EMS – Is it Safe?

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A tragic emergency health care intervention outcome

It does happen....

http://www.objectivesafety.net

Major deal...

A devastating tragedy...

A few weeks ago in New York

An ETT down the wrong hole may kill your patient and be a terrible burden for the patient’s family and for the medic involved

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

Objectives

1. Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance crashes.

2. Explore factors related to ambulance crashes and identify potential mechanisms of injury to patients and transport providers.

3. Explain new transport safety technologies and innovations, and describe the new concepts that are underdevelopment.

4. Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers during transport.

This week......

Last month....
Some questions for you all:

- Have you ever been in a EMS crash?
- How many times?
  - 1?
  - 2?
  - More?
- Have you ever been hurt in an EMS crash?
- Do you know any one who has ever been hurt in an EMS crash?
- Do you know of anyone who has been killed in an EMS crash?

Transport related aspects of EMS

- dispatch of EMS vehicles
- transport policies and protocol
- vehicle fleets and vehicle design
- vehicle purchase standards
- Intelligent Transportation Systems technology
- driver training
- training simulation
- driver performance monitoring
- roadside and road design
- integrated traffic safety technologies
- scene safety and visibility
- safety data capture
- safety oversight

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 happened??

- Why is it that Emergency Medical Services have developed outside the umbrella of transportation safety infrastructure??

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

What a novel idea...

EMS Transport Safety

- 'patient safety'
- AND also
- 'provider' and 'public safety'
A few weeks ago...

August 16th...

August 22, 2005...

Firstly!

An accident?  

or

a predictable and preventable event

An 'Accident'....?

So....

▪ On their way TO the hospital
▪ With a patient who was not in cardiac arrest or in a life threatening situation
▪ All 5 in the ambulance critically injured
What are the solutions?
- Training?
- Practice Policy?
- Transportation Systems Engineering?
- Automotive Engineering?
- Education of other road users???

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
   - \(1 + 2 + 3 = \text{resultant inability to design and evaluate efficacy of injury interventions}\)
4. What oversight is there?
5. Which organizations would determine policy?

This IS a transportation safety issue
- Systems engineering
  - Where do ambulance crashes occur?
  - What transportation safety-engineering interventions
- ITS –
  - Does opticom work effectively in this environment given the traffic density and emergency vehicle density?
  - Merit of emergency vehicles being fitted with early warning technologies
- Proper design of emergency vehicle traffic flow
  - Fleet mix to match anticipated transport environmental challenges (eg police model – bicycle, motorcycle, horse, three wheeled, cruiser, van, truck)?

EMS Best Practice, Sept 2006

A Simple Question....

Ambulance Safety Research: A New Field

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

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
- Serious head injury in 45% of fatal occupant injuries
- 70% of fatal crashes EMS crashes during Emergency Use
- More likely to crash at an intersection with traffic (OR 3.7 vs 1.6 vs p=0.001) & more people & injuries/crash than similar sized vehicles

Fatalities and funerals

A Simple Question:..

WINGS, WHEELS & ROTORS

A Simple Question: Safe, ergonomics, epidemiology

So for EMS personnel...
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

A word about occupational transportation fatalities...

- WE HAVE A BIG PROBLEM HERE

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
- Safety Equipment Design
- Vehicle and Safety Equipment Testing and Standard development
- Safety policies

Unique workplace

- In vehicles
- At roadside and other emergency scenes

the EMS transport process

- communications/dispatch
  - the patient
  - restraining device/seat
  - transporting device/gurney
- paramedics/transport nurses, 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
This is not acceptable

In the USA*

- ~5,000 crashes a year
- ~ One fatality each week
- ~ 103 pedestrians or occupants of other car
- Approximately 4 child fatalities per year
- ~10 serious injuries each day
- Cost estimates > $500 million annually
- USA crash fatality rate/capita 35x higher than in Australia

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**Occupational Health and Safety...?**

- This IS an Automotive Safety issue

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**Balance of concerns and risk during transport**

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

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**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

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**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 ?

