"The Safe Transfer"
Ambulance Safety – What You Can't Afford Not To Know

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A tragic emergency health care intervention outcome

It does happen….

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……

Thursday July 5th 2007……

"...I’d like to know what can be done so this never happens again…."

Friday July 20th 2007....
The worst ambulance crash in USA history

Five Killed In Crash Of Ambulance And Semi

http://www.huffingtonpost.com/
Key Elements to Safety

- Data Capture
- Vehicle Biomechanics and Crashworthiness
- Ergonomics and Biohazards
- Transportation Environment
- Safety Management – evaluation and analysis

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

Outline

1. Review of data on ambulance crashes and ground transport safety
2. Review of safety standards and guidelines that exist for the ground patient transport environment and update of latest safety developments
3. Identification of ground transport safety issues, hazards and areas of risk to patients, providers and public
4. Highlight unacceptable mythology and challenges to advancing ground transport safety
5. Profile innovation, strategies and knowledge transfer to enhance safety and reduce risks of ground patient transport

Goals

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

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
  - Captains chair
  - Standing or kneeling

Yesterday’s Visibility Webinar
www.GlobalEMSForum.org

Firstly!

- An accident?
- or a predictable and preventable event
The ‘workplace’ is also a crash scene

- communications/dispatch
- policies and procedures
- the patient
- restraining device/seat
- transporting device/gurney
- paramedics/transport nurses, doctors & family
- patient monitoring equipment
- clinical care & interventions
- the vehicle
- the driving/vehicle
- the road

The ambulance transport process

The Emergency Department (ED)

Vehicle interior ‘Workplace’ Hazards

An ambulance is not an ED /ICU on wheels

Ambulance Transport Safety IS Complex AND Multidisciplinary

- Epidemiological Data Collection
- Risk Management
- Public Safety
- Transport Policy
- PPE
- Driver Training
- Safety Technology
- Regulations & Standards
- Fleet Safety Program

A 30 year international ambulance safety snapshot

- USA
  - Population 2007 – 300,000,000
  - Annual Ambulance crashes – 5,000
  - Ambulance fatalities over 30 years – 1,600
- Australia
  - Population 2007 - 20,000,000
  - Annual Ambulance crashes
  - Ambulance fatalities over 30 years
- UK
  - Population 2007 – 60,000,000
  - Annual Ambulance crashes – 400
  - Ambulance fatalities over 30 years – ?
Nascar Safety Expert

On ambulance patient compartment
“It is a death vault”

Tom Gideon,
Head of Safety, GM Nascar

USA ambulance transport

- ~ 5,000 crashes a year
- One fatality each week
- ~ 23 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

UK Department for Transport

Ambulances
- ~ 400 ambulance crashes per year
- 2 X crashes involved emergency response
- 4 X more likely to be involved in a crash than other road users

Bigger is not necessarily better......
ASA Health, Safety and Risk

1960 to 2007

A passenger vehicle - sure

A laundry or mail truck? ?

A passenger vehicle - yes!

Some odd facts

- Ambulances are generally not built by the automotive industry
- Intelligent Transportation Systems (ITS), transportation safety and systems engineering are not generally integrated into EMS
- Although all EMS systems have medical direction and oversight, it is rare for there to be transportation expertise oversight

Safety oversight of what and by whom

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

Dynamic v Static Safety Testing

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

The Crash Event - Crash Testing

- An introduction
- What one needs to know
- What do the tests really mean
- And, what tests are meaningful

Dynamic Testing

- Intrusion
  - vehicle to vehicle or vehicle to fixed narrow object
- Deceleration
  - sudden stop – ie. sled test

Dynamic, Deceleration Sled Testing of Ambulance Paediatric Restraints
If we know this – and its published....


Why do we do this?

Johns Hopkins University

Test 1 – Right side impact

1. Target vehicle,
   Type I ambulance

2. Bullet vehicle,
   Type II ambulance

Closing speed 44 mph

Vehicle Crash Testing

Closing speed 44 mph

Preparation of test vehicles

Pre-impact CTD positioning


Medical vehicles and their equipment - Road Ambulances

"Without exception, all persons, medical devices, equipment, and objects normally carried on the road ambulance shall be maintained to prevent them from becoming a projectile when subject to a force...."

50th percentile manikins - 10 G in Forward, Rearward, Transverse, & Vertical directions

Certified by Notified Body and Ambulance Mfg.

