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?

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

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

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

Canada - EMS Safety Leaders

- The West
  - British Columbia
  - Alberta
  - Saskatchewan
- The East
  - Ontario
  - Quebec
  - New Brunswick
  - Nova Scotia
  - Prince Edward Island
  - Newfoundland
- The North
  - Yukon Territory
  - Northwest Territory
  - Nunavut

Dan Berry P. Eng (1948-1998)
Emergency Medical Services (EMS)
An important and unique transport system
- Public safety, public health and emergency service
- Is there to save lives

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

Tragedy you don’t want to be involved in

Patient Safety- A routine concept...
But Patient Safety is just one part of this system

EMS Transport Safety
- ‘patient safety’ AND also
- ‘provider’ and ‘public safety’

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

Some odd USA and also Canadian 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
Ambulance transport a serious transport safety problem...

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

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

ESC – Does your ambulance have it??

- Transport Canada announced that effective August 31, 2011, automakers must install Electronic Stability Control (ESC) technology in Canadian vehicles.
- 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

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

Transport Medicine

- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

Firstly!

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

A tragic emergency health care intervention outcome

It does happen....

A devastating tragedy...

- An ETT down the wrong hole may kill your patient and be a terrible burden for the pts family and for the medic involved
Negative impact on system performance…

- BUT an EMS crash can kill all those involved AND wipe out a rural EMS system AND negatively impact a regions response capacity……

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 safest?
- 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?

Challenges to Optimizing EMS Transport Safety

- Disparate and fragmented safety infrastructure
- Lack of a centralized EMS Safety oversight or data
- A large number of small groups of end users, with a mix of volunteers and professionals
- Ambulances are non-standard vehicles, a truck chassis and an after market box or a modified van
- EMS vehicle safety is not integrated as a part of the transport safety industry

Challenges to Optimizing EMS Transport Safety

- Rear compartment exempt from FMVSS
- Complex automotive safety area bridging acute clinical care, public health, public safety and automotive safety
- Very recent history as a research issue
- Limited fiscal support for cross disciplinary EMS transport safety research

What’s missing

1. What data is collected nationally?
   - We have no denominator data
   - We have incomplete numerator data
2. Absent population based national injury data or injury mechanics data
3. Absent structured transportation safety engineering input
   1 + 2 + 3 = resultant inability to design and evaluate efficacy of injury interventions
4. What oversight is there?
5. Which organizations would determine policy?

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 AND Canada there are more safety standards for moving cattle than for moving patients

Creating a Safety Culture

- Awareness
- Training
- Incentive
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 driving skill
- other road users
- the road

An ambulance is not an ED/ICU on wheels

The Emergency Department (ED)

Would we...? Seeing that we are health care providers – let's look at it this way –
- Would we use medical equipment that was built by folks who were not technically qualified or trained biomedical engineers and who just said – “this device is safe”?
- Or would we expect them to be qualified in this field and that their products were tested in a meaningful way to ensure that they were safe?

June 17th 2008
a paramedic and a patient killed

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!!!

June 17th 2008
a paramedic and a patient killed

June 17th 2008
a paramedic and a patient killed

June 17th 2008
a paramedic and a patient killed

June 17th 2008
a paramedic and a patient killed
In this vehicle...

October 31, 2008 - Kentucky

April 30, 2009 - Tennessee

August 2009 – Impaired...

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

February 1, 2010

April 28, 2010

EMT Indicted On Murder Charges

EMT Indicted on Murder Charges after Crash

Second N.B. ambulance crashes

EMT Safety Foundation
www.EMSsafetyfoundation.org
Safety is a tool to save
- Lives
- Time
- Money
must be evidenced based

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!

So why do we operate in conflict with science???
- and they don’t care what your job title is or if you are a patient, a provider or a member of the public

The laws of physics prevail…

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

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

Policies? – is pull over to the right really safer…?
May 13, 2010.. Two weeks ago

MedStar Ambulances Will No Longer "Run Hot" When Transporting Cardiac Arrest Patients (4/21/2010)

*MedStar ambulances will no longer 'run hot' - when paramedics inside are giving chest compressions to patients in cardiac arrest, officials say.* This policy, which took effect Friday, will affect about 1,400 of the more than 100,000 calls to which MedStar responds annually in the 15 Tarrant County cities it serves.

Safety is Good Business

Are you self insured???

