The Ride of Your Life – Ambulance Safety

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

Who am I?

- Nadine Levick MD, MPH
- Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Harlem, Maimonides, Brooklyn & 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

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

Emergency Medical Services (EMS)

- An important and unique transport system
  - Public safety, public health and emergency service
  - Is there to save lives

Some odd USA 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

http://www.objectivesafety.net

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

Your Interactive Handout awaits you online at...

- www.objectivesafety.net
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

The EMS Safety Foundation
www.EMSSafetyFoundation.org

Day 1: http://www.emsresponder.com/web/online/Safety/Live-From-RETTmobil/25$13137


Day 4: http://www.emsresponder.com/features/article.jsp?id=13197&siteSection=25
May 13, 2010. Last week

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
  - Captains chair
  - Standing or kneeling

The 'workplace' is also a crash scene

Absence of USA standards and oversight

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

Canada - Corporate Manslaughter
Corporate Homicide Act: 8th April, 2008

Preventable...

- James Woodman
  - is a paramedic who, on his first day as a paramedic, suffered a severe TBI when the ambulance he was riding in (in the back) was t-boned and rolled onto its side.
  - He remains in a persistent vegetative state in an ECF in Colorado.

- It is assumed that when the ambulance rolled onto its side, the Lifepack 10 struck James in the head.......

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 fatal 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##

Kahn CA, Pirrallo RG, Kuhn EM, Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9
Becker, Zaloshnja, Levick, Li, Miller, Acc Anal Prev 2003
NIOSH, 2003
Ray AM, Kupas DF, Prehosp Emerg Care 2005 Dec; 9:412-415

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

EMS Transport General Concerns

- 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 should be used, 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
- Electronic Driver monitoring/feedback systems appear to be highly effective
- Head protection??

What do we know now??

- Intersection crashes are the most lethal
- There are documented hazards, some which can be avoided
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Safety is Good Business

June 2007

The inevitable bottom line…
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

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

The Huntsville Times

Ambulance suit gets $3.1 million

Very Expensive

EMS CANNOT Afford to keep paying out like this....

- Transport Medicine
- Biomechanics
- Ergonomics
- Fleet Safety
- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety
EMS Transport Safety

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

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.


Transport related aspects -

- dispatch of EMS/Medical transport vehicles
- transport policies and protocols
- vehicle fleets and vehicle design
- Intelligent Transportation Systems (ITS) technology
- driver training
- driver performance monitoring
- roadside and road design
- integrated traffic safety technologies
- scene safety and visibility
- safety data capture
- safety oversight

Key Issues

- Mythology – That Emergency Medical Service personnel are safe
- Injury Hazards
  - Biohazard
  - Chemical/Radiation
  - Physical/Mechanical trauma – THE BIG PROBLEM
- Motor Vehicle Crashes are the highest cause of death at work – EMS has > 2X the mean national rate
- An R & D and Regulatory Gap
  - Occupational Health and Safety
    - the workplace is in a vehicle – exposure data are scant
  - Automotive Safety
    - 'exempt' from automotive research and regulation

