Approaches to Optimizing Emergency Medical Services Transportation Safety

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Outline
- Background issues and hazards
- Size fleet, fleet mix, personnel mix
- General approaches to safety
- Future needs

Introduction
- Emergency Medical Services – (EMS)
- Important interface between public health, transportation, public safety and emergency and acute care and the community
- Unique challenges - patient, provider and public safety and transportation safety
- Unique needs of this important part of our health care and transportation system

An important and unique system
- Public safety, public health and emergency service
- Is there to save lives
- A more recent service compared to Fire and Police

What is the scope of EMS?
- Emergency care, public health, public safety and patient transport
- Bridge between the community and the hospital
- Volunteer – professional
- Urban – rural
- Disaster response
- Majority of transports NOT critical or life threatening

Emergency Medical Service – Ambulance Transport
- What are the 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 system be optimized?

A tragic emergency health care intervention outcome

It does happen....

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

Operating in an environment where many aspects of safety are still devoid of safety standards – requires detailed technical knowledge and understanding in technical disciplines OUTSIDE of healthcare disciplines.

An interhospital transport ? “Do no harm…. ?

New Information 2007-2008

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

Charged with Vehicular Homicide

Firstly!

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:

National EMS data

In the USA*
- ~ 50,000 vehicles
- ~ 5,000 crashes a year
- ~ One fatality each week
  - ~ 25 pedestrians or occupants of other car
  - ~ Approximately 1 child fatality per year
- ~18 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

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

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 3.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)**
- > 82% of fatal EMT occupational fatalities are MVC related***
- Serious head injury in >65% of fatal occupant injury#
- More likely to crash at an intersection with traffic lights (37% vs 18%; p=0.001) & more people & injuries/crash than similar sized vehicles##


Occupational transportation fatalities...

- WE HAVE A BIG PROBLEM HERE

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??
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

General approaches

- Policy
- Training
- Technology
- Vehicle design – chassis, interior features and layout, vehicle type
- Standards
- Learning from global best practices
- Contrast with an office chair
- Current fleet
- Future fleet

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
- Independent resources and information

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

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

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
Driver issues

Which is best, how many hours...??

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

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

And when a rare crash happens....

Unit 302 Accident

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 youtube??

The jury is out on
- Opticon
- Simulators

Policy makes a difference...
- "Are our policies killing people?"
- 1991-2000, 302,969 Emergency vehicles were involved in MVCs - 1,565 involving fatalities*
- In PA 1997-2001, ambulances were more likely than similar sized vehicles to be involved in:
  - 4-way intersection crashes (42% vs 23%, p<0.001)
  - Collisions at traffic signals (37% vs 18%, p<0.001)
  - MVCs with more people injured (76% vs 61%, p<0.001)


Vehicle Operations Position Statement

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?
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

State SHSP EMS Focus*

July 2007 Report

July 2007

Pennsylvania Code

NAEMT July 2006 Position statement

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

Use proven safety tools
Transport oversight?

- In contrast to the bus and truck industries, which have:
  - comprehensive safety oversight
  - transportation safety interventions
  - transportation safety data capture via the Federal Motor Carrier Safety Administration (FMCSA)
- EMS has been focused more as an acute healthcare delivery and emergency medical service and largely outside of much of the other transportation oversight infrastructure that exists.

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

Vehicle design – chassis, interior features and layout, vehicle type

1960 to 2007

- A passenger vehicle - sure
- A 'laundry or mail truck' - ??
- A passenger vehicle - yes!

Some recent adverse outcomes

- 'Workplace' Hazards

Full Vehicle Crash Testing

Test 1 – Right side impact
And this all takes place in 60 milliseconds – the blink of an eye

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

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

Propaganda that kills... July 2007

Occupant protection......??

USA Ambulances: FMVSS Exempt

Propaganda that kills...

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

AMD 2007 – ‘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 !!??

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No ‘a’… then NO ‘F’ !!!!!

\[ F = ma \]

where

- \( F \) – force
- \( m \) – mass
- \( a \) – acceleration

Kikk certified and FMVSS exempt…?

F = ma

where

- \( F \) – force
- \( m \) – mass
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FMVSS exempt……

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 sidefacing 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
Recent Visibility Webinar
www.GlobalEMSForum.org

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

Benefit of Safety

- Safe practices save lives, time and money

R & D

“Ripoff and Duplicate”

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

Innovation

The EMS Safety Foundation
Intro and Logistics Webinars from December 11th 2007 & Jan 8th 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
  - Air 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 aftermarket structural vehicle modifications that can potentially decrease crashworthiness integrity that were seen in study vehicles.

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

NSW Australian vehicles
Flexibility to manage two patients

High speed crash, rolled and the occupants (patient and medics) had only minor scratches

Norway initiatives

Sweden initiatives

Other successful models

Ergonomic layout and equipment

Securing equipment

Future needs
- Safe vehicle design and structure
- Standards – scene visibility, vehicle and personnel visibility
- Head protection
- Meaningful driver training and monitoring
- Communication systems
- Protective clothing
- Vehicle testing standards
- Minimum equipment to carry based on demonstrated outcomes
Safety Management

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

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?

Risk/Hazards

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

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
- ‘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. 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
**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