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

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……

… Nov 8th’s Fatality

And Nov 10th’s 2007 obituary…

Real world answers to real world questions -
➤ What features will enhance safety of my new vehicle purchase?
➤ What color scheme do I want on my vehicle to make it safest?
➤ Do I need a helmet, and if so which one?
➤ What policies offer the safest system?
➤ How do I get my team to address safety issues?
➤ What data should I collect when something goes wrong, and how to analyze it?

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

http://www.objectivesafety.net
EMS Transport Safety

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

Firstly!

- An accident?
- or a predictable and preventable event

In a nutshell

- Am here to try to save you Lives
- Time and Money

Thursday July 5th 2007.....
Paramedic Allan Parson's killed

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

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

Five Killed In Crash of Ambulance and Semi

Charged with Vehicular Homicide

2 killed, 3 injured....
September 23, 2007 - PA
2 counts of vehicular homicide... November 5, 2007 - PA

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

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.

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

National EMS data

In the USA*
- ~ 50,000 vehicles
- ~ 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

*FARS/BTS 2005-6
Is it your service’s tragic year?

- ~ 50 fatalities a year
- 15,000 EMS services
- Each year one in 300 services experiences a fatality

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 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)**
- > 74% of EMS occupational fatalities are MVC related***
- Serious head injury in 65% of fatal occupant injuries#

- WE HAVE A BIG PROBLEM HERE

Occupational transportation fatalities...

Absence of standards and oversight

- Challenges in identifying best practice
- Myriad of unregulated commercial products
- No safety performance standards
- Absent national safety oversight

Some odd facts

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

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 (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

Clinical Care? Occupational Health and Safety.....?

- This IS a Transportation and Automotive Safety issue
- This is a Systems safety issue

So for EMS personnel...

- What’s going to kill you?
- What’s going to injure you?
This is not how you want to see your partner during a transport.

**Workplace' Hazards**

- 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

**Safety is Good Business**

- Safe practices save lives, time and money.
This is about you and your safety

- What safety practices do you use?
  - Seat belts?
  - EVOC training?
  - Equipment lock down?
  - Helmets?
  - Driver Feedback technology?
  - Tared dispatch?

Balance of concerns and risk during transport

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

Goals

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

Ambulance Safety Research: A New Field

- Engineering
- Ergonomic
- Epidemiology

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??

Risk/Hazards

- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

EMS Best Practice, Sept 2006

Increasing awareness...

It does happen...
New EMS helmet prototypes for 2008

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

Driver issues
- Intrusions
- Decelerations
- Intrusion vs Deceleration
- Intrusion = vehicle to vehicle or vehicle to fixed narrow object
- Deceleration = sudden stop – ie. sled test

Dynamic vs. Static Safety Testing
- Dynamic Safety Testing
  - requires sophisticated, expensive equipment
  - measurably demonstrates forces generated during collision
  - accepted international standard for vehicle restraint systems

And very Predictable...
- Intersections are lethal environments
- 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.....

So.. The real world for an EMS vehicle approaching a red light
- Intersection passenger car stopping distance at 40 mph dry and wet
- Perception + Reaction time + Vehicle Braking time (dry)
- Stopping distance: Perception + Reaction time + Vehicle Braking time
- Varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc

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

Dynamic Safety Testing
- Intrusion
- Deceleration

Intersection passenger car stopping distance
- at 40 mph dry and wet
- Perception + Reaction time + Vehicle Braking time (wet)

* Stopping distance: Perception + Reaction time + Vehicle Braking time (varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)
If we know this – and it’s published...


Why do we do this?

Full Vehicle Crash Testing

Test 1 – Right side impact

And this all takes place in 60 milliseconds – the blink of an eye

USA Ambulances: FMVSS Exempt

Propaganda that kills...

July 2007

Occupant protection......??
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

KKK/AMD – ‘safety testing’

- Ignorant of automotive safety principles – and specifies that a ‘successful test’ is -
  - No structural damage to any load bearing or supporting members, i.e., torn or broken material, broken welds, popped or sheared body rivets, bolts, and/or fasteners, shall be evident during the application of the force and after the release of the force.

Unacceptable, and ridiculous current 2007 USA ambulance ‘safety testing’ practices !!!!

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

No ‘a’... then NO ‘F’ !!!!!

\[ F = ma \]

- F – force
- m – mass
- a – acceleration

Most trucks, SUVs do poorly in whiplash test

- In 2007, Krueger performed a frontal impact on a vehicle in the test. The vehicle’s safety measures were evaluated.

A few key words about restraint systems...

Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

NOT new technical data...

The Ride of Your Life....
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.

Rash of “Safety Concept” vehicles..... Devoid of substantive automotive safety engineering input or testing.