<table>
<thead>
<tr>
<th>Year</th>
<th>Premiums $M</th>
<th>Incurred Medical $M</th>
<th>Incurred Indemnity $M</th>
<th>Insurance $M</th>
<th>Modified Premium $M</th>
<th>Claims P</th>
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<td>2001</td>
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<td>128</td>
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<tr>
<td>2000</td>
<td>10.6</td>
<td>430</td>
<td>83</td>
<td>194</td>
<td>59</td>
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<tr>
<td>1999</td>
<td>10.1</td>
<td>405</td>
<td>155</td>
<td>117</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>9.6</td>
<td>411</td>
<td>13</td>
<td>30</td>
<td>51</td>
<td></td>
</tr>
</tbody>
</table>

Workers Compensation Rate increased by 27 %

A problem

2007 Insurance data –
- 27 fold more likely to have a claim based on transport than related to medical care

2003 Insurance data –
- 10 fold more likely to have a claim based on transport than related to medical care

Expensive….

Very Expensive

EMS CANNOT Afford to keep paying out like this…. 
Safety saves time, lives AND money
Canada, Nova Scotia

- Since 2000 working towards a goal of zero loss ratio with insurance provider
- 10 million kilometers per year
- 150 emergency response ambulance units
- Collision claim history measured in dollars per 100,000 kilometers traveled:
  - 2000/2001: $1725.00
  - 2001/2002: $1049.00
  - 2002/2003: $751.00
  - 2003/2004: $416.00
  - 2004/2005: $229.00

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>176 feet</td>
</tr>
<tr>
<td>Wet</td>
<td>220 feet</td>
</tr>
</tbody>
</table>

* Stopping distance: Perception time + Reaction time + Vehicle braking time

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

A few key words about restraint systems…

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

During impact

CTD dynamics

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

Systems safety failure AND dangerous

NOT new technical data…

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

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

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

- 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

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

- 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

**Unique workplace**
- In vehicles
- At roadside and other emergency scenes

**An Aviation Safety Plan**

**Canada - Corporate Manslaughter Corporate Homicide Act: 8th April, 2008**
An interhospital transport? “Do no harm….”?

The alligator is at the door…

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
- 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

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 EMS
- EMS Systems - >15,000
- Personnel - ~1 million (~30% F/T professional & 70% volunteer)
- Vehicles - ~50,000 (Type I, Type II, Type III, Freightliners, motorcycles)
- Transports - ~50 million (to Emergency Depts ~ 50%, < 1/3 emergent)
- Cost - ~$8 Billion annually
- Safety Oversight - ? Disparate

and what is an EMS crash?
- Definition of an EMS crash
- Definition of Emergency Response Mode

How are we counting these events?
What/Where are the relevant data bases?
- FARS
- NASS/CDS
- GES
- State Traffic Records
- FMCSA
- BLS
- NEMSIS
- Other

USA Emergency Vehicles
Minimum Annual Fatalities 1995-2007
FARS – A National Data Set?
Small numbers – but NO data captured from 20% of the nation in 10 years

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

Denominator …?*
- # vehicles
- # types of vehicles
- # runs
- # miles/kms
- Nature of patient
- Severity of patient

Moose crash data…? – not EMS crash data

Is response time really a meaningful measure of patient outcome??
- What are the confidence limits?
- What about demographics, population density?

Jan 2010 - Evaluating Trauma Management Performance in Europe
Yongjun Shen, Elke Hermans, Da Ruan, Geert Wets, Tom Brijs and Koen Vanhoof

Occupational transportation fatalities...

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


WE HAVE A BIG PROBLEM HERE

EMSSafety
So does it make sense?

- Gloves and universal precautions?
  - good biohazard protection BUT
  - aren’t going to give much protection in an ambulance crash

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

- 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

And...

- ...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

A survivable impact??

New Information/Technical Developments Jan 2006–Jan 2010

- SAFETY LAU - EMS identified as one of the 4 E’s – (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users)
- International Ergonomists Association (IEA) - publication June 2006
- Enhanced Safety of Vehicles (ESV) - publications June 2007, 2009
- American Society Safety Engineers (ASSE) - publications June 2006, 2007
- National Academies TRB – Inaugural EMS Safety address, Jan 2007
- NEMSAC established – April 2007
- Cardiac Safety in the Ambulance – publication June 2007
- Transportation Safety Advancement Group (TSAG) – Feb 2008
- Society for Automotive Engineers (SAE) – publications Oct 2007, 2008, 2009
- Worker visibility Act - Nov 2008
- SAE Ambulance Standards development – April 2009
- NFPA Ambulance Standards Committee – June 2009

A challenge we know now...

- ...is that there is a major problem with the present approach and what is being done currently

Research papers in the past 30 years

- EMS Safety
  - 42 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

We should use the best safety practices demonstrated in engineering

Priorities......