Ambulance design & transport safety initiatives timeline

- 1960’s National Academy of Medicine – the Cadillac to the chassis and box truck, birth of the American ambulance
- 1969 – Swedish Searle crash tests
- 1967 – JOMSA grade – ‘First Motorola’
- 1979 – First NTSB report and birth of EVOC
- 1980 – Swedish barrier crash tests
- 1987 – JAMA paper – Paul Auerbach
- 1995 – First published text on Ambulance collisions and by an optometrist
- 1998 – First published text on Ambulance in Emergency Medical Services
- 1999 – First ambulance rear compartment sled tests with instrumented dummies
- 2000 – First peer-reviewed engineering publication on ambulance crashworthiness
- 2000 – First peer-reviewed engineering publication on ambulance crashworthiness
- 2001 – First peer-reviewed engineering publication on ambulance crashworthiness
- 2002 – First peer-reviewed engineering publication on ambulance crashworthiness
- 2003 – Mobile Medical Transport Safety Task Force (MMTS) established
- 2003 – Mobile Medical Transport Safety Task Force (MMTS) established
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- 2005 – Mobile Medical Transport Safety Task Force (MMTS) established
- 2006 – First NAEMSP ambulance safety keynote
- 2006 – First EMS Chiefs of Canada ambulance safety keynote
- 2007 – Mobile Medical Transport Safety Task Force (MMTS) established
- 2007 – Mobile Medical Transport Safety Task Force (MMTS) established
- 2008 – First Ground EMS Transport Safety Summit November 2008
- 2009 – Second TRB Ground EMS Transport Safety Summit October 2009
- 2010 – Second TRB Ground EMS Transport Safety Summit October 2009
- 2011 – First peer-reviewed engineering publication on ambulance safety
- 2012 – First peer-reviewed engineering publication on ambulance safety
- 2013 – First peer-reviewed engineering publication on ambulance safety
- 2014 – First peer-reviewed engineering publication on ambulance safety
- 2015 – First peer-reviewed engineering publication on ambulance safety
- 2016 – First peer-reviewed engineering publication on ambulance safety
- 2017 – First peer-reviewed engineering publication on ambulance safety
- 2018 – First peer-reviewed engineering publication on ambulance safety
- 2019 – First peer-reviewed engineering publication on ambulance safety
- 2020 – First peer-reviewed engineering publication on ambulance safety
- 2021 – First peer-reviewed engineering publication on ambulance safety

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
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 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?

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

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 there are more safety standards for moving cattle than for moving patients
Creating a Safety Culture
- Awareness
- Training
- Incentive

the EMS transport process
- communications/dispach
- the patient
- restraining device/seats
- transporting device/journey
- paramedics/transport nurse, 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

What is a survivable impact?
$E = \frac{1}{2} m v^2$
$v^2 = 2a$

12 mph (20 km/hr)?

~ 30 mph - survivable
What is a survivable impact?

\[ E = \frac{1}{2} mv^2 \quad \text{and} \quad v^2 = 2as \]

- 60 mph – not survivable

A survivable impact??

A serious problem...

Tragedy you don’t want to be involved in

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

"...I’d like to know what can be done so this never happens again...."

January 10, 2008

AMBER ALERT...
This is not a crashworthy environment...

April 14th, 2008

In this vehicle...

June 17th, 2008

a paramedic and a patient killed

In this vehicle...

October 31, 2008 - Kentucky

A paramedic and a patient killed.

In this vehicle...

April 20, 2008...??

In this vehicle...
April 30, 2009 - Tennessee

Minnesota - June 20, 2009

August 2009 – Impaired...

October 22, 2009, TN

Provider and Patient Killed

Monday November 30, 2009

Smithfield

December 2009
Is there an acceptable rate of morbidity and mortality for pre-hospital transport systems?

How bad is the problem

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
- ~ One fatality each week
  - 23 pedestrians or occupants of other car
  - ~10 serious injuries each day
- Cost estimates > $500 million annually

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

So for EMS personnel...
- What’s going to kill you?
- What’s going to injure you?
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

So does it make sense?

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

Occupational transportation fatalities...


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##

Ambulance transport a serious USA 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

Balance of concerns and risk during transport

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

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

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

Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

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

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

And 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

Ambulance Safety Research: A New Field

DOT Funding for Reptiles and Road Kill

Moose crash data...? – not EMS crash data

New Information/Technical Developments Jan 2006- Jan 2010

- SAFETEA-LU, 2006 – 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
- AMD Engineering Public Comments, July 2007
- KKK-F, August 2007
- OSHA September 11, 2007 EMS safety in Federal Register
- State Strategic Highway Safety Plans, October 2007
- EMS Safety Foundation established – Dec 2007
- National Academies TRB – Inaugural EMS Safety Subcommittee meeting Jan 2008
- 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
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.....

Creating a Safety Culture

Awareness
Training
Incentive
USA EMS in 1917

1960 to 2009

Some recent adverse outcomes

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

People are passengers and not packages or parcels

Carl Craigle EMT-P, Chief Platte Valley Ambulance, CO

It does happen.....

