The Ride of Your Life: Managing the Risks and Hazards of Ambulance Transport

Outline

I. Review of data on ambulance crashes and safety standards and guidelines that exist for the ground EMS
II. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public
III. Highlight unacceptable mythology and challenges to advancing EMS transport safety
IV. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient transport

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?

Firstly!

An accident?

or a predictable and preventable event
**A tragic emergency health care intervention outcome**

It happens....

**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
- BUT an EMS crash can kill all involved AND wipe out an EMS systems 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

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**In a nutshell**

- Am here to try to save you
- Lives
- Time and
- Money

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**October 2008 JEMS Article “Rig Safety – 911”**

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**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

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**There are more safety standards for moving cattle than for moving patients in the USA**

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**the EMS transport process**

- communications/dispatch
- the patient
- restraining devices/bed
- 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

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**The Emergency Department (ED)**
An ambulance is not an ED / ICU on wheels

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

USA EMS data
In the USA:
- ~ 50,000 vehicles
- ~ 5,000 crashes a year
- One fatality each week
  - ~ 25 pedestrians or occupants of other car
  - Approximately 6 child fatalities per year
- ~10 serious injuries each day
- Cost estimates > $500 million annually
- USA crash fatality rate/capita 35x higher than in Australia

Is it your service’s tragic year?
- ~ 50 fatalities a year
- 15,000 EMS services
- Each year one in 300 services experiences a fatality

Creating a Safety Culture
within a company must start with upper management’s commitment to safety
- Awareness
- Training
- Incentive

Safety - Why now?
- Operating optimally in a transportation environment that is largely devoid of specific safety standards for the hazards and risks present
- Bridge the gap between what technical information exists and what is accessible and applied to EMS

January 10, 2008
This is not a crashworthy environment

Jan 28th, 2008

AMBULANCE CRASH HURTS 4

Feb 21st, 2008

April 14th, 2008

May 19th, 2008

April 20, 2008, ??

**New York Post**

AMBULANCE CRASH HURTS 4

Feb 21st, 2008

New York, New York

An emergency service contractor's right eye was injured after the ambulance in which she was a patient rolled over and struck a tree in the village of Lakeville.

Second update Mr. B. was flown by helicopter to the Hochstein Medical Center in Olean. Other patients were treated and released.

-- William W. Genter

An ambulance driver was rushed to the hospital after a crash in Lakeville, N.Y., on Sunday, July 12.

A New York Post photo shows the ambulance with damage to its roof and side. The driver of the ambulance was treated for minor injuries and released.

**New York Post**

AMBULANCE CRASH HURTS 4

April 14th, 2008

New York, New York

An ambulance carrying a COVID patient rolled over in the village of Lakeville, N.Y., on Monday, April 5. The driver, who was injured, was rushed to the hospital for treatment.

A New York Post photo shows the ambulance with damage to its roof and side. The driver of the ambulance was treated for minor injuries and released.

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AMBULANCE CRASH HURTS 4

May 19th, 2008

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June 17th 2008
a paramedic and a patient killed

In this vehicle...

October 31, 2009, Kentucky

Florida - January 12, 2009

February 11, 2009 – North Carolina

EMS Safety
► 'patient safety'
AND also
► 'provider' and 'public 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

Thursday July 5th 2007......
Paramedic Allan Parson’s killed

"...I’d like to know what can be done so this never happens again...."
2 weeks later... Friday July 20th 2007

The worst ambulance crash in USA history

Five Killed in Crash of Ambulance and Semi

July 21, 2007 06:41 AM EST

The highest Sandy experienced were, you know, the rough window of transportation. It was a really bad thing. Sandy)

People are passengers and NOT packages or parcels

Fatalities and funerals

UPS and Laundry trucks have very similar design and even more stringent safety requirements to EMS vehicles

But very different cargo......

Some odd facts

- Ambulances are generally not built by the automotive industry
- Intelligent Transportation Systems (ITS), transportation safety engineering is not generally integrated into EMS systems
- Although all EMS systems have medical direction and oversight, it is rare for there to be transportation expertise oversight

Some recent adverse outcomes

An interhospital transport

"Do no harm...."

This IS a Transportation and Automotive Safety issue

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
Testing the real world

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

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

Absence of standards and oversight
- Challenges in identifying best practice
- Myriad of unregulated commercial products
- No safety performance standards
- Absent national safety oversight

What we need to consider, where is the 'bang for buck' in ambulance transport safety:

USA EMS in 1917

USA 1960's

1960 to 2009

A passenger vehicle - sure

A passenger vehicle - yes!

"Ambulance transport has a death toll....."

Carl Craigie EMT-P, Chief Platte Valley Ambulance

‘Real world’ head-on post crash
So for EMS personnel...

- What’s going to kill you?
- What’s going to injure you?

Ground Transport Safety IS Complex AND Multidisciplinary

- Epidemiological Data Collection
- Risk Management
- Public Safety
- Transport Policy
- Driver Training
- Communications technology
- Safety Technology
- Regulations and Standards
- Fleet Safety Program

Occupational Health and Safety.....?

- This IS a Transportation and Automotive Safety issue
- This is a Systems safety issue

Goals

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

EMS Best Practice, Sept 2006
Patients must be in the over the shoulder harness, medics restrained in seat belts, equipment secured

What are the solutions?
- Training?
- Practice Policy?
- Transportation Systems Engineering?
- Automotive Engineering?
- Education of other road users???

Hmm...

So why is it...
- That the EMS providers -
  - Were wearing navy blue – one of the most difficult colors to see at night
  - Had no head protection, when all other emergency personnel at the scene did
  - Had no protective clothing, when other emergency personnel at the scene did???

