

Connecticut Trauma Conference,  
Looking Back to the Future  
March 31, 2006

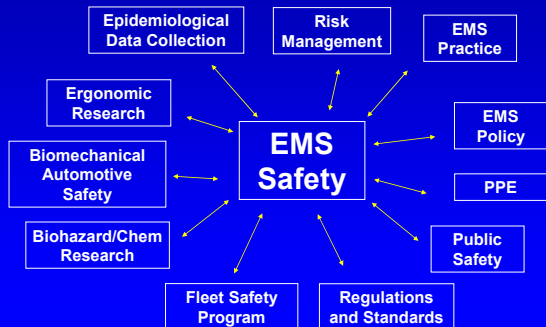
## Issues in Pre-hospital Care Staying Alive in the Field?

Nadine Levick MD, MPH

## So you are EMS personnel...

- ▶ What's going to kill you?
- ▶ What's going to injure you?

## EMS Safety IS Complex AND Multidisciplinary



## This morning's Scope

- ▶ **Key Issues**
  - Fatality and Injury data
- ▶ **Guidelines – standards**
  - Transport safety
  - Practice protocols
  - Occupational Health and Safety
- ▶ **What's missing**
- ▶ **What needs to happen NOW**
- ▶ **Future**
  - Meaningful Goals
  - New policies
  - New practices
  - New standards
  - New vehicles
  - New technologies

## EMS Fatalities

- ▶ 12.7 fatalities/100,000 EMS workers
- ▶ Greater than 2 X the national average (5.0 fatalities/100,000)
- ▶ Similar to Police (14.2/100,000) and Fire Fighters (16.5/100,000)

\* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, *Annals of Emergency Medicine*, Dec 2002

## A tragic emergency health care intervention outcome



It does happen....

## 'New World' Hazards for EMS..



## 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: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

## So does it make sense ?

- ▶ Gloves and universal precautions?...  
... good biohazard protection BUT aren't going to give much protection in a ambulance crash

## A word about occupational transportation fatalities..



▶ WE HAVE A BIG PROBLEM HERE

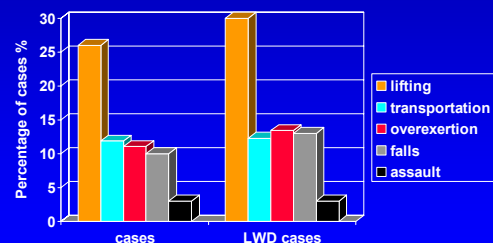
\* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

## EMS Injuries\*

- ▶ Higher than the injury rate for any private industry published by DOL
- ▶ 34.6 injuries/100 fulltime workers per year
- ▶ 1.5 x that of fire fighters
- ▶ 5.8 x that of health services personnel
- ▶ 7 x the national average

\* Maguire, Hunting, Guidotti & Smith, Occupational Injuries among Emergency Medical Services Personnel, Prehospital and Emergency Care Oct/Dec 2005

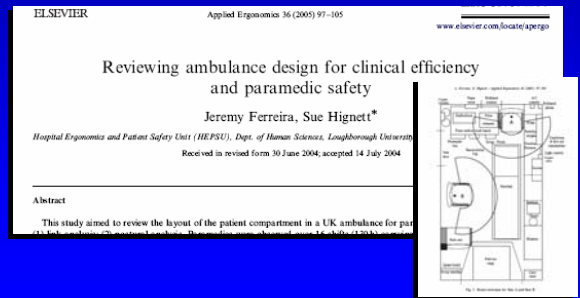
## And the injury events..



## Is any of this a surprise?

- ▶ It shouldn't be....
- ▶ Its all published and in the peer reviewed literature

## We should use the best safety practices demonstrated



## Key Issues

- ▶ Mythology
  - That Emergency Medical Service personnel are safe
- ▶ Injury Hazards
  - Biohazard
  - Chemical/Radiation
  - Physical/Mechanical trauma – THE BIG PROBLEM
- ▶ Motor Vehicle Crashes are the highest cause of death at work – EMS has > 2X the mean national rate
- ▶ An R & D and Regulatory Gap
  - Occupational Health and Safety
    - the workplace is in a vehicle – exposure data are scant
  - Automotive Safety
    - a vehicle is the work place – 'exempt' from automotive research and regulation

## USA EMS

- ▶ EMS Systems - >15,000
- ▶ Personnel - ~1 million (~30% F/T professional & 70% volunteer)
- ▶ Vehicles - ~50,000 (Type I, Type II, Type III, Freightliners, ?motorcycles)
- ▶ Transports - ~30 million patients
- ▶ Cost - ~\$5 Billion annually
- ▶ Safety Oversight - ? Disparate

## Guidelines – standards

- ▶ Transport safety
- ▶ Practice protocols
- ▶ Occupational Health and Safety

## What's missing

- ▶ What data is collected nationally
- ▶ What oversight is there
- ▶ Which organizations would determine policy

