A tragic emergency health care intervention outcome

It does happen....

Ambulance Transport Safety: Where is the State of the Art

Moving Sick Kids Safely - Optimizing Transport Safety for Crew, Neonates, and Children

Key Issues

Mythology
- That Emergency Medical Service personnel are safe

Injury Hazards
- Biomechanical
- 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
  - Epidemiology, Bio/Chem Hazards and Ergonomics
  - Regulation and Research
- Automotive Safety
  - Engineering and Impact Biomechanics
  - Regulation and Research
- EMS Industry
  - Legal, Technical, Clinical & Fiscal
  - Practice Policy, Risk Management and Fleet Safety
- Academia
  - Independent and collaborative
  - R & D and evaluation of all of the above

Goals

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

Pediatric Patient Transport Safety IS Complex AND Multidisciplinary

Epidemiological Data Collection Risk Management Transport Practice

Ergonomic Research Automotive Safety

Ergonomic/Chem Research

Fire Safety

Ideally Who, What and Where?

- Occupational Health and Safety
  - Epidemiology, Bio/Chem Hazards and Ergonomics
  - Regulation and Research
- Automotive Safety
  - Engineering and Impact Biomechanics
  - Regulation and Research
- EMS Industry
  - Legal, Technical, Clinical & Fiscal
  - Practice Policy, Risk Management and Fleet Safety
- Academia
  - Independent and collaborative
  - R & D and evaluation of all of the above

The NTSB

History and Mission

The National Transportation Safety Board is an independent Federal agency charged with investigating every civil aircraft, railroad, and highway accident and every marine, pipeline, and railroad transportation accident. The NTSB's mission is made possible by the Federal Aviation Act of 1958, as amended by the Surface Transportation Board Act of 1991 (49 U.S.C. 11101 et seq.), and competitive contracts for accident investigations.

- NTSB investigates aircraft and rail accidents on a select basis.
- NTSB accident investigations are the public's eyes and ears on accident scenes.
- NTSB investigators review all available data and property damage.
- NTSB investigators conduct an independent technical analysis of factual and physical evidence.
- NTSB investigators assess the safety of all modes of transportation.
- NTSB investigators maintain public confidence in the transportation system.
- NTSB investigators address public concerns and provide recommendations to government agencies.
- NTSB investigators work with government agencies to implement previously recommended safety actions.
- NTSB investigators develop future research and safety initiatives.

Outline

I. Look at the data on ambulance transport safety
II. Highlight important predictable and preventable occupant risks and hazards during neonatal and pediatric transport
III. Demonstrate what happens during an ambulance crash
IV. Review of guidelines, standards and innovation
V. Outline practices and strategies to enhance occupant safety and reduce risks of crash-related injury
Peds Transports

- One in ten (~6 million) ambulance transports involves a child
- Only ~1.8 million are children <5 yrs
- Ambulances ≠ standard passenger vehicles
- Pediatric patients in ambulances ≠ children in passenger cars
- Standard automotive safety practices cannot be applied directly to ambulances

Kids are not little adults

- Behavior
- Communication skills
- Fear
- Development
- Size and shape
- Biomechanics

Safety in Pediatric Ambulance Transport

- Is part of a SYSTEM

Firstly!

- An accident?
- Or a predictable and preventable event

“Are our policies killing people?”

- 1991-2000, 202,969 Emergency vehicles were involved in MVCs - 1,565 involving fatalities*
- In PA 1997-2001, ambulances were more likely than similar sized vehicles to be involved in:
  - 4 way intersection crashes (43% vs 23%, p=0.001)
  - Collisions at traffic signals (37% vs 18%, p<0.001)
  - MVCs with more people injured (76% vs 61%, p<0.001)

*Comparison of crashes involving Ambulances with those of similar sized vehicles – Adam Ray, Douglas Kupas, PEC Dec 2005:9:412-415

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….
This is not acceptable

- One fatality each week
  - 2/3 pedestrians or occupants of other car
  - 4 child fatalities per year (>2X airbags 2004-2005)
- ~10 serious injuries each day
- Cost estimates > $500 million annually
- USA Crash fatality rate/capita 35x higher than in Australia

**Predictable risks**

- More often at intersections, & with another vehicle (p < 0.001)
- 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
- 70% of fatal crashes EMS crashes during Emergency Use
- 82% of fatally injured EMS rear occupants unrestrained
- > 74% of EMT occupational fatalities are MVC related
- 70% of fatal crashes EMS crashes during Emergency Use
- More likely to crash at an intersection with traffic lights (37% vs 18% p=0.001) & more people & injuries/crash than similar sized vehicles

**USA Ambulances: FMVSS Exempt**

Development of an Effective Ambulance Patient Restraint

- 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
- Much uncertainty as to what is safe and what is unsafe occupant protection practice
- 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

