 crashes a year
- ~1 fatality each week
  - ~2/3 pedestrians or occupants of other car
- ~10 serious injuries each day
- Cost estimates > $500 million annually

Balance of concerns and risk during transport

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

An interhospital transport? “Do no harm….”?

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)
- > 74% of EMT occupational fatalities are MVC related
- > 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

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

and who’s life was he racing to save?
Occupational transportation fatalities..

WE HAVE A BIG PROBLEM HERE

www.EMSSafetyfoundation.org

and what is killing EMS?

EMS personnel fatalities*

- 74% transportation related
  - 1/5 of ground transport fatalities were struck by moving vehicles
- 11% were cardiovascular
- 9% were homicide
- 4% needle sticks, electrocution, drowning and other

www.EMSSafetyfoundation.org

So does it make sense?

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

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

A challenge we know now...

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

Um desafio que nós sabemos agora...

- ... há que está um problema grave com a aproximação atual e o que está sendo feita atualmente
- e muitas práticas estão em conflito com, ou não suportado perto, ciência de engenharia técnica existente

Some new dimensions

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

Systems safety of:

- Travel to and from the scene
- 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

Safe Systems Approach

Safe Systems Approach

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

- Measurement
- Outcomes
- Technical expertise

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}mv^2 \quad v^2 = 2as

~ 30 mph - survivable

~ 60 mph - not survivable

A survivable impact??

A serious problem...

July 20th 2007
The worst ambulance crash in USA history

Five Killed in Crash of Ambulance and Semi

July 21, 2007 06:20 AM EDT

The crash, which involved an ambulance and a semi-truck, killed five people and injured several others. The accident occurred on the Pennsylvania Turnpike near Reading, Pennsylvania.

Emergency personnel at the scene described the crash as the worst in Pennsylvania in recent memory. "It's been a tough day," said one emergency worker. "We've never seen anything like this."
June 17th, 2008
a paramedic and a patient killed

In this vehicle...

October 31, 2008 - Kentucky

April 30, 2009 - Tennessee

January 14, 2010

February 1, 2010

Sept 16, 2010
Jan 8, 2011
Driver Collides with Ambulance Transporting His Daughter

April 18, 2011
Pedestrian hit by a moving ambulance - South Carolina

June 3, 2011
Crash Involving Ambulance - South Traffic on Montalvo - Response In Minneapolis Hills

July 5, 2011
Two Hurt in Milwaukee Ambulance Crash

In the USA there are more safety standards for moving cattle than for moving patients

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

In the USA
• ~ 50 fatalities a year
• 15,000 EMS services
• Each year one in 300 services experiences a fatality

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
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

Ground Ambulance Transport Safety IS Complex AND Multidisciplinary

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

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

‘Workplace’ Hazards

It does happen....
But what about head protection?

New EMS helmet prototypes

The laws of physics prevail...
• and they don’t care what your job title is or if you are a patient, a provider or a member of the public

Transport Medicine

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
Have you ever driven impaired/distracted?

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

Talking increases crash risk 5x
Texting is COMPLETELY UNACCEPTABLE

April 14th, 2008

What policies and procedures do you have in place to protect your providers, service, patients and public???

August 2009 – Impaired...

This IS a Transportation and Automotive Safety issue

EMT Indicted On Murder Charges

Benefit of Safety
- Any cost of addressing these issues is dwarfed in contrast to the huge burden of not doing so - in financial costs let alone the personal, societal, ethical and litigation costs
Important…

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

Goals

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

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

Safety is Good Business

Insurance data

- 2011 - 35 x more transport claims than medical care claims
- 2007 - 27 x more likely to have a claim based on transport than related to medical care
- 2003 - 10 x more likely to have a claim based on transport than related to medical care

An increasing problem

Expensive….

The Huntsville Times

Ambulance suit gets $3.1 million

Very Expensive

$14 Million Judgement Against AMR

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

Red light Roulette

Dynamic Safety Testing

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

Full Vehicle Crash Tests

Test 1 - Right side impact

Test 2 - Frontal

Testing the real world

2000 Full Vehicle Crash Testing
Pre-impact CTD positioning
And this all takes place in 60 milliseconds – the blink of an eye.

Impact residue

CTD dynamics

During impact

A few key words about restraint systems…

Dynamic Sled Testing of Ambulance Pediatric Restraints

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


Why do we do this?

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

What do we know now??
- Intersection crashes are the most lethal
- There are 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 are forward or rear facing and can slide toward the patient
- Head protection??
- Electronic Driver monitoring/feedback systems appear to be highly effective

Air EMS is a role model for safety initiatives and focus

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

Ambulance Safety Research: A New Field

Based on technically sound scientific principles
We should use the best safety practices demonstrated in engineering… in automotive safety engineering and in ergonomics. This is a well-defined technical science.

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

The science of stretcher lifting & loading.