## What needs to happen NOW

- ▶ **Data**
  - ♦ Epidemiology
  - ♦ Ergonomic
- ▶ **Safety oversight**

## Future

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

## Ideally Who, What and Where ?

- ▶ **Occupational Health and Safety**
  - ♦ Epidemiology, Bio/Chem Hazards and Ergonomics
  - ♦ Regulation and Research
- ▶ **Automotive Safety**
  - ♦ Epidemiology, Engineering and Impact Biomechanics
  - ♦ Regulation and Research
- ▶ **EMS Industry**
  - ♦ Occ. Health, Automotive, Technical, Clinical & Fiscal data
  - ♦ Practice Policy, Risk Management and Fleet Safety
- ▶ **Academia**
  - ♦ Independent and collaborative
  - ♦ R & D and evaluation of all of the above

## Goals

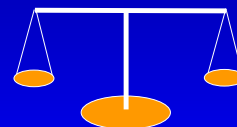
- ▶ **Standards for safety**
- ▶ **Policy based on Science**
- ▶ **Databases to demonstrate outcome**

## Predictable risks

- ▶ More often at intersections, & with another vehicle ( $p < 0.001$ )\*
- ▶ Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)\*
- ▶ 82% of fatally injured EMS rear occupants unrestrained\*\*
- ▶ > 74% of EMT occupational fatalities are MVC related\*\*\*
- ▶ Serious head injury in >65% of fatal occupant injuries#
- ▶ 70% of fatal crashes EMS crashes during Emergency Use#
- ▶ More likely to crash at an intersection with traffic lights (37% vs 18%  $p=0.001$ ) & more people & injuries/crash than similar sized vehicles##

\*Kahn CA, Pirralo RG, Kuhn EM, Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9  
\*\*Becker, Zeloshnjaj, Levick, Li, Miller, Acc Anal Prev 2003  
\*\*\*Maguire, Hunting, Smith, Levick, Annals Emerg Med Dec 2002  
##ICM 2003  
##Ray AM, Kipias DF, Prehosp Emerg Care 2005 Dec; 9:412-415  
##NHTSA, 49 CFR Parts 571, 572 & 589 Docket no. 92-28; notice 7

## Balance of concerns and risk during transport



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

## “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

## This is happening out there NOW....

### Is a license enough for ambulance drivers?

#### Extent of EMT training questioned by widower

By DAVID DODGE  
[DDodge@journal Sentinel.com](mailto:DDodge@journal Sentinel.com)

Published: Aug. 17, 2005  
 Milwaukee Journal Sentinel, The Aug 1, 2005 by [David Dodge](#)

While sorting out his wife's death in the collision of her car and an ambulance, Theune came across a single sentence he can't forget and wants to change.

"The ambulance shall be driven by an individual with a valid driver's license."

In a chapter of the Wisconsin Administrative Code, between the sections governing all-terrain vehicles and amusement rides, are the laws concerning ambulance service in the state. The part covering drivers reads: Theune explained, "Only a valid driver's license is needed."

"It's no different than someone who delivers pizzas."

The prosecutor who reviewed the circumstances of the collision and recommended that the ambulance driver be indicted for driving too fast for conditions and failure to obey traffic signals agrees with Theune.



Cindy Theune

#### Quotable

“It's no different than someone who delivers pizzas.”

- Gregg Theune, crash victim's husband, on training

## Protective devices/concepts

### In the event of a crash

- ▶ Vehicle crashworthiness
- ▶ Seat/seat belt systems
- ▶ Equipment lock downs
- ▶ Padding
- ▶ Head protection

### To prevent a crash

- ▶ Driver feedback
- ▶ Driver monitoring
- ▶ Driver training
- ▶ Vehicle technologies
- ▶ Tiered dispatch
- ▶ Appropriate policies

## 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

## The 'workplace' IS a vehicle

- ▶ Providers often in vulnerable positions during transport.

- ♦ Bench seat
- ♦ Captains chair
- ♦ Standing or kneeling



Captain's chair  
 Bench Seat  
 Stretcher  
 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

## Crash Prevention

- ▶ EVOC
- ▶ Tiered Dispatch
- ▶ The “Black Box”
- ▶ Intelligent vehicle design
- ▶ Appropriate policy

## The “Black Box”

Driver behavior monitoring and feedback device

EMT Education - Articles

How to modify the risk-taking behaviour of emergency medical services drivers?



How to modify the risk-taking behaviour of emergency medical services drivers?  
De Grosse K, Deroo AF, Calle RA, Vanhaute GA, Bultman WA.  
University Hospital, Department of Emergency Medicine, De Pintelaan 185, B-3000 Ghent, Belgium conclude that for second tier units only a small amount of time is gained by high and an aggressive style of driving. Furthermore, we are convinced that a “black box” is a to modify the risk-taking behaviour of emergency medical services drivers.

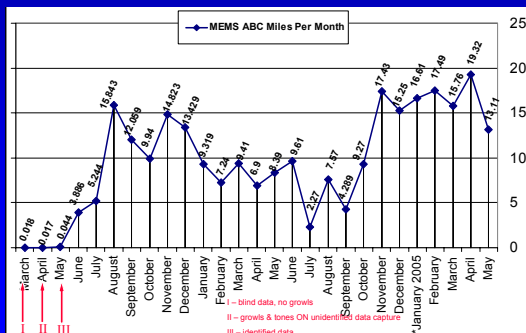
High speed and an aggressive style of driving are major risk factors for serious traffic accidents. Consequently, frontline emergency medical services vehicles have an increased collision risk. In order to reduce this risk, we designed an on-board computer (OBC) to modify the risk-taking behaviour of emergency medical services drivers.



## Purpose of ‘Black box’