Ambulance Transport Safety: Everything You Really Need to Know

To quote Steve "Sid" Caesar – Director IHS ES

"We want everyone to get home safely each day"

Here we are!

Where am I really from? ...Yes, it IS that big!

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?

Your Interactive Handout awaits you online at…

- www.objectivesafety.net

This WILL be FAST!! No need to take any notes – all text slides will be awaiting you in your online Handout

http://www.objectivesafety.net

Firstly!

- An accident?
- or a predictable and preventable event

A tragic emergency health care intervention outcome

It does happen….
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......

Ambulance Transport Safety

- Emergency care, public health, public safety, and patient transportation.
- Important Principle: Ambulance transport safety is part of a system, the overall balance of risk involves the safety of all occupants and the public.
- All get home safely

In a nutshell

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

October 2008 JEMS Article
“Rig Safety – 9-1-1”

Breaking News!!
National Academies
TRB EMS/Medical Transport Safety Summit – November 7, 2008

The TRB and EMS

- TRB Mission: Provides leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal.
- Provides service to government, public, and scientific and engineering communities.

- TRB Goals:
  1. Being prepared for challenges.
  2. Conduct and promote excellence.
  3. Provide timely and informed advice.
  4. Act as an effective and trusted forum.
  5. Contribute to professional development.
  6. Conduct and promote communications efforts.
  7. Promote collaboration.

Transportation Research Board is an excellent resource... we should be using it!!

October 28, 2008 - Air EMS on NTSB’s Most Wanted List...
2008 - Air EMS on the NTSB’s “Most Wanted List”, where is ground EMS??

Creating a Safety Culture
within a company must start with upper management’s commitment to safety
- Awareness
- Training
- Incentive

A Simple Question....

Safety - Why now?
- Operating optimally in a transportation environment that is largely devoid of specific safety standards for the hazards and risks present
- Bridge the gap between what technical information exists and what is accessible and applied to EMS

EMS Safety
- ‘patient safety'
- AND also
- ‘provider' and ‘public safety'

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

New Information 2006-2008
- Enhanced Safety of Vehicles (ESV), June 2007
- American Society Safety Engineers (ASSE), June 2006 & June 2007
- International Ergonomists Association (IEA), June 2006
- Transportation Research Board – EMS Safety address, Jan 2007
- NWA Engineering Public Conference, July 2007
- OSHA 30th Anniversary, August 24, 2007 Federal Register
- MDOT, Maryland Department of Transportation
- ERRA, Equitable, Responsible, Efficient Transportation Equity Act: A Legacy for Riders
- State Strategic Highway Safety Plans, October 2007
- State EMS Council Policies
- APHA, Nov 2007
- Transportation Research Board – Inaugural EMS Safety Subcommittee
- NIOSH Emergency Responder Roundtable, March 2008
- Transportation Research Board – Ambulance Transport Safety Summit
- Worker visibility Act, to be implemented, Nov 24 2008
- OSHA EMS best practices site 2008

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

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

Five Killed in Crash of Ambulance and Semi
July 21, 2007 06:20 AM EDT

The National Highway Traffic Safety Administration (NHTSA) said the crash killed five people and injured three. The crash occurred on Interstate 80 in western Pennsylvania, near the town of State College.

The passengers, who were passengers in the ambulance, were named as: Allan Parson, 44, of Oakland, Pennsylvania; Christopher Parson, 47, of Oakland; Joseph Parson, 41, of Oakland; and Charles Parson, 43, of Oakland.

The driver of the ambulance, who was a paramedic, was identified as Allan Parson, 44, of Oakland. The ambulance, which was运输ing a patient with a spinal injury, was traveling in the left lane of the highway.

The semi-truck, which was traveling in the right lane, failed to yield to the ambulance and hit it head-on.

The driver of the semi-truck, who was identified as John Johnson, 52, of New Jersey, was also killed in the crash.

Emergency crews from several area hospitals responded to the crash, which occurred just before 2:30 p.m. on July 5.

The highway was closed in both directions for several hours as authorities investigated the crash. The investigation is being conducted by the NTSB, the Pennsylvania State Police, and the Department of Transportation.
This is not a crashworthy environment.

Emergency personnel throughout the region are still shocked and mourning their own.

"That's one of our recent vicodinals, when one of our own," said Steve Dinkelman of the Prince Fire Department.

"Everyone is heartbroken," said Tom, "Everybody tổes after everybody.

Brad Bailey, director of Peling County Emergency Management Agency, said the accident had cost a life.

"We've affected every emergency personnel in the county," he said. "We've lost a fellow human being and we're not doing it in vain. We will have to live with this."
Fatalities and funerals

Charged with Vehicular Homicide

2 counts of vehicular homicide... November 5, 2007 - PA

An interhospital transport - “Do no harm…”?

