Ambulance Transport Safety—What You Can’t Afford Not To Know

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

And Nov 10th’s 2007 obituary…

In a nutshell

Am here to try to save you Lives Time and Money

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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

A tragic emergency health care intervention outcome

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

The worst ambulance crash in USA history

Friday July 20th 2007

Five Killed In Crash of Ambulance and Semi

Jan 18th, 2008

Jan 23rd, 2008

Charged with Vehicular Homicide

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

"as he had been trained to do...??"
2 killed, 3 injured…
September 23, 2007 - PA

Car, Ambulance Crash In Marshall Township, 2 Dead

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

Speeding, Alcohol Blamed In Fatal Ambulance Crash

November 5, 2007

Firstly!

An accident?

or a predictable and preventable event

Testing the real world

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

EMS Transport Safety
- 'patient safety'
  AND also
- 'provider' and '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

Unique workplace
- In vehicles
- At roadside and other emergency scenes

the EMS transport process
- communications/dispacth
- 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
Ground Transport Safety IS Complex AND Multidisciplinary

Epidemiological Data Collection

Risk Management

Public Safety

Transport Policy

Pre-Post

Driver Training

Communications Technology

Safety Technology

Regulatory and Standards

Fleet Safety Programs

Is there an acceptable rate of morbidity and mortality for pre-hospital transport systems??

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

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 2.7 vs restrained)**
- 82% of fatally injured EMS rear occupants unrestrained**
- 14% of EMS 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**

Absence of standards and oversight

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

What a fabulous Ambulance!
USA 1960’s

1960 to 2007

A passenger vehicle - sure

A ‘laundry or mail truck’ - ?

A passenger vehicle - yes!

Tragedy you don’t want to be involved in

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

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

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

Carl Craigle 2MT-P, Chief Platte Valley Ambulance
Colorado Springs, April 2007
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?

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

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

This is not how you want to see your partner during a transport

‘Workplace’ Hazards

Preventable...

James Woodman
- is a paramedic who, on his first day as a paramedic, suffered a severe TBI when the ambulance he was riding in (in the back) was t-boned and rolled onto its side.
- He remains in a persistent vegetative state in an ECF in Colorado.
- It is assumed that when the ambulance rolled onto its side, the lifepack 10 struck James in the head.......

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 a ambulance crash.

Occupational transportation fatalities...

WE HAVE A BIG PROBLEM HERE


What do ambulance crashes really cost?

- Loss of life and injury
- Negative impact on EMS system
- Collisions are the largest liability cost and exceed 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/arbitration/lawsuit
  - medical/lability costs of injured EMTs
  - hiring of new employees to replace injured personnel
  - retraining and psychological counseling of personnel involved and others
  - increased insurance rates

2007 Insurance data –

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

June 2007

A problem

2007 Insurance data –

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

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

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??

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

New EMS helmet prototypes for 2008

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???

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.....

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

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

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

The Mabel Rule
- Never make a left
- Make three rights instead

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

Driver issues
- Air EMS is a role model for safety initiatives and focus

R & D
"Ripoff and Duplicate"
- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from
Safety is Good Business

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

UPS: The ‘Big Brown’

- No left turns – instead make three rights
- Don’t back up
- Don’t employ any drivers under 25 years of age
- Don’t employ anyone with a history of driving convictions

Valuable information from the transportation industry

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

IAFC June 2007
The Effects of Stress Degradation on Fire Fighters and EMS Responders

Knowledge transfer

July 2007
No need to reinvent the wheel...

Tips for Emergency Vehicle Operations

An excellent model

Coming Soon!

Traffic Incident Management Systems (TIMS)

Ambulance Safety Research: A New Field

The Crash Event - Crash Testing

Intrusion vs Deceleration
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?

Full Vehicle Crash Testing
Test 1 – Right side impact

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

NIOSH Ambulance Occupant Safety Crash Testing

Fire Service Emergency Vehicle Safety Initiative – Phase II
Developed an innovative web based emergency vehicle safety educational program to support the volunteer fire services in partnership with the NVFC:
http://www.nvfc.org/evsp/index.html

Emergency Vehicle Safe Operations for Volunteer & Small Combination Emergency Service Organizations
And keep focus on ‘All hazards’ in addition to crashworthiness

- Driver age?
- Driving history?
- Patient condition?
- Dispatch?
- Vehicle stability?
- Driver feedback technologies?