It isn’t like this outside of the USA

USA Ambulances: FMVSS Exemption

FMVSS exempt......

NFPA Ambulance Standard Development
- NFPA Ambulance Standard Development underway
- Scope for integrating appropriate technical expertise
- Key to encourage collaboration with automotive safety technical experts
- Essential that the standards are realistic for general ambulance services

Balance of concerns and risk during transport
- Response and transport time
- Clinical care provision
- Occupant safety/protection
- Public Safety
Benefit of Safety
- Safe practices save lives, time and money

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

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Stopping Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>44 feet</td>
</tr>
<tr>
<td>Wet</td>
<td>220 feet</td>
</tr>
</tbody>
</table>

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

The Crash Event - Crash Testing
- An introduction
- What one needs to know
- What do the tests really mean
- And, what tests are meaningful

Intrusion vs Deceleration
- Intrusion = vehicle to vehicle or vehicle to fixed narrow object
- Deceleration = sudden stop – ie. sled test

Intrusion
Deceleration

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

If we know this – and its published....

Why do we do this?

Foldable

What is actually happening during an ambulance crash

Precious Cargo

Johns Hopkins University
- Target vehicle, Type I ambulance
- Bullet vehicle, Type II ambulance
Closing speed 44 mph
And this all takes place in 60 milliseconds – the blink of an eye

A few key words about restraint systems…

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

NOT new technical data…

USA 2004, NIOSH Head strike zone hazards

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 for side-facing occupants are potentially lethal – and is in NO WAY SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE.

Increasing awareness …
What do we know now??

- Intersection crashes are the most lethal
- There are documented hazards, some which can be avoided
- Occupant and equipment restraint with standard belts is effective. (Over the shoulder harnesses for patients should be used, with the gurney in the upright position where medically feasible)
- Some vehicle design features are beneficial - automotive grade padding in head strike areas, seats that can slide toward the patient
- Electronic Driver monitoring/feedback systems appear to be highly effective
- Head protection??

Rash of “Safety Concept” vehicles….. *Devoid* of substantive automotive safety engineering input or testing

- Sure… these vehicles all parade around the EMS and Fire shows
- NOT ONE of these vehicles has been to the automotive safety shows or scrutinized by the automotive safety industry

Yes, the ride of your life….

Innovation

Transportation Research Board is an excellent resource… we should be using it!!

Safety concepts out there now

- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies - ITS
- New Safety Standards

Important…

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

National Academies
TRB EMS/Medical Transport Safety Inaugural Summit – November 7, 2008
next is to be October 29th, 2009
What about changing driver behavior in the real world?

Purpose of ‘Feedback box’ Program
- Enhance Safety
- Improve Driver Performance
- Save Maintenance Dollars
- Aid Accident / Incident Investigation

How the Device Works
- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has individual key “fob”
- Data collected every second including: vehicle speed and performance, driver behaviors and emergency mode
- Auditory feedback of warning ‘growls’, and penalty tones
- Data downloaded automatically every day

Demonstrated Effectiveness

A key to safe ambulance transport

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

Other monitoring devices
- Primarily to record events during and immediately preceding a crash
- Give no driver crash prevention feedback
- Administratively burdensome
- Intrusive
- Not demonstrated to be as effective in improving vehicle maintenance costs or as effective in modifying driver behavior long term

You want a system that works!!
- Does the system really work?
- Is it going to be a major burden on your staff to implement?
- What are the real costs?
- Are you going to have video of your company vehicle on you tube??

The jury is out on
- Opticon
- Simulators
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

Visibility and lighting issues

News we don’t want to see
Caught On Video: EMT Struck By Car

Worker visibility Act: November 24th 2008

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!

Summit County EMS - Colorado

Old vehicle

New yellow vehicle markings

Staff use lime-green vests & jackets

"The multicolored (patterned) ambulance while distinctive, may suffer decreased conspicuity because of the effects of camouflage" De Lorenzo & Eilers Annals EM 1991

International approaches

The state of the art non-USA vehicles have NO squad bench nor the after market structural vehicle modifications that can potentially decrease crashworthiness integrity that were seen in study vehicles.
Vehicle Occupant Safety design

Safe and Ergonomic design

Ergonomic layout and equipment

NSW Australian vehicles

Flexibility to manage two patients

Vehicle design in NSW Australian vehicles is a key focus.

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

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?
Were we safer in the Cadillac???

Fleet Mix?

“Ripoff and Duplicate”
- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

Tips for Emergency Vehicle Operations

An excellent model

USFA Emergency Vehicle Safety Initiative

Traffic Incident Management Systems (TIMS)
- Released April 2008
- FEMA, USFA, IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents

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

http://www.EveryoneGoesHome.com

Traffic Incident Management Systems (TIMS)

http://www.EveryoneGoesHome.com
What you can do now
- Have a written and implemented ‘safety program’
- Secure all equipment
- Secure occupants with standard belts
- Don’t drive through red lights/stop signs
- Use properly implemented “Feedback Boxes”

What do we know works…
- Vehicle Operations Safety Policies
- Squad bench lap seat belts
- Patient over the shoulder belts
- Securing equipment
- Forward and rear facing seating
- Some electronic technical devices
- Safety awareness
- Cultural change

Important Principles!
1. A culture 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

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

Predictable Preventable and NO ACCIDENT

Conclusion
- EMS transport has serious hazards and safety issues
- Major advances in EMS safety research, infrastructure and practice over the past 5 years
- New technologies for vehicle design, occupant PPE and equipment restraint and driver performance are now available
- Development of substantive EMS safety standards is a necessity and a reality
- 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 safety and occupant protection

And….
- It is no longer acceptable for EMS to be functioning outside of automotive safety 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 available online
http://www.objectivesafety.net