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.

http://www.objectivesafety.net

Goals

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

IMPORTANT ADVISORY

- Due to respect for the wishes of the families of medics killed in the line of duty there is to be NO PHOTOGRAPHY of any aspect of the images in this presentation - that is NO video, NO photography, NO digital images of any type

and… now for my most scary slide

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…….

A few months ago in Canada
Emergency Medical Service vehicles

- 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?

"Nation's Emergency Care System is fragmented, unable to respond to disasters", says Institute of Medicine, June 14, 2006

Three days ago...

Last Week

Two weeks ago ....

This week....

The Huntsville Times

Ambulance suit gets $3.1 million

Two weeks ago…

Last month....

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 laundry or parcels

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 laundry or parcels

What a novel idea...

EMS Transport Safety

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

An interhospital transport ? "Do no harm..... ?

An accident ?

or a predictable and preventable event
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
- What data is collected nationally?
  - We have no denominator data
  - We have incomplete numerator data
- Absent population based national injury data or injury mechanics data
- Absent structured transportation safety engineering input
- $1 + 2 + 3 =$ resultant inability to design and evaluate efficacy of injury interventions
- What oversight is there?
- Which organizations would determine policy?

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

EMS Best Practice, Sept 2006

A Simple Question….
- C45 - A criminal offence to not act in a way that protects the worker

1970 to 2006

Ambulance Safety Research: A New Field

We should use the best safety practices demonstrated in engineering and in ergonomics.

Predictable risks

- Fatal crashes 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)*
- 42% of fatally injured EMS rear occupants unrestrained**
- 74% of EMS occupational fatalities are MVC related***
- 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

What is killing EMS?

- 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, 1 , DEATH AND CAUSE: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

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

CPR?

EMSNetwork

The most of this advanced knowledge, training and skills absolutely reduce the need for the ambulance to "fail" back to the hospital. Why does it still happen? We lack the "IT" and the "WE" to prevent it. It is in the hearts and minds. We lack the standards and the means to do so. "We have a big problem here"...
Safety oversight of what and by whom

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

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 driving/standing skill
- Other road users
- The road

This is not acceptable

In the USA*
- ~ 5,000 crashes a year
- ~ One fatality each week
- ~2/3 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

Occupational Health and Safety.....?

- This IS an Automotive Safety issue

Balance of concerns and risk during transport

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

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?

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) and thus CMVSS
CMVSS and FMVSS

USA Ambulances: FMVSS Exempt

EMS Transport General Concerns
- 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

NAEMT July 2006 Position statement

Tips for Emergency Vehicle Operations

The truck and bus industry is on the right track.... Where is EMS??
Transportation Research Board is an excellent resource... we should be using it!!

**Active Projects**
(all due early 2007)

- 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

**Integration and Collaboration**


- EMERGENCY MEDICAL SERVICES DISPATCH SERVICES
  - Increase participation and use of Regional EMS Councils in local and Highway Safety Council traffic safety programs.

- PRE-HOSPITAL TRAINING PROGRAMS
  - The local present in the use of the New York system, provide hands-on, practice for future providers, and prepare them for the new system.

- ROAD CONDITION AND INCIDENT RESPONSE
  - Provide a database for regional and county EMS representatives in local DOT emergency management plan development and implementation.


- EMS RESPONDER CRASH PREVENTION
  - Undertake a systematic review of other state actions and protocols to improve responder crash prevention and identify those appropriate for the New York State pre-hospital system.
  - Increase education and enforcement of EMS provider to appropriate traffic safety practices.
  - Develop and implement appropriate traffic safety protocols at state, regional, and local levels.
  - Review treatment modalities and 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.
  - Partner with organizations that provide public driver awareness and education campaigns to improve driver awareness and appropriate response to approaching emergency vehicles.

**USFA Emergency Vehicle Safety Initiative**

**VFIS Summer 2006**

**Sit Down for EMS Safety!**

**Where is transport research?**
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 + Reaction time + Vehicle Braking time (varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)

Increasing awareness...

‘Workplace’ Hazards

It does happen....
But what about head protection?

New EMS helmet prototypes for 2006-2007

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

The 'workplace' is also a crash scene

News we don't want to see...
Caught On Video: EMT Struck By Car

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???

The difference having data makes?

It isn't like this outside of North America
And now Edmonton too!!!

Safety leadership... from the IAFC and USFA


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

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 seat systems
- Equipment lock downs
- Padding
- Head protection

Intelligent Transport Safety Systems

The “Black Box” Program
Enhance Safety
Improve Driver Performance
Save Maintenance Dollars
Aid Accident / Incident Investigation
The “Black 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.

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

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 where 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??

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.
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

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…..”

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

Sam P. Alberman
Firefighter Fatality in the United States in 2005

Safety Enhancements Being Implemented

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

Future

- Meaningful Goals
- New policies
- New practices
- New standards
- New vehicles
- New technologies
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