But what about head protection?

Attitudes to Head Protection in EMS

“Ambulance transport has a death toll.....”

Carl Craigle EMT-P, Chief Platte Valley Ambulance

Carl Craigle EMT-P, Chief Platte Valley Ambulance

Levick NR, Garigan M, A Solution to Head Injury Protection for Emergency Medical Service Providers, International Association for Ergonomics (IAE), July 2006
Role of a head protective device
- A simple, immediate and inexpensive adjunct – a protective device –
  - To protect occupants from hazardous interiors
  - As vehicle crashworthiness design advances
  - As driver training advances
  - For when equipment becomes unsecured
  - As EMS Safety Standards are developed, for both EMS vehicles and EMS occupational safety

New EMS helmet prototypes for 2006-2007

What is known
- Ambulance transport is part of a system of integrated elements, as is an ambulance vehicle a microcosm safety system of interrelated occupant and safety issues
- The laws of physics prevail –

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

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
An Aviation Safety Plan

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

Duke Policies

Duke Risk Assessment Approach
Integrating Risk Assessment and Operational Practice!!
- Green
- Blue
- Yellow
- Red

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

1995- Deceleration Sled test (upon impact) 24 G, 30mph
Choose the Best Option

Immobilization board

Foldable

Full Vehicle Crash Tests

Test 1 – Right side impact

Test 2 – Frontal

2000 Full Vehicle Crash Testing
Pre-impact CTD positioning

Preparation of test vehicles

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

Impact residue

During impact

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

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

A few key words about restraint systems…

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

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?
• NFPA?
• SAE…?
• ASTM…?
• International –ASA –CEN
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

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

October 2008 JEMS Article
“Rig Safety – 911”

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

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

USA Ambulances: FMVSS Exempt

Occupant protection......??

July 2007
May 13, 2010. Last week

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 require 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!!

FMVSS exempt……

Standards Development Update

- NFPA – Meetings March 2010
- SAE – x2 standards underdevelopment
  - General vehicle crashworthiness and occupant safety standard
  - Specific equipment and occupant restraint standard
- ISO - ISO/AWI 39001 - Road-traffic Safety management systems
  - Recent update meeting in Canada

Visibility and lighting issues
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

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...
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!

Color-blindness affects 10% of the population

Emergency Vehicles – Viewer Awareness

- Location
- Size
- Shape
- Speed
- Intended path

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

Muskoka EMS - Canada

Old design

New design
Old design
Muskoka EMS - Canada

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

New design

In-vehicle technologies to enhance transport safety

• Aftermarket in vehicle electronic e-safety devices with monitoring and feedback

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

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

MEMS - Seatbelt Violations per Month

MEMS MONTHLY OVER SPEED VIOLATION TREND 2003/2004

MEMS ABC Miles Per Month
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.

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

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??
Resource availability and allocation technologies

EMS Transport Safety

- ‘patient safety’
- AND also
- ‘provider’ and ‘public safety’

Innovation

Safety concepts out there now

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

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
  - vehicle protection design and testing
  - vehicle performance safety
  - vehicle and personnel human factors issues
- Dissemination and Policy
  - knowledge handle
  - standards, specifications and policy

October 29, 2009

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

2009 TRB Summit Participants
http://www.objectivesafety.net/TRBSummit2009.htm

- Technical experts
  - Automotive safety engineering, occupant protection
  - Automotive and EMS operational ergonomics and human factors
  - Transportation systems safety engineering
- Government agencies
  - National Highway Traffic Safety Administration (NHTSA)
  - Federal Highway Administration (FHWA)
  - Federal Motor Carrier Safety Administration (FMCSA)
  - Bureau of Labor and Statistics (BLS)
  - Department of Homeland Security (DHS)
- EMS State Directors
  - EMS Services
  - Industry partners
  - Academics
- EMS Equipment
  - EMS Services
  - Industry partners
  - Academics
- EMS Safety
  - EMS Services
  - Industry partners
  - Academics