**Multidisciplinary collaboration and the way forward**

- Development of interdisciplinary teams
  - healthcare professionals
  - safety engineering expertise
  - regulatory bodies
  - manufacturers
- Safer practices save lives, time and money
Protective devices/concepts

In the event of a crash
- Vehicle crashworthiness
- Seat/seat belt systems
- Equipment lock downs
- Padding
- Head protection

To prevent a crash
- Driver feedback
- Driver monitoring
- Driver training
- Vehicle and other technologies
- Tiered dispatch
- Appropriate policies

Crash Occupant Protection

- Collision speed
- Direction of impact
- Vehicle stiffness and mass
- Compartment size & projectiles
- Intelligent vehicle technology
- Passive protection
- Head protection
- Occupant restraints

Safety for emergency transport

Policy that reflects SCIENCE

Global EMS Vehicle Safety Standards

- EMS Safety and Performance Standards
  - Australia & New Zealand 4535
  - Common European Community (CEN) EN1789
  - (International Joint Commission on Medical Transport)
- Non EMS Specific USA Standards
  - [Aviation - FAA/CAA/JAA]
  - [Draft Z15 – fleet vehicles]
- USA Other
  - [Purchase Specification: KKK & NTEA – AMD]
  - [Guideline: EMSC Dos and Don’ts, and (CAAS and CAMTS)]

American National Standard

Safe Practices for Motor Vehicle Fleet Operations
Draft ANSI/ASSE Z15.1-200X

Transport Safety Guidelines

EMSC/NHTSA fact sheet

http://www.emsc.org
http://www.nhtsa.dot.gov

USA EMS Risk/Hazards

- Predictable risks
- Serious occupational hazard
- Predictable fatal injuries

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

This is about you and your safety

- What safety practices do you use??
  - Seat belts?
  - EVOC training?
  - Equipment lock down?
  - Helmets?
  - "Black Box" technology?
  - Tiered dispatch?
The ‘workplace’

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

Air EMS is a role model for safety initiatives and focus

View of Ambulance interior from rear

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

- Awareness
- Training
- Incentive

Safety process

- Identify hazards
- Raise awareness of safety issues
- Create a safety attitude
- Promote Teamwork
- Provide motivation
- Accomplish established goals

Dynamic Safety Testing

- requires sophisticated, expensive equipment
- measurably demonstrates forces generated during collision
- accepted international standard for vehicle restraint systems
Test 1 – Right side impact

1. Target vehicle, Type I ambulance
2. Bullet vehicle, Type II ambulance
Closing speed 44 mph

Test 2 – Frontal

1. Bullet vehicle, Type III ambulance
2. Target vehicle, Type II ambulance
Closing speed 34 mph

Preparation of test vehicles
Pre-impact CTD positioning

New concepts out there now
- Black Boxes
- Tiered dispatch
- Helmets
- Enhanced ambulance vehicle design
- Cross disciplinary ambulance transport safety task force established

The “Black Box”
Driver behavior monitoring and feedback device
Results

- A dramatic improvement in driver performance in every measured area
- Crews accepted “big-brother” without complaint
- Sustained improvement in safety proxies over a 15 month period, with no in-service or retraining after the initial introduction period.
- No change in response times
- Fewer crashes and less severe crashes
- QA – Proof we didn’t stop at McDonald’s
Other successful models

Important Principles
1. Ambulances are NOT standard passenger vehicles

Important Principles
2. Pediatric patients in ambulances have needs which differ from children in passenger cars

Important Principles
3. Design, performance and practice policy should be based on properly conducted science

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

Very 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

-Predictable
Preventable
and
NO 'ACCIDENT'

Conclusion
- Major advances in EMS transport 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 safety standards is a necessity and a reality
- Enhanced cross-disciplinary collaboration in development of safety initiatives now exist
- EMS is still way behind the state of the art in vehicle safety and occupant protection

Conclusions
- Prevention is key - the transport environment includes predictable and preventable risks.
- Every member of a transport program must play a role to actively manage risk and to avoid taking unnecessary risk.
- Pediatric transport in ambulances ≠ passenger vehicles
- Focus on safety of ALL aspects of the ambulance environment - safer patient transport practices exist & should be used
- Basic but important - Unrestrained occupants and equipment are a potential injury risk to all occupants
Conclusions

- New safety developments are underway: be ready to integrate them into your practice.
- There is a need for a defined pathway for translation of problem identification to resolution and policy implementation.
- The absence of any national infrastructure for safety oversight in patient transport is not an acceptable situation.
- And above all, WE NEED DATA.

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.

Electronic Info:

- www.objectivesafety.net
- Electronic Handout of today’s presentation
- “Ambulance Safety: Where is the State of the Art?” Webinar June 14, 2005 Recorded online - Free access via the internet
- Comprehensive Reference List on EMS Safety