Stretcher Load - #1 (CNLOAD01)

So what's important...
- A stretcher system that doesn't harm your back... and your services wallet
- The new Mondial Ferno
- A 27 inch loading height

And what is the loading height of your ambulance??
Size matters…. Less than 27 inches will save your back!!!!

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

October 2008 JEMS Article “Rig Safety – 911”

Global EMS Vehicle Safety Standards v Specifications and Guidelines
- EMS Safety and Performance Standards
  - Australia & New Zealand 4538
- Common European Community (CEN) EN1789
- Non EMS Specific USA Standards
  - [Aviation - FAA/CAN/JAA]
  - [Fire vehicles - ASSE/ANSI 215 ]
- USA Other
  - Purchase Specification: KKK
  - “Standards” - NTEA, AMD, ASTM F 20, NFPA (latest)
  - Guideline: EMIC, Dox and Dorns, and (ASTNA, CAAS and CAMTS)

2011….

Which of these two vehicles would you want?
Sprinter v Ford Transit crash test
http://www.youtube.com/watch?v=O3kN6WF5vAA&feature=related

October 2008 JEMS Article “Rig Safety – 911”

http://www.objectivesafety.net/JEMSRigSafety911.pdf
American National Standard
ANSI/ASSE Z15.1-2006
Safe Practices for Fleet Motor Vehicle Operations

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

Best Practices?

EMS Best Practice, Sept 2006

Day visibility

Night visibility

Here’s the real world at 6 ft...

Policy and practice ignorant of existing technical safety data

This addresses some very real risks, very creatively – and currently ONLY available in London Ontario!
The multicolored (patterned) ambulance while distinctive, may suffer decreased conspicuity because of the effects of camouflage.

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

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

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

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

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

Innovation
Human Interface approaches
- Hardware fitted to the vehicle
- Non hardware App Driven cellular technology

The “Feedback box”
Driver behavior monitoring and feedback device

Extensive Indirect cost savings
- Fewer out of service vehicles
- Improved transport times
- Decreased administrative lost in managing unsafe behaviors
- Decreased legal burden
- Automatic system wide data
- Insurance benefits

Monitoring and feedback devices
- Implementation well received by the providers.
- 20% cost saving in vehicle maintenance within 6 months.
- No increase in response times
- Fewer crashes and less severe crashes
- Sustained improvement in safety proxies, with no inservice or retraining after the initial introduction period.

ACETECH™ Auto Vehicle Informatics (AVI) key features

THE ACETECH™ AVI advantage
- ACETECH™ AVI – Vehicle Informatics
  - Know where your vehicles are
  - Dispatch the closest, most appropriate unit
  - Improved productivity
  - Reduced carbon emissions
  - Reduced risk of severe injuries
  - Reduced response time
  - Panic /emergency button is sent to operations

Telematics

The Cloud is Global
Telematicus

- "Learn" - All Trips recorded (start trip/stop trip)
- Established the benchmarks
- "Alarm Active"
- "Guide" - Speed feedback activated
- Driver Clinics
- Automated Application updates
- "Sustain" - Messaging, Incident Management

GPS and GPRS status
A smart phone App that is a safety tool

Driver and vehicle ids
Driver controls GGD on mobile platform to provide data
Driver feedback to GGD scorecards, messages, training.
Closed loop system

Harsh Braking per 100 trips

Resource availability and allocation technologies

TRB Ambulance Transport Safety Summits

TRB TRANSPORTATION RESEARCH BOARD

What could you learn from the National Academies – right NOW and gratis

- The realm of burden and benefit
- Measuring the safety of the system
- Determining the economic, ethical and risk benefit challenges

- Transport System Management
- Fleet safety and oversight technologies and policies
- Operations management - dispatch, congestion routing, deployment of resources, benchmarking

- Vehicle safety
- Occupant protection design and testing
- Vehicle performance safety
- Vehicle and personnel human factors issues

- Dissemination and Policy
- Knowledge transfer
- Standards, specifications and policy

Independent Technical Expertise

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

TRB Ambulance Transport Safety Summits

- There have been two TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise


- Next is Dec 12, 2011

Its out there NOW

- There have been two TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise


- Next is Dec 12, 2011
2011 December TRB EMS Safety Strategies and Solutions Summit

- To be held on Dec 12 onsite Washington DC USA and online
- Auspices of the National Academies of Science, Medicine and Engineering

European EMS Innovation
Rettmobil 2011 – May 11-13th

- 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

Birds eye view

- Advisory Board and Technical Expert Panel
  - EMS Safety Foundation, Director of Human Factors and Ergonomics
  - Chris Fitzgerald, Injury and Risk Management
No side squad bench seat
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
Texas - Careflite's new vehicle

Careflite’s new vehicle

The new Oslo Ambulance

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 ?

Were we safer in the Cadillac???

What do we know works...
• 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
• Some 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

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

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