EMS Transport - New Trends in Ambulance Safety

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To quote Steve "Sid" Caesar – Director IHS ES
“We want everyone to get home safely each day”

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

Interactive handout
http://www.objectivesafety.net

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
† BUT an EMS crash can kill all involved AND wipe out an EMS systems response capacity......

Recent adverse EMS transport outcomes

Interactive handout
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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?

Recent adverse EMS transport outcomes

.....May 21st, 2007, Seattle

.....May 25th 2007?
Help is on the way???
November 24th 2008

Some odd facts

- Ambulances are generally not built by the automotive industry
- Intelligent Transportation Systems (ITS), transportation safety engineering and transport systems engineering are 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

What do ambulance crashes really cost?

- Loss of life and injury
- Negative impact on EMS system
- Collisions are the largest liability cost and exceeds malpractice or negligence
- Besides the direct financial costs of replacing a damaged ambulance and equipment, there are additional hidden costs incurred:
  - investigating the ambulance collision
  - litigation/settlement/lawsuit
  - medical/disability costs of injured EMTs
  - hiring of new employees to replace injured personnel
  - retraining and psychological counseling of personnel involved and others
  - increased insurance rates

The Huntsville Times
Ambulance suit gets $3.1 million

June 2007

A few weeks ago ....

2 dead in Michigan ambulance crash

This month....

Last month....

Anchorage Daily News
Paramedic injured in crash is recovering

EMS

What happened?
This is not acceptable

In the USA*

- ~ 5,000 crashes a year
- ~ One fatality each week
- ~ 1/3 pedestrians or occupants of other car
- ~10 serious injuries each day
- Cost estimates > $500 million annually
- USA crash fatality rate/capita 35x higher than in Australia

FARS/BTS 2005-6

Ambulance Safety Research: A New Field

- engineering
- epidemiology

EMS Provider Fatalities

- 12.7 fatalities/100,000 EMS workers
- Greater than 2 X the national average (5.0 fatalities/100,000)
- Similar to Police (14.2/100,000) and Fire Fighters (16.5/100,000)

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

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services, A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

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 3.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)*
- 82% of fatally injured EMS rear occupants unrestrained**
- 5% of EMS 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

Occupational Health and Safety....?

This IS an Automotive Safety issue

EMS Transport Safety IS Complex AND Multidisciplinary
An interhospital transport?

An ambulance involved in a crash, patient pronounced dead at scene.

Firstly!

An accident?
or

a predictable and preventable event

The EMS transport process

- communications/dispatch
- the patient
- restraining devices/seat
- transporting devices/gurney
- paramedics/transport nurses, doctors & family
- patient monitoring equipment
- clinical care & interventions
- protective equipment
- scene safety
- the vehicle
- the driver/driving skill
- other road users
- the road

The Emergency Department (ED)

An ambulance is not an ED / ICU on wheels

Balance of concerns and risk during transport

- Response and transport time
- Clinical care provision
- Occupant safety/protection
- Public Safety
**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
  - Captain’s chair
  - Standing or kneeling

**The ‘workplace’ is also a crash scene**

**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 Depots - 90%, < 10% 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

**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 ?

**A Simple Question…**

**What are the solutions?**
- Practice Policy?
- Training?
- Transportation Systems Engineering?
- Automotive Engineering?
- Education of other road users???

**Knowledge Transfer?**

**Active Projects**
- Commercial Motor Vehicle Driver Training Curricula and Delivery Methods and Their Effectiveness
- Commercial Motor Vehicle Carrier Safety Management Certification
- The Role of Safety Culture in Preventing Commercial Vehicle Crashes
- The Impact of Behavior-Based Safety Techniques on Commercial Motor Vehicle Drivers
- Health and Wellness Programs for Commercial Motor Vehicle Drivers
1960 to 2007

A passenger vehicle - sure

A laundry or mail truck - ?

We've known for 10 years that red fire trucks are twice as likely as lime yellow trucks to crash at an intersection.