So

What’s important
What’s not important

What's going to save your life
What might take your life

What's going to hurt you
What's going to protect you

What is factual
What is garbage

What is new
What is not new
**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

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

**What we need to consider, where is the 'bang for buck' in ambulance transport safety:**

**1960 to 2007**
- A passenger vehicle - sure
- A 'laundry or mail truck'??
- A passenger vehicle...

**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**

**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 (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
Ground Transport Safety IS Complex AND Multidisciplinary

- Epidemiological Data Collection
- Ergonomic Research
- Biomechanical Automotive Safety
- Software/Chef research
- Communications technology
- Safety Technology
- Regulations and Standards
- Fleet Safety Program
- Public Safety
- Risk Management
- Transport Policy
- Driver Training
- Safety

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

There are more safety standards for moving cattle than for moving patients

The EMS transport process

- communications/dispatch
- the patient
- restraining device/seat
- transporting device/gurney
- paramedic/transport nurse, 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)

- USA EMS data

USA EMS data

In the USA*

- ~50,000 vehicles
- ~5,000 crashes a year
- One fatality each week
- ~15 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 there an acceptable rate of morbidity and mortality for pre-hospital transport systems??

An ambulance is not an ED/ICU on wheels

The Emergency Department (ED)
Is it your service’s tragic year?

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

So for EMS personnel...

- What’s going to kill you?
- What’s going to injure you?

‘Workplace’ Hazards

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, Institute of Medicine, National Academy Press, 2002

Workplace Hazards

‘Real world’ head-on post crash

“Ambulance transport has a death toll....”

Carl Craigie EMT-P, Chief Platte Valley Ambulance
Colorado Springs, April 2007

Paramedic injured in crash is recovering

Aurora Daily News
Clinical Care?
Occupational Health and Safety…..?

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

Key Safety Priority areas of focus
\( n = 155 \)

Safety is Good Business

This IS a Transportation and Automotive Safety issue

This is a Systems safety issue

June 2007

A problem

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

EMS CANNOT Afford to keep paying out like this…..

A number of potential interventions to enhance safety have been identified:
- Safety Policy
- Safety performance standards
- Vehicle crashworthiness
- Vehicle interior ergonomics
- Personal Protective Equipment design
- Driver selection, training and simulation
- Safety and risk awareness modification
- Risk behavior modification
- Intelligent Transportation Systems (ITS)

Benefit of Safety
- 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 ?
  - Tiered 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

Goals

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

Increasing awareness ...

EMS Best Practice, Sept 2006

- 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

But what about head protection?

New EMS helmet prototypes for 2008

It does happen....
Problems
- No Standards
- Unique safety and hazard protection needs
- A number of less than appropriate devices out there

Dynamic Safety Testing
- Requires sophisticated, expensive equipment
- Measurably demonstrates forces generated during collision
- Accepted international standard for vehicle 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

Intrusion vs Deceleration
- Intrusion = vehicle to vehicle or vehicle to fixed narrow object
- Deceleration = sudden stop – i.e. sled test

If we know this – and its 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.

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.....

The real world
Intersection passenger car stopping distance at 40 mph dry and wet

And very Predictable...

Ambulance Standards??

What KKK-A-1822F, AMD and FMVSS state and don’t state...

NIOSH Ambulance Occupant Safety Crash Testing

Impact Direction 25 MPH !
Very Predictable...

25 MPH

So.. The real world for an EMS vehicle approaching a red light

KKK?
AMD?
FMVSS?
NFPA?

Dry
Stopped at +
Perception + Reaction time Vehicle Braking time (dry)

Wet
Stopped at
Perception + Reaction time Vehicle Braking time (wet)

* Stopping distance: Perception time + Reaction time + Vehicle braking time (varies with age, skill, agility, distance, vehicle type, tire pressure, road etc)
USA KKK ambulance purchase specifications
- Specifications for the purchase of a Star of Life Ambulance
- Static Pull test
- 2200 Lbs. static stretcher test in longitudinal, lateral & vertical
- No dynamic test for vehicle, occupants or equipment
- No automotive test manikin
- Voluntary

USA Ambulance Manufacturing Division (AMD)
Ambulance Standards – August 2007
- No dynamic or impact test
- No automotive test manikin
- Mandates NO 'crumple zone'
- No impact tested anchorages for occupant restraint or equipment
- Internal, not independent

AMD – static 'safety testing'
- Inconsistent with 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.

Occupant protection......??
July 2007

KKK certified and FMVSS exempt...??

No ‘a’... then NO ‘F’ !!!!!

\[ F = ma \]

where
\[ F \] – force
\[ m \] – mass
\[ a \] – acceleration

Unacceptable, and non-automotive AMD/KKK-F 'safety testing' practices and standards !??