February 2007 CEN frontal deceleration test
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

Unacceptable, and ridiculous current 2007 USA ambulance “safety testing” practices !??

F = ma
where F – force
m – mass
a – acceleration

Ambulance Safety Research: A New Field

and what is killing EMS ?
EMS personnel fatalities*
- 74% transportation related
- 15% of ground transport fatalities were struck by moving vehicles
- 11% were cardiovascular
- 9% were homicide
- 4% needle sticks, electrocution, drowning and other

Predictable risks
- Fatal crashes more often at intersections, & with another vehicle (p < 0.001)*
- 90% of fatal crashes EMS crashes during Emergency Use*
- Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & improperly restrained occupants (OR 2.3 vs restrained)**
- 82% of fatally injured EMS rear occupants unrestrained**
- > 74% of EMT 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##

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

* Stopping distance = Perception time + Reaction time + Vehicle braking time
(curves with age, skill, agility, distance + vehicle type, dry/wet road etc.)
Balance of concerns and risk during transport

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

A problem

2007 Insurance data –
- 27 fold more likely to have a claim based on transport than related to medical care

Last week

Injured Ambulance Passengers Awarded 56.4 Billion
Massachusetts Landmark City of
Reckless Insurance Payment

2007 Insurance data – 27 fold more likely to have a claim based on transport than related to medical care

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
- Investigation/insurance/bureaucracy
- 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

An interhospital transport? “Do no harm….”?

Corporate Manslaughter - Corporate Homicide Act – 8th April, 2008

Charged with Vehicular Homicide

But what about head protection?
And the injury events...

Your back... – 1880’s

2007!!

An important step...

Ambulance Transport Safety

How you don’t want to see your partner transported...

News we don’t want to see

Caught On Video: EMT Struck By Car

Day visibility

- Stopping distance at 60mph is 260 ft
- A driver will first see a pedestrian wearing retro reflective material safely at 500ft
Night visibility

Science not, next best guess

Day/night color sensitivity is very different, especially for blues and reds, at the ends of the spectrum

“Ripoff and Duplicate”
- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

Best Practices?

EMS Best Practice, Sept 2006

American National Standard
ANSI/ASSE Z15.1-2006
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

Valuable information from the transportation industry

An excellent model

September 2007, Its not magic.....

The Grandma Mabel Rule
- Never make a right
- Make three lefts instead

Seat belts save lives!

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

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

The Driver
- Driver selection
- Driver monitoring and feedback
- Driver Impairment
- Driver training

"The best driver safety device is a rear view mirror with a cop in it"
Dudley Moore

Fleet Driver Training...

Ambulance Driver Safety - Australia

A UK program

Can you demonstrate effectiveness independently?
- Change driver behavior
- Carrot not stick
- Vehicle maintenance improvement
- Decreased administrative burden
- Insurance benefits
What about changing driver behavior in the real world?

Driver behavior monitoring and feedback device: A “Safety-o-meter”

The “Safety-o-meter box”: A transportation safety monitoring and feedback device

Demonstrated Effectiveness

A key to safe ambulance transport

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 seatbelts
- Equipment lock downs
- Padding
- Head protection

Intelligent Transport Safety Systems

Back up Camera..... Shouldn't all vehicles have one of these?
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.”

Ergonomic design

- Safety technology is a key focus.

Ergonomic layout and equipment

- NSW Australian vehicles

- Scotland neonate/peds transport

Safety Management

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

Vehicle Occupant Safety design

- 2007 European design
- Major events for innovation sharing
- but regional and often language isolation
Clear safety message

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

Future

- Goals
- New vehicles
- New technologies
- Futuristic vehicles
- New policies
- New practices
- New Standards

PREDICTABLE PREVENTABLE and NO ‘ACCIDENT’

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

Conclusions

- Prevention is key, ambulance transport environment includes predictable and preventable occupant risks.
- Unrestrained occupants and equipment are a potential injury risk to all occupants.
- Every member of an ambulance program must play a role to actively manage risk and to avoid taking unnecessary risks.
- Focus on safety of ALL aspects of the transport environment.
- Safer patient transport practices exist & should be used
- New technologies for vehicle design, occupant PPE and equipment restraint and driver performance are now available.
- There is a need for a defined pathway for translation of problem identification to resolution and policy implementation.

Thank you!

Any Questions??

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