We've known for 10 years that red fire trucks are twice as likely as lime yellow trucks to crash at an intersection.  

Key Issues

- Mythology
- That Emergency Medical Service personnel are safe
- Injury Hazards
  - Occupational Hazards
  - Physical Hazards
  - Biohazard
  - Chemical/Radiation
- 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 workplace – ‘exempt’ from automotive research and regulation

'Workplace' Hazards

But what about head protection?

Role of a protective head 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
Hmm…

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???

A problem

2007 Insurance data –

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

Goals

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

EMS Best Practice, Sept 2006

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

Global EMS Standards

- Australia & New Zealand ASA 4535
- Common European Community  EN1789
- “USA KKK & NTEA – AMD”
- [Aviation - FAA/CAA/JAA]
- CAMTS
- CAAS
- International Joint Commission on Medical Transport
- ANSI/ASSE Z15
USA ambulance purchase specifications

- Static Pull test
- 2200 lbs. (8G’s) in Longitudinal and Lateral
- No dynamic test
- No definition to manikin mass
- No restraint for equipment
- Voluntary

Some KKK spec info

- Text detail:
  - Lighting systems
    - 151 lines of text, 2 tables and a diagram, over 5 pages
  - Preparation of painting, color and markings
    - 107 lines of text, 1 table, over 3 pages
  - Protection of patients and crew
    - 2½ lines of text

USA Ambulances: FMVSS Exempt

- DOT NHTSA, FMVSS 49 CFR Parts 571, 572 & 589 Docket no. 92-28; notice 7
  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

EMS Transport Safety

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

Safe Practices for Fleet Motor Vehicle Operations

NAEMT July 2006 Position Statement

- ‘patient safety’
- ‘provider’ and ‘public safety’
Innovation

This month's JEMS

Safety at the scene

If we know this – and it's published....

Why do we do this?

Patients must be in the over the shoulder harness, medics restrained in seat belts, equipment secured

Full Vehicle Crash Tests

Test 1 – Right side impact

Test 2 – Frontal

Johns Hopkins University

Test 1 – Right side impact

Test 2 – Frontal
High speed crash, rolled and the occupants (patient and medics) had only minor scratches

Vehicle Occupant Safety design
2007 European design
Safety technology is a key issue

Ergonomic design
Ergonomic layout and equipment
Policy Changes

CPR?

New Australian vehicles

UK Ambulance vehicles
Clear safety message

Sweden initiatives

Norway initiatives

Other successful models

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?

Driver behavior monitoring and feedback device


AMBEX-999 Research Forum 2006 – Research most likely to change practice award

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

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

Demonstrated Effectiveness

Automotive Injury Triangle and Safety Development
Protective devices/concepts

To prevent a crash:
- Driver feedback
- Driver monitoring
- Driver testing
- Vehicle Intelligent Transportation System (ITS) technologies
- Tiered dispatch
- Appropriate policies

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

Intelligent Transport Safety Systems

Vehicle visibility and conspicuity

The difference having data makes?

Protective Equipment

Integration and Collaboration

Tips for Emergency Vehicle Operations

Transportation Research Board is an excellent resource... we should be using it!!
No need to reinvent the wheel...

USFA Emergency Vehicle Safety Initiative

March 2007 - FHWA

An excellent model

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

Vehicle design and safety

- The principles of automotive safety involve a complex science, engineering technical skill, expertise, training and knowledge
- “Give the engineers a working list of our needs and let them tell us how it should be built to accomplish those tasks…”

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 for side facing occupants are potentially lethal – and is in NO WAY SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE

Were we safer in the Cadillac???
Fleet Mix?

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.

Small changes can make a BIG DIFFERENCE

- PREPARE – TEACH – REACH – RESPOND
  - Look at your own safety record
  - Teach safety and hazard awareness
  - Reach out with safety information to all your EMS providers
  - Respond with the best safety practices

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