

Ambulance Transport Safety: Where is the State of the Art

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



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A tragic emergency health care intervention outcome



The NTSB



History and Mission

The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation – railroad, highway, marine and pipeline – and issuing safety recommendations aimed at preventing future accidents. The Safety Board determines the probable cause of:

- all U.S. civil aviation accidents and certain public-use aircraft accidents;
- selected highway accidents;
- railroad accidents involving passenger trains or any train accident that results in at least one fatality or major property damage;
- major marine accidents and any marine accident involving a public and a navigable vessel;
- pipeline accidents involving a fatality or substantial property damage;
- selected transportation accidents that involve problems of a recurring nature.

The Board derives its authority from [Title 49 of the United States Code, Chapter 11](#). The rules of the Board are located in [Chapter 1701, Title 49 of the Code of Federal Regulations](#).

The NTSB is responsible for maintaining the government's database of civil aviation accidents and also conducts special studies of transportation safety issues of national significance. The NTSB provides investigations to courts as U.S. Accident Representatives as

Outline

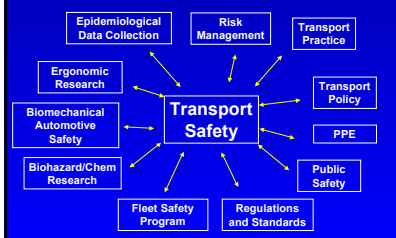
- I. Look at the data on ambulance transport safety
- II. Highlight important predictable and preventable occupant risks and hazards during neonatal and pediatric transport
- III. Demonstrate what happens during an ambulance crash
- IV. Review of guidelines, standards and innovation
- V. Outline practices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



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
 - a vehicle is the work place – 'exempt' from automotive research and regulation

Pediatric Patient Transport Safety IS Complex AND Multidisciplinary



Ideally Who, What and Where ?

- ▶ Occupational Health and Safety
 - Epidemiology, Bio/Chem Hazards and Ergonomics
 - Regulation and Research
- ▶ Automotive Safety
 - Epidemiology, Engineering and Impact Biomechanics
 - Regulation and Research
- ▶ EMS Industry
 - Occ. Health, Automotive, Technical, Clinical & Fiscal data
 - 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



<http://www.objectivesafety.net>

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

courant.com
 Girl, medics injured in crash

NEW HAVEN, Conn. (AP) — A 10-year-old girl, three medics and a paramedic were injured when their ambulance crashed into a building.

The girl was being transported to a hospital for a leg injury when the ambulance crashed into a building.



“Are our policies killing people?”

- ▶ 1991-2000, 302,969 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.....

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 restraint/belts

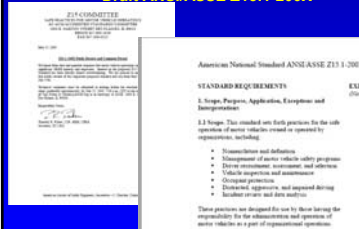
Safety for emergency transport

Policy that reflects SCIENCE

Global EMS Vehicle Safety Standards v Specifications and Guidelines

- ▶ 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

The fact sheet is titled "The Do's and Don'ts of Transporting Children in an Ambulance". It lists several guidelines:

- Do's:**
 - DO drive cautiously at safe speeds observing traffic laws.
 - DO tightly secure all monitoring devices and other equipment.
 - DO ensure a reliable restraint system are used by EMS and other occupants, including the patient.
 - DO transport children who are not patients, properly restrained, in an alternate passenger vehicle, whenever possible.
 - DO encourage utilization of the DOT NHTSA (Emergency Vehicle Operating Course (EVOC), National Standard Curriculum).
- Don'ts:**
 - DO NOT drive at unsafe high speeds with rapid acceleration, decelerations, and turns.
 - DO NOT leave monitoring devices and other equipment unsecured in moving EMS vehicles.
 - DO NOT allow parents, caregivers, EMTs or other passengers to be unsecured during transport.
 - DO NOT have the child/infant held in the parent, caregiver, or EMT's arms or lap during transport.
 - DO NOT allow emergency vehicles to be operated by persons who have not completed the DOT EVOC or equivalent.

At the bottom, it provides the URLs: <http://www.ems-c.org> and <http://www.nhtsa.dot.gov>

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

USA EMS Risk/Hazards

- ▶ Predictable risks
- ▶ Serious occupational hazard
- ▶ Predictable fatal injuries

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'

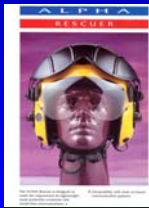
- ▶ EMT's often in vulnerable positions during transport.
 - Bench seat
 - Captains chair
 - Standing or kneeling



Air EMS is a role model for safety initiatives and focus



head protection?



Creating a Safety Culture

within a company must start with upper management's commitment to safety

- ▶ Awareness
- ▶ Training
- ▶ Incentive

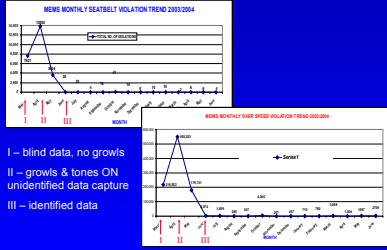
Safety process

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

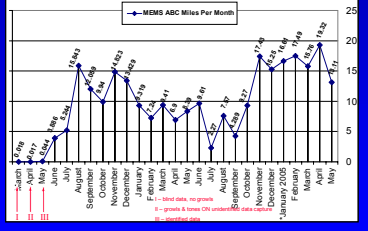
Dynamic Safety Testing

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

'Black Box' performance:



MEMS Average Between Count Miles 2003/2005



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 inservice 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

New USA design initiatives



New Swedish vehicles



New Australian vehicles



NETS Transport

Newborn Emergency Transport Service (Victoria)

Launch of Custom-built Ambulance for the Newborn Emergency Transport Service (NETS), Victoria

22nd Mar 2005

Media Release



Special ambulance to transport sick tiny tots

The Minister for Health, the Hon Bronwyn Pike, MP, today officially launched the first of three new state-of-the-art ambulances to safely transport critically ill and premature babies from around the State and bring them safely back to neonatal intensive care units in Melbourne.

New UK London Ambulance/neonatal vehicles



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
- Unrestrained occupants and equipment are a potential injury risk to all occupants

**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