October 29, 2009 TRB Summit

- Technical experts
  - Automotive safety engineering, occupant protection
- EMS Services
  - EMS Services
- Industry partners
  - EMS Services
- Academics
- EMS Safety
  - EMS Services
  - Industry partners
  - Academics

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- Technical experts
  - Automotive safety engineering, occupant protection
  - Automotive and EMS operational ergonomics and human factors
  - Transportation systems safety engineering
- Government agencies
  - National Highway Traffic Safety Administration (NHTSA)
  - Federal Highway Administration (FHWA)
  - Federal Motor Carrier Safety Administration (FMCSA)
  - Bureau of Labor and Statistics (BLS)
  - Department of Homeland Security (DHS)
- EMS State Directors
  - EMS Services
  - Industry partners
  - Academics
- EMS Equipment
  - EMS Services
  - Industry partners
  - Academics
- EMS Safety
  - EMS Services
  - Industry partners
  - Academics

2009 TRB Summit Participants
http://www.objectivesafety.net/TRBSummit2009.htm

- Technical experts
  - Automotive safety engineering, occupant protection
  - Automotive and EMS operational ergonomics and human factors
  - Transportation systems safety engineering
- Government agencies
  - National Highway Traffic Safety Administration (NHTSA)
  - Federal Highway Administration (FHWA)
  - Federal Motor Carrier Safety Administration (FMCSA)
  - Bureau of Labor and Statistics (BLS)
  - Department of Homeland Security (DHS)
- EMS State Directors
  - EMS Services
  - Industry partners
  - Academics
- EMS Equipment
  - EMS Services
  - Industry partners
  - Academics
- EMS Safety
  - EMS Services
  - Industry partners
  - Academics
Please do go and access this information, it comes from technical and operational experts and it is gratis.

There have been two TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise. See www.trb.org, and for the Summit archives: www.objectivesafety.net/TRBSummit2008.htm www.objectivesafety.net/TRBSummit2009.htm

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: A practical and functional model
Interdisciplinary and Operational
- Innovation
- Collaboration
- Knowledge transfer

The EMS Safety Foundation
November 2009 Webinar for Public Access
www.EMSSafetyFoundation.org and www.objectivesafety.net

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

Mission
- This is a team of like minded innovators across EMS Medical Transport and a number of technical disciplines, who share the common mission of enhancing the safety of EMS delivery for all involved.

In a nutshell
- EMS Safety Foundation is a not-for-profit multidisciplinary virtual think tank and test bed for safety innovation and knowledge transfer
- It is a virtual network integrating the end users and the technical experts
- A tool to enhance the safety of delivery of EMS services

R & D “Ripoff and Duplicate”
- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from
Ambulance Vehicle & Ergonomics Workshop, October 2009

Automotive engineers addressing EMS Safety Foundation Workshop

Ergonomist Chris Fitzgerald addressing the Workshop

Stretcher lifting & loading

Stretcher Load - # 1 (CLOAD01)

EMS Safety Foundation Delegation bringing International Innovation to you!
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

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

Manitoba’s new fleet

EMS selected to test new ambulance

Two design secrets, more cost savings, say health officials

Saskatchewan Health is conducting a pilot project, implementing a total redesign of the EMS in rural and northern regions of the province, with a new ambulance vehicle.

According to Dr. Lorraine, the new design is similar to existing cars, and includes a whole new set of anti-aging and anti-corrosion features, such as CSP.

As a reminder, the description of the car is for paramedics to be engaged in it to be able to work off the ambulances towards better equipment, said Dr. Elizabeth.

Demonstration also explained the new ambulances require less maintenance, and have an overall increased efficiency.

The also mentioned that it can be converted into a new model by removing materials, eliminating certain parts of the new design and offering a new look to the vehicles in both sections.
Small AED
this vehicle is safety crash tested by automotive experts

Unlike this vehicle

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 are other passenger vehicle manufacturers by the standards set by the society for automotive engineers

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

Were we safer in the Cadillac???

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

Safety Management
- A Safety Culture
- Protective Policies
- Protective Devices
  - In the event of a crash
  - To prevent 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 available online
http://www.objectivesafety.net