- EMS Safety
  - 42 papers - on ambulance safety
  - 2 papers - on ambulance ergonomics
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- Computer Workstations
  - 30,000 papers - on ergonomics of computer work stations

- Erectile Dysfunction
  - 100,000 papers – on Erectile Dysfunction
...in automotive safety engineering

and in ergonomics

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

‘Workplace’ Hazards

Bigger is not necessarily better.....

Nascar Safety Expert

• On ambulance patient compartment
  “It is a death vault”

Tom Gideon,
Head of Safety, GM Nascar

and who’s life was he racing to save?

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

New EMS helmet prototypes

Which of these two vehicles would you want?
Sprinter v Ford Transit crash test
http://www.youtube.com/watch?v=C3kN6WF5vAA&feature=related

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

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

Yet another potentially lethal example marketed as a ‘safety innovation’ YET outside of automotive safety practice

Airbags in the back....?? Hazardous for this environment
Absent safety testing standards, any meaningful crash or injury mechanism data or effective occupant positioning – as per the automotive engineers, rear compartment airbags are likely to be highly hazardous

Yes, the ride of your life....
- Sure... these vehicles all parade around the EMS and Fire shows
- BUT...
- NOT ONE of these vehicles has been to the automotive safety shows or scrutinized by the automotive safety industry
Ambulance Vehicle Standards??

- KKK?
- AMD?
- FMVSS?
- CMVSS?
- NFPA?
- SAE...?
- ASTM...?
- International
  - ASA
  - CEN

Global EMS Vehicle Safety Standards v Specifications and Guidelines

- EMS Safety and Performance Standards
  - Australia & New Zealand 4356
  - Common European Community (CEN) EN1789
- Non EMS Specific USA Standards
  - [Aviation - FAA/CAA(UA)]
  - [Fire vehicles - ASSE/ANSI Z15 ]
- USA Other
  - Purchase Specification: KKK
  - “Standards” – NTEA – AMD, ASTM F 20, NFPA (devel)
  - Guideline: EMSC Dos and Don ts, and (ASTNA, CAAS and CAMTS)

October 2008 JEMS Article “Rig Safety – 911”

http://www.objectivesafety.net/JEMSRigSafety911.pdf

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

Australia & New Zealand
Ambulance restraint standard AS/NZS 4535:1999

- "Restraint systems shall apply to all equipment and people carried in an ambulance..."
- Dynamic Testing - 50th & 95th percentile manikins
- 24G in Forward and Rearward
- 10G in Transverse

European Committee for Standardization
Medical vehicles and their equipment - Road Ambulances

- "Without exception, all persons, medical devices, equipment, and objects normally carried on the road ambulance shall be maintained to prevent them from becoming a projectile when subject to a force..."
- 50th percentile manikins - 10 G in Forward, Rearward, Transverse, & Vertical directions
- Certified by Notified Body and Ambulance Mfg.

ISO – 39001
Road-traffic Safety management systems

USA KKK ambulance purchase specifications

- Specifications for the purchase of a Star of Life Ambulance
  - Static Pull test
  - 2200 Lbs. static stretcher test in longitudinal, lateral & vertical
  - No dynamic test for vehicle, occupants or equipment
  - No automotive test manikin
- Voluntary

USA Ambulance Manufacturing Division (AMD) Ambulance Standards – August 2007

- No dynamic or impact test
- No automotive test manikin
- Mandates NO ‘crumple zone’
- No impact tested anchorages for occupant restraint or equipment
- Internal, not independent

NTSB 1979... and 30 years later and still the same problem

What KKK-A-1822F, AMD and FMVSS state and don’t state...

USA Ambulances: FMVSS Exempt

Occupant protection......??

July 2007

May 13, 2010.. Two weeks ago

Medic Survivors

Medic Fatality

Pt & nurse Fatality

KKK/AMD – static ‘safety testing’

- Ignorant of automotive safety principles – and specifies -
  - No structural damage to any load bearing or supporting members, i.e., torn or broken material, broken welds, popped or sheared body rivets, bolts, and/or fasteners, shall be evident during the application of the force and after the release of the force.

KKK Specification and AMD Standards both default to the FMVSS for safety – however..