- NO automotive safety engineer
- NO crashworthiness engineer
- NO reference to ANY existing or relevant automotive safety or crashworthiness technical publications.....
- yet multiple occupant fatalities and injuries annually.

Yes, the ride of your life....

- Sure... these vehicles all parade around the EMS and Fire shows BUT...
- NOT ONE of these vehicles has been to the automotive safety shows or scrutinized by the automotive safety industry.

Innovation

- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies - ITS
- New Safety Standards

Safety concepts out there now

The EMS Safety Foundation
Intro and Logistics Webinars from December 11th 2007 & Jan 9th 2008 Ems Safety Foundation tab at www.objectivesafety.net

Ambulance Transport Safety Task Force (ATS) and the National Transportation safety Board (NTSB)

National Academies Transportation Research Board’s (TRB) And Your New EMS Transport Safety Subcommittee
TRB EMS Safety Update
- Brought together NHTSA, FHWA, TRB, National Academies, DOT, CAMTS & EMS
- 3 presentations
  - TRB and EMS
  - Safety air/ground
  - Ground Ambulance Safety Issues and Directions
- Recorded presentations and handouts available at www.objectivesafety.net
- Potential for EMS safety research funding
- Next TRB meeting January 11-15, 2009 – all are welcome

Ambulance Transportation Safety Task Force
January 25th 2008

International approaches
- The state of the art non-USA vehicles have NO squad bench nor the after market structural vehicle modifications that can potentially decrease crashworthiness integrity that were seen in study vehicles.

Major events for innovation sharing
- but regional and often language isolation
http://www.rettmobil.org/

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

Australia, Melbourne

NSW Australian vehicles

Norway initiatives
Sweden initiatives

Other successful models

Ergonomic layout and equipment

Securing equipment

Safety concepts out there now

- Fleet Safety Management
- Z-15
- Driver monitoring and feedback
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies - ITS
- Visibility and Conspicuity
- New Safety Standards
- Life Safety Initiatives
- Resources and information

American National Standard
ANSI/ASSE Z15.1-2006
Safe Practices for Fleet Motor Vehicle Operations

What Z1S 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

Use proven safety tools
NAEMT July 2006 Position statement

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

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???

What about changing driver behavior in the real world??

Purpose of ‘Feedback box’ Program

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

You want a system that works!!

Does the system really work
Is it going to be a major burden on your staff to implement
What are the real costs
Are you going to have video of your company vehicle on YouTube??

News we don’t want to see

Caught On Video: EMT Struck By Car

Worker visibility Act: Help is on the way!! November 24th 2008
There are grants to assist you.. Science not, next best guess
Policy and practice ignorant of existing technical safety data

Day visibility
Night visibility
Visibility and Conspicuity ...?

Under Way... Emergency Vehicle Visibility and Conspicuity Study
- Funded by the USFA
- Conducted by IFSTA
- Looking at the effectiveness of reflective markings used on emergency vehicles
- Doing best practice research and working with manufacturers

This looks cool AND SAFE!
- Having access to that technical knowledge supports changes to improve safety practice
From this..... to this

Another excellent example - From this to ... this!

- Operating in an environment where many aspects of safety are still devoid of safety standards – requires technical knowledge and understanding

Not rocket science...

But whatever color .... if you run a red light some will be killed

R & D “Ripoff and Duplicate”

- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

Air EMS is a role model for safety initiatives and focus

Integration and Collaboration
No need to reinvent the wheel...

March 2007 - FHWA

Tips for Emergency Vehicle Operations

USFA Emergency Vehicle Safety Initiative

Coming Soon!
Traffic Incident Management Systems (TIMS)
- USFA report to be released any day
- Research and writing by IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents
- Will be available in a downloadable format

Safety Management
- A Safety Culture
- Protective Policies
- Protective Devices
- To prevent a crash
- In the event of 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

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?

Some simple and available solutions out there now
- Intersection Policy
- PPE
- ‘Feedback’ boxes
What do we know works...

- Vehicle Operations Safety Policies
- Squad bench lap seat belts
- Patient over the shoulder harnesses
- Securing equipment
- Forward and rear facing seating
- Some electronic technical devices
- Safety awareness
- Cultural change

What you can do now

- Have a written and implemented ‘safety program’
- Secure all equipment
- Secure occupants with standard belts
- Don’t drive through red lights/stop signs
- Use properly implemented “Feedback Boxes”
- Monitor crash events with common denominators (e.g., per 100,000 miles and per trip)

Important Principles!

1. A culture of safety
2. Drive cautiously
3. Wear your belts & restrain all occupants
4. Don’t drive through red lights/stop signs
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 reality
- 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 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