2nd MMTS Summitt

May 10th, 2006

Research, Technology and Reality -

Everything You Always Wanted to Know About Ambulance Safety Science but Were Afraid to Ask

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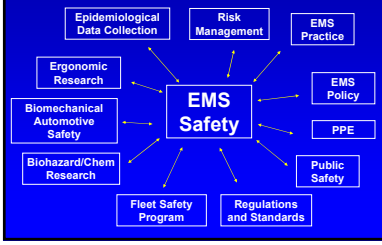
EMS Safety IS Complex AND Multidisciplinary



What's new

- New automotive safety technologies
  - EVS
  - ITS
  - Monitoring and feedback enhancements
- New expertise
  - ASSE
  - SAE
  - UTRC
  - Ergonomics
  - Industrial Design

Regional University Transportation Research Centers

Essentials

- Automotive Safety is a Science that has clear and well founded principles and concepts.
- Fleet: 50,000 vehicles, Type I, II, III, freightliner, motorcycles
- 16 million trips to the Emergency Department annually

What a novel idea…

Technical Research

- Based on reliable and real world field data
- Cost effective and practical
- Involve low cost development – University engineering and transportation research centers

"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 (43% 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)

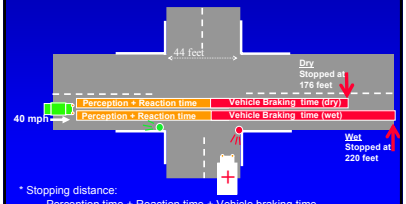
**Comparison of Crashes Involving Ambulances with those of similar sized vehicles – Adam Ray, Douglas Kupas, PEC Dec 2005;9:412-415*

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

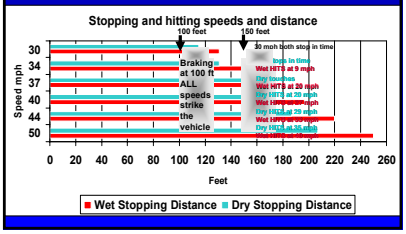
Intersection passenger car stopping distance* at 40 mph dry and wet



* Stopping distance:
Perception time + Reaction time + Vehicle braking time
(varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)

They CANT STOP IN TIME

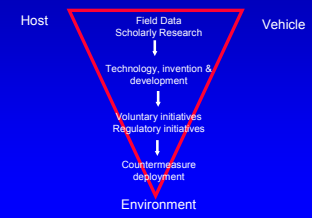
Even at 30 mph & 100 feet away
- dry and wet conditions-



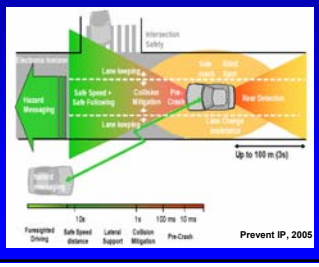
A peer reviewed tragedy

- Persistent disconnect between automotive safety science and EMS transport safety approach
- Pre-hospital and Emergency Care 2004
  - *"EMS vehicle drivers are advised to approach the intersection, slowing to ensure that traffic has stopped and making eye contact with other drivers before entering the intersection."*
- In the modern era of road safety to suggest that a strategy of "eye contact" to be made at an intersection with a driver traveling at ~ 40mph in the hope that this would result in a safety intervention, is at best frightening

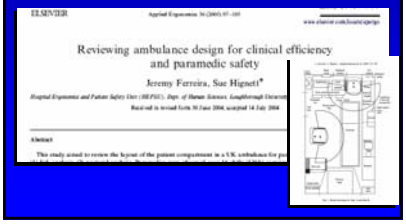
Automotive Injury Triangle and Safety Development



Intelligent Transport Safety Systems



We should use the best safety practices demonstrated



ELSEVIER

Reviewing ambulance design for clinical efficiency and paramedic safety

Jeremy Ferreira, Sue Hignett*

and… now for my most scary slide

The difference having data makes?

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

TRB Active Projects

(all due late 2006)

- 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

Published TRB Projects

(available at www.trb.org)

- Effective Commercial Truck and Bus Safety Management Techniques (2003)
- Security Measures in the Commercial Trucking and Bus Industries (2003)
- Highway/Heavy Vehicle Interaction (2003)
- Individual Differences and the "High Risk" Commercial Driver (2004)
- Training of Commercial Motor Vehicle Drivers (2004)
- Operational Differences and Similarities Among the Motorcoach, School Bus, and Trucking Industries (2005)
- Effective Motorcoach Industry Hours of Service and Fatigue Management Techniques (2005)
- Commercial Motor Vehicle Driver Safety Belt Usage (2005)
- Literature Review on Health and Fatigue Issues Associated with Commercial Motor Vehicle Driver Hours of Work (2005)
- Alternative Truck and Bus Inspection Strategies (2006)

Concern

- What is currently occurring as routine practice in EMS is in many ways ignoring that science, and worse there are initiatives that are automotive safety in their entirety that are occurring outside of the automotive safety industry and those principles.

