**The Ride of Your Life: Ambulance Transport Safety - Separating Fact from Fiction**

**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.

**EMS Transport Safety**

- 'patient safety'
- AND also
- 'provider' and 'public safety'

**Ambulance transport a serious transport safety problem...**

In the USA
- the most lethal vehicle on the road both per mile travelled and per vehicle
- is exempt from commercial fleet safety oversight from Federal Motor Carrier Safety Administration (FMCSA)
- 2/3 fatalities not in the ambulance
- Exempt from most FMVSS standards

**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

**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

**Absence of USA standards and oversight**

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

**...and**

- Is your ambulance crashworthy?
- Do you have a telematics feedback system?
- Enhanced Stability Control (ESC) – Does your ambulance have it??
  - An estimated >16% decrease in vehicle crashes
- and what is your loading height??
  - ...is it less than 27 inches (68cm)??

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Predictable risks
- Fatal crashes more often at intersections, & with another vehicle (p < 0.001)
- 70% of fatal crashes EMS crashes during Emergency Use
- Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained) **
- 82% of fatally injured EMS rear occupants unrestrained**
- > 74% of EMT occupational fatalities are MVC related***
- Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)**
- 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

Transport Medicine
- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

Key elements
- Crashworthiness
- Vehicle design
- Occupant protection

Impact biomechanics
- Operational tasks
- Human factors analysis
- Range of reach
- Patient loading and unloading

Transport Ergonomics
- 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

Fleet safety
- 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?
  - What policies offer the safest system?
  - How do I get my team to address safety issues?
  - Do I need a helmet, and if so which one?
  - What data should I collect when something goes wrong, and how to analyze it?
In the USA AND Canada there are more safety standards for moving cattle than for moving patients.

The Emergency Department (ED) is not just a hospital ward on wheels.

An ambulance is not an ED / ICU on wheels.

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.

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

Ground Ambulance Transport Safety IS Complex AND Multidisciplinary

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

Science behind Policy
• “For successful technology, reality must take precedence over public relations, for Nature cannot be fooled.”
  Richard P. Feynman 1988
June 17th 2008
a paramedic and a patient killed

In this vehicle...

October 31, 2008 - Kentucky

April 30, 2009 - Tennessee

And...
This is in a setting where
- transport safety is the major and most costly adverse event in EMS
- And there have been all sorts of major technical and informational developments since Jan 2006

We should use the best safety practices demonstrated in engineering

...in automotive safety engineering

and in ergonomics
Range of reach.. This is a well defined technical science

‘Workplace’ Hazards

Bigger is not necessarily better.....

Goals

- Standards for safety
- Policy based on Science
- Databases to demonstrate outcome
If we know this – and its published….


Why do we do this?

Immobilization board

Foldable
Choose the Best Option

Vehicle Crashworthiness testing

Europe - 2007 to meet CEN

Test 1 – Right side impact

- Target vehicle, Type I ambulance
- Bullet vehicle, Type II ambulance

Closing speed 44 mph

Johns Hopkins University

Pre-impact CTD positioning

2000 Full Vehicle Crash Testing

Preparation of test vehicles

Test 2 - Frontal

- Bullet vehicle, Type III ambulance
- Target vehicle, Type II ambulance

Closing speed 34 mph

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

Impact residue

Pre-impact CTD positioning

During impact

CTD dynamics

High speed crash, rolled and the occupants (patient and medics) had only minor scratches
A few key words about restraint systems...

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

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 sidefacing occupants are potentially lethal – and in NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE

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

October 2008 JEMS Article
“Rig Safety – 911”
http://www.objectivesafety.net/JEMS/RigSafety911.pdf

Invehicle technologies to enhance transport safety
- Aftermarket in vehicle electronic e-safety devices with monitoring and feedback

In-vincible... Delivers time-saving Safety and Fleet Management Solution
What about changing driver behavior in the real world??

This technology is conceptually like a vehicle safety ‘pulse oximeter’ – that with auditory feedback - can save your life, your coworkers life, your patients life, and others on the road.

And when a rare crash happens....

The “Feedback Box” -
A transportation safety monitoring and feedback device

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Feedback box Summary
- The system works
- Objectively improved performance
- No increase in response times
- At fault accidents reduced
- Accepted into the culture
- However:
  - The system requires monitoring
  - Must be reinforced by management
  - Must be incentives for good performance
  - Must be consequences for poor performance

Unit 302 Accident

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.

A key to safe ambulance transport

Exeuctive 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
This is where the technical experts were, operational EMS providers and the government agencies too.

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

Vehicle safety:
- occupant protection design and testing
- vehicle performance safety
- vehicle and personnel human factors issues

TRB 2009 Summit – addressed the key and interdisciplinary issues, in one day – please seek that information out.

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


Its out there NOW
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Emergency Medical Services Safety Foundation:
- A practical and functional model
  - Interdisciplinary and Operational
    - Innovation
    - Collaboration
    - Knowledge transfer

Background:
- EMS Safety Foundation has been established 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

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
Vehicle Occupant Safety design

European design

Safety technology is a key focus

Interdisciplinary Collaboration is what is key – not orthopedic folks talking to cardiologists – BUT collaboration between the health care folks appropriate automotive and occupant protection engineers and transportation system design and industry standards that make sense – and

Meaningful measures of outcome and performance

Safe and Ergonomic design

Collaboration and Outcomes

• Interdisciplinary Collaboration is what is key – not orthopedic folks talking to cardiologists – BUT collaboration between the health care folks appropriate automotive and occupant protection engineers and transportation system design and industry standards that make sense – and

• Meaningful measures of outcome and performance

Texas’ Careflite’s new vehicles

Careflite’s new vehicle

Careflite’s new vehicle
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 operations and policy
- We must be outcomes driven
- We MUST cease to be a fiefdom in a discipline we have no technical background or expertise in

So what do we need to do ??
- Reach out to the appropriate experts – they sure do want to help us
- STOP being philistines and be the scientists we are trained to be and at least seek a scientific approach
- Get your heads out of the sand – there is plenty of valid technical information – FMCSA, TRB, SAE
- Make policy and purchase decisions on technically sound data, not a marketing brochure
- HAVE MEANINGFUL AND TRANSLATABLE OUTCOME MEASURES FOR YOUR SERVICES SAFETY PERFORMANCE

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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

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