- FMVSS has a specific exemption for ambulance vehicles once you are 600mm or 2 feet positioned rearward of the driver
- KKK requires a ‘national test lab’ to conduct AMD ‘tests’ BUT NOT an automotive test lab!
- No dynamic impact tests AT ALL
- No crashworthiness tests

Ridiculous current 2009 USA ambulance ‘safety testing’ ?!? – Is NOT consistent with accepted automotive safety practice...
No ‘a’… then NO ‘F’ !!!!!

\[ F = ma \]

where

- \( F \) – force
- \( m \) – mass
- \( a \) – acceleration

Yes a “nationally recognized testing lab” – BUT - NOT an automotive/occupant safety crash test lab!!

Visibility and lighting issues

Hmm…

It isn’t like this in the rest of the world

Worker visibility Act: November 24th 2008

Day visibility

Night visibility

Here’s the real world at 6 ft…
August 2009 – Visibility review

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. De Lorenzo & Eilers Annals EM 1991

Color-blindness affects 10% of the population

Color-blindness affects 10% of the population

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

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

Muskoka EMS - Canada

Old design

New design
Muskoka EMS - Canada

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

Innovation

What’s new
- New automotive safety technologies
  - Crashworthiness
  - ESV
  - ITS
  - Monitoring and feedback enhancements
- New expertise
  - EMS Safety Foundation
  - TRB
  - ASSE
  - SAE
  - UTRC
  - Ergonomics
  - Industrial Design

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??

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

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

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

What’s new
- New automotive safety technologies
  - Crashworthiness
  - ESV
  - ITS
  - Monitoring and feedback enhancements
- New expertise
  - EMS Safety Foundation
  - TRB
  - ASSE
  - SAE
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  - Industrial Design

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- Enhance Safety
- Improve Driver Performance
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- Aid Accident / Incident Investigation
**How the Device Works**
- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has an 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**

**And when a rare crash happens….**

**Unit 302 Accident**

**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

**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
The jury is out on

- Opticon
- Simulators

Resource availability and allocation technologies

National Academies TRB EMS/Medical Transport Safety Inaugural Summit – November 7, 2008
http://www.objectivesafety.net/TRBSummit2008.htm

National Academies TRB Ambulance Transport Safety Summit – October 29, 2009
http://www.objectivesafety.net/TRBSummit2009.htm

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

Its out there NOW

- 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

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
What the independent technically expert occupant protection and automotive safety engineers say about our current ambulances and ‘safety’ approaches:

- “The rear compartment Death Vault”
- “The Kitchen Design must go”
- “The Kill, Kill, Kill (KKK) spec”
- “The organ donor harness system”

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

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.

The EMS Safety Foundation
www.EMSSafetyFoundation.org
2010 Rettmobil Delegation

The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational
- Innovation
- Collaboration
- Knowledge transfer

R & D “Ripoff and Duplicate”

- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

EMS Ergonomist Chris Fitzgerald addressing the EMS Safety Foundation Workshop

Automotive engineers addressing EMS Safety Foundation Workshop

EMS Safety Foundation
Ambulance Vehicle & Ergonomics Workshop, October 2009

EMS Safety Foundation
EMS Safety Foundation Workshop
The science of Stretcher lifting & loading

Stretcher Load - # 1 (CNLOAD01)

EMS Safety Foundation Delegation
bringing International Innovation to you!

EMS Responder Rettmobil 2010 Delegation

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

http://www.emsresponder.com/web/online/Safety/Live-From-RETTmobil/25$13137
Vehicle Occupant Safety design

European design

Safety technology is a key focus.

Safe and Ergonomic design

Patient Transferring Slides
Small AED

Ergonomic layout and equipment

Flexibility to manage two patients

“Together for your safety”
Ambulance Investigation - Norway

National analysis group
- National Health Authority
  Licensing health professionals
- National Vehicle & Roads Administration
  Approval and technical control of ambulances
- Paramedics from Oslo university hospital
Ambulance investigation

- Accidents involving an ambulance with injury or death
- Accidents involving an ambulance with major damage to property
- Accidents where equipment inside the ambulance cause injury / danger of injury

Texas - Careflite’s new vehicle

Manitoba’s new fleet

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, ergonomists and industry standards that make sense – and
- Meaningful measures of outcome and performance

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

Science behind Policy

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

**this vehicle is safety crash tested by automotive experts**

Unlikely 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???

Is this acceptable…?
- There are ambulances rolling out of the show room on a daily basis – as we speak – being designed by health care providers and built by after market retrofitters, who are not at all governed as other passenger vehicle manufacturers by the standards set by the society for automotive engineers

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

What is the EMS Transport Safety Research Agenda?
- Shouldn’t it be driven by data, and appropriate technical expertise
And what is the EMS Transport Safety Research budget??

- What has been spent by whom, on what and how, and with what oversight??

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

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 Management

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

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

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