Low Hanging Fruit

- There is NO JUSTIFICATION for NOT using over the shoulder harnesses on EVERY patient
- There is NO JUSTIFICATION for NOT firmly securing each and every piece of equipment during transport
- Seat belts should be used routinely, and in the RARE circumstance that use of the seat belt is not possible due to patient care needs – the driver of the vehicle should be notified that there are vulnerable occupants and extra driving caution applied
- There is NO JUSTIFICATION for not having crash and event data for EACH service by 100,000 miles traveled and per trip for each year of operation

What is known in automotive safety:

- The seat is a key safety device for passengers in a vehicle
- Any device that allows or encourages an occupant to be out of the seat puts them at risk
- Crash dummies are designed to be seated in a seat – testing of devices that allow an occupant to be out of a seat using a crash dummy are unreliable and may well give false results

- What we need to consider, where is the ‘bang for buck’ in ambulance transport safety:

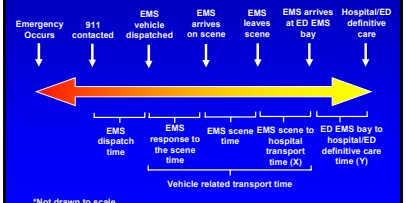
Current fleet

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

Future

- Vehicle design enhancements
- PPE
- Practice policy
- Data/Monitoring/Oversight

911 Call to Hospital/ED Definitive Care Time Intervals*



*Not drawn to scale

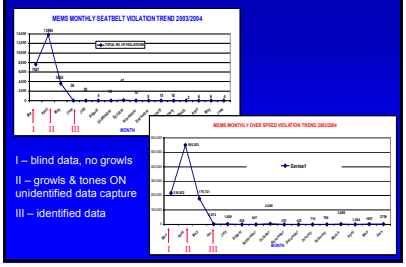
Purpose of a ‘Black box’ Program

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

The “Black Box”

Driver behavior monitoring and feedback device

Demonstrated Effectiveness

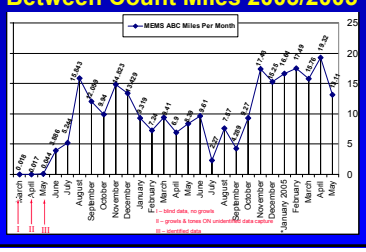


I – blind data, no growls

II – growls & tones ON unidentified data capture

III – identified data

MEMS Road Safety Average Between Count Miles 2003/2005



Improved safety, performance and decreased costs

- No increase in response times
- Pays for itself in 6 months in reduced maintenance costs alone
- Improved safety proxies by orders of magnitude and sustained with no in-service
- Reduced crash rate by up to 90%
- Well accepted
- Is it ethical NOT to have these devices in all vehicles now?

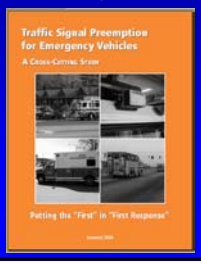
Other monitoring devices

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

The jury is out on

- Opticon
- Simulators

Data, but is it generalizable



The 'workplace' IS a vehicle

- Providers often in vulnerable positions during transport.
  - Bench seat
  - Captains chair
  - Standing or kneeling

View of Ambulance interior from Rear

But what about 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 Helmets for 2006

Real world

- We do know from large samples that the most common reason for medics to get up is to get to the radio
- We do know that CPR enroute to the hospital is a very rare event – too small in frequency to even evaluate using national data bases, and often with non survival out come when it does occur

Project SUPPORT, Johns Hopkins Engineering/Public Health Collaboration

Levick NR, Lincoln A, Gupta P et al

- Passive and active protection of EMT
- Minimize injury severity to the EMT
- Simple retro-fit to existing ambulances
- not interfere with treatment activities or EMT access to the patient
- be relatively inexpensive
- ? Equipment restraint

Netting and Harness System

1. Netting system
2. Limited motion harness, with characteristics of safety, strength and ease of use

What we know:

- Secure providers and other seated occupants with existing restraints
- Secure patient with over the shoulder harness
- Secure Equipment
- Use driver and vehicle monitoring and feedback technology
- Use tiered dispatch as in John Russell's impressive data!

What we don't know

- We have NO POPULATION based data on vehicle crash injury rates
- We have NO POPULATION based data on mechanisms of vehicle crash injury
- We have NO WAY of evaluating that any safety interventions impact injury rates or injury mechanisms
- We have NO ERGONOMIC data

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

John Flynn, NSW Ambulance Sydney Australia

A glimpse of the future

What's missing

1. What EMS safety data is collected nationally?
   - We have no complete denominator data
   - We even have incomplete numerator data
2. Absent population based national injury data or injury mechanics data for EMS
3. Absent structured automotive safety engineering input

   1+ 2 +3 = resultant inability to design and evaluate efficacy of injury interventions

4. What oversight is there?
5. Which organizations would determine policy?

Current and Future Research

- Epidemiology
- Ergonomic hazards
- PPE & Head protection
  (coexistent with Bio/Chem/Radiation hazard initiatives)
- Transport
  - Vehicle/Occupant automotive testing
  - Vehicle design innovation
  - Driver behavior (Real time and Simulated)
  - Intelligent Transportation Systems
- Operations tracking
- Data systems/reporting systems
- Enhanced Practice Policies evaluation

What needs to happen NOW

- Data
  - Epidemiology
  - Ergonomic
- Safety research priorities
- Safety oversight

Key Points

Vehicle Operation
Safe driving practice
Stop at red lights, stop signs
EVOC

Vehicle Design
Non-hostile interiors
Attention to ergonomics
Compact vehicles ie. vans
Lock down positions for routine equipment
ITS – driver/vehicle feedback devices

Safety Practices
Secure all equipment
Use portable communications
Notify driver if rear occupants are in vulnerable positions

PPE
Use of seat belts
Biohazard protection
Head protection

Safety Management
Safety program
Safe driving policy
Safety monitoring and feedback
ANSI/ASSE Z.15

Future

- Meaningful Goals
- New policies
- New practices
- New standards
- New vehicles
- New technologies

http://www.objectivesafety.net