What’s new

- New expertise and collaborations
- New automotive and transportation safety technologies
- New Information
- New events

Safety oversight of what and by whom

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

Risk/Hazards

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

EMS Best Practice, Sept 2006

- New Information
- New events

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

Z15 Incident Rates

- Incident rate based on number of vehicles operated:
  Incident rate = Number of incidents / Number of vehicles

- Incident rate based on vehicle mileage:
  Incident rate = Number of incidents / Vehicle mileage

- Injury incident rate based on vehicle mileage:
  Injury incident rate = (Number of incidents / Vehicle mileage) x 1,000,000

- Incident rates based on service activity:
  Incidents per 10,000 transports = Number of incidents / Number of transports

- Vehicle injury rates based on work hours:
  Vehicle incidents per 200,000 hours = Number of incidents / Number of hours worked

Use proven safety tools
Policy makes a difference...

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

WEMSA Leadership

WEMSA – October 2007

1. Emergency Vehicle Operations Policy
2. Vehicle operations training and evaluation
3. A program of graduated driver responsibility
4. Drivers only age 25 and over
5. Complete stop at an intersection
6. Restricted use of Red Lights and Sirens
7. Monitoring of emergency vehicle operations

WEMSA covered some key and important policies and procedures
But...

What about hours of service?
What about visibility at the scene? For providers and the vehicles?
What about protective equipment?
What about ambulance design safety?
What about reporting of adverse events?

What about changing driver behavior in the real world??

Demonstrated Effectiveness

- Change driver behavior
- Carrot not stick
- Vehicle maintenance improvement
- Decreased administrative burden
- Insurance benefits

Purpose of ‘Feedback box’ Program

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

Unit 302 Accident

Extensive Indirect cost savings

- Fewer out of service vehicles
- Improved transport times
- Decreased administrative lost in managing unsafe behaviors
- Decreased legal burden
- Automatic system wide data
- Insurance benefits

And when a rare crash happens....

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

Demonstrated Effectiveness

- Blind data, no growls
- Grows & tones (iv unidentified data capture
- Identified data

Demonstrated clearly

- Driver risk behavior can be substantially modified and improved with monitoring device, with real time auditory feedback.

News we don’t want to see

Caught On Video: EMT Struck By Car

[Video Link]
May 21st, 2007, Seattle

Help is on the way!! November 24th 2008

There are grants to assist you..

Science not, next best guess

Visibility and Conspicuity ...?

Recent Visibility Webinar

www.GlobalEMSForum.org
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

Make sure that EVERYTHING is tied down!

Very cool – even high visibility hoses!!

And what a smart vehicle!!

Good visibility!

This looks cool AND SAFE!

Not rocket science...
Very cool !!!

Day visibility

Night visibility

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

Ambulance Standards??
- KKK?
- AMD?
- FMVSS?
- NFPA?

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

USA Ambulances: FMVSS Exempt

Propaganda that kills…
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 – static ‘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!!?

F = ma

where F – force
          m – mass
          a – acceleration

No ‘a’… then NO ‘F’ !!!!!

FMVSS exempt......

KKK certified and FMVSS exempt...?
A closer look

A few key words about restraint systems...

NOT new technical data...

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

NIOSH Ambulance Occupant Safety Crash Testing

Impact Direction
25 MPH

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

Increasing awareness ...

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

Bigger is not necessarily better......
Innovation

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

Major events for innovation sharing – but regional and often language isolation

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

Ergonomic design
Ergonomic layout and equipment

NSW Australian vehicles
Flexibility to manage two patients
Securing equipment
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
- Seat/seat belt systems
- Equipment lock downs
- Padding
- Head protection

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

Creating a Safety Culture

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

Some simple and available solutions out there now
- Intersection Policy
- PPE
- Black 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 (ie. 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