USA Ambulances:
FMVSS Exemption

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
- Restraint belt system
- Equipment lock downs
- Funding
- Head protection

A few key words about restraint systems...

'Safety' approaches being driven by manufacturers' claims and sales rather than by science and data.

A few key words about restraint systems...

Intelligent Transport Safety Systems

NOT new technical data...

NOT new technical data...

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

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

JEMS and EMS Responder ARE NOT automotive safety journals
- And the reviews in them are completely inappropriate, misleading and outside of what is known in automotive safety
- We should NOT TOLERATE this as it is both completely irresponsible and very dangerous ......

Innovation

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

The Driver

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

Driver issues

What about changing driver behavior in the real world??

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

Conclusion: When controlling the vehicle and utilizing the road, the role of learning becomes vital as well as regular exercise and feedback. Regular feedback is essential for improving driving. Feedback should be immediate and constructive to encourage good driving habits.
**How the Device Works**
- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has individual key “fob”
- Data collected every second including: vehicle speed and performance, driver behaviors, and emergency mode
- Auditory feedback of warning ‘growls’, and penalty tones
- Data downloaded automatically every day

**Demonstrated Effectiveness**

**A key to safe ambulance transport**

**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.

**Other monitoring devices**
- Primarily to record events during and immediately preceding a crash
- Give no driver crash prevention feedback
- Intrusive
- Not demonstrated to be as effective in improving vehicle maintenance costs or as effective in modifying driver behavior long term

**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 you tube??

**The jury is out on**
- Opticon
- Simulators

**The EMS Safety Foundation**
Intro and Logistics Webinars from December 11th 2007 & Jan 8th 2008
EMS Safety Foundation tab at www.objectivesafety.net

**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.
RETTmobil – ‘Mobile Rescue’
Major European event for EMS innovation
Fulda, Germany May 2008
http://www.rettmobil.com/

EMS Safety Foundation's
2008 RETTmobil Delegation

Vehicle Occupant Safety design
2008 European design
Safety technology is a key focus

Ergonomic design

One patient or Two patients and you can reach both AND your equipment...
a fleet based initiative
High speed crash, rolled and the occupants (patient and medics) had only minor scratches.

Ergonomic layout and equipment

Securing equipment

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?

Were we safer in the Cadillac???
Other successful models

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

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???

News we don’t want to see

Caught On Video: EMT Struck By Car

Two paramedics were critically injured.

© 2017 NAEMT. The deaths of two paramedics, one seriously injured, of an ambulance struck by a vehicle in Chicago. The paramedics were on their way to a call when the ambulance was hit by a car. Both paramedics were in critical condition.
Worker visibility Act: Help is on the way!! November 24th 2008

Visibility and Conspicuity ...?

Night visibility

Visibility and lighting issues

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

Policy and practice ignorant of existing technical safety data
This looks cool AND SAFE!

This is AWESOME – and addresses some very real risks, very creatively – and currently ONLY available in London Ontario!

Having access to that technical knowledge supports changes to improve safety practice

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

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


State Strategic Highway Safety Plans

Required as part of the SAFETEA-LU legislation

(Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users)

Effective October 1st 2007

Focus is the 4 ‘E’s

- Engineering
- Education
- Enforcement
- Emergency Medical Services

EMS is a core theme
Ambulance Safety Summit  
November 7th, 2008

- EMS Transportation Safety Subcommittee of the National Academies Transportation Research Board (TRB)
- Onsite panel of invited technical experts, in addition to policy makers and EMS leaders:
  - Safety data capture
  - Transport fleet management, EMS vehicle operations
  - Automotive safety and occupant protection
  - Ergonomics and human factors
  - Standards
- Will be beamed live via Webinar and recorded electronically and TRB e-circular produced
- Access to live participation requires pre-registration
- Pre-registration info disseminated in early October

TRB Jan 2009 EMS Subcommittee Meeting and Seminar

- The Subcommittee on EMS Transportation Safety of the National Academies Transportation Research Board winter subcommittee meeting and seminar is in DC during the 2009 January TRB symposium
- Your input and participation (onsite or online) is valued
- You can submit your suggestions/input for the TRB EMS Subcommittee meeting online -
  - http://www.emssaftyfoundation.org/TRBpriority.htm

New NHTSA EMS info link

- There is a new Federal link to EMS info – a great resource!
- www.EMS.gov

Tips for Emergency Vehicle Operations

- www.GlobalEMSForum.org
- "Running Hot or Not", "Being Seen at the Scene" and "Ambulance Standards" Webinars

No need to reinvent the wheel...

- March 2007 - FHWA
- Tips for Emergency Vehicle Operations
  - USFA Emergency Vehicle Safety Initiative
  - Traffic Incident Management Systems (TIMS)
- Released April 2008
- FEMA, USFA, IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents
Risk/Hazards
- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

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??

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

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 (i.e. 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. 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
- 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