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**EMS Transport Safety IS Complex AND Multidisciplinary**
Background: USA Problems

- No reporting system or database specifically for identifying ambulance crash related injury
- No occupational and health safety standards to protect providers from injury
- Rear passenger compartment, > 60cm behind driver - exempt from Federal Motor Vehicle Safety Standards (FMVSS)

USA Ambulances: FMVSS Exempt

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 (e.g., 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

and who’s life was he racing to save?

NASCAR, Car of tomorrow ready to go

USA Today - March 23rd, 2007
And very Predictable...

Intersection 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

- Perception time + Reaction time + Vehicle Braking time (varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)

Increasing awareness ...


- EMERGENCY MEDICAL SERVICES DISPATCH SERVICES
- EMERGENCY MEDICAL SERVICES PARTNERSHIPS
- Increase the participation and role of Regional EMS Councils in local and regional highway traffic safety boards and organizations
- PRE-HOSPITAL TRAINING PROGRAMS
- Train EMS providers in the use of new medical protocols; provide funds and other support to certified EMS Course Sponsors to train EMS providers in the use of these protocols; and collaborate with Regional EMS Councils and/or Regional Emergency Medical Advisory Committees (REMAC) on the development and implementation of training programs
- ROAD CONDITION AND INCIDENT RESPONSE
- Provide a placeholder for regional and county EMS representatives in the process of municipal DOT emergency management plan development and implementation

EMS RESPONDER CRASH PREVENTION
- Undertake a systematic review of other state actions and protocols to compare New York State ambulance safety
- Increase education and involvement of EMS providers in principles of appropriate traffic safety techniques
- Develop and implement ambulance traffic safety protocols at state, region, and service level
- Undertake a systematic review of current protocols to identify those that may contribute to injuries resulting from the impact of ambulance crashes
- Identify methods to provide incentives for adoption by EMS services of protocols that enhance traffic safety
- Provide information to help improve public driver awareness and education campaigns to improve driver awareness of paramedics' responsibilities and appropriate response to approaching emergency vehicles

'Workplace' Hazards

But what about head protection?

New EMS helmet prototypes for 2006-2007

Hmm...

It does happen....

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

The difference having data makes?

This looks cool AND SAFE!

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

Safety leadership... from the IAFC and USFA

Automotive Injury Triangle and Safety Development

Protective devices/concepts
To prevent a crash
- Driver feedback
- Driver monitoring
- Driver training
- Vehicle Intelligent Transportation System (ITS) technologies
- Tiered dispatch
- Appropriate policies

In the event of a crash
- Vehicle crashworthiness
- Seatbelt restraint systems
- Equipment lock downs
- Padding
- Head protection

Intelligent Transport Safety Systems
Back up Camera…. Shouldn’t all vehicles have one of these?

The “Black Box”
Driver behavior monitoring and feedback device

Purpose of ‘Black box’ Program

- Enhance Safety
- Improve Driver Performance
- Save Maintenance Dollars
- Aid Accident / Incident Investigation

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.

Demonstrated Effectiveness

A key to safe ambulance transport

What do we know now??

- Intersection crashes are the most lethal
- There are documented hazards, some which can be avoided
- Occupant and equipment restraint with standard belts is effective. (Over the shoulder harnesses for patients should be used, with the gurney in the upright position when medically feasible)
- 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??

Dynamic Safety Testing

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

If we know this – and its published....
Why do we do this?

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

Foldable

Full Vehicle Crash Tests

Test 1 – Right side impact

Test 2 – Frontal

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

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???
Safety Management

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

Creating a Safety Culture

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

- Awareness
- Training
- Incentive

An excellent model

USA design initiatives

- 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

New Australian vehicles

Active Projects
(all due early 2007)

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

UK Ambulance vehicles

Clear safety message
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?

Safety Enhancements Being Implemented

- EVOC
- Tiered dispatch
- Monitoring & Feedback devices
- Helmets
- Optimized ambulance vehicle design
- New Policies and Standards

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

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

PREDICTABLE PREVENTABLE and NO ACCIDENT
Conclusion

- EMS transport has serious hazards and safety issues.
- Major advances in EMS 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 EMS 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.

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 and death.

Thank you!

Any Questions??

Electronic handout available online:
http://www.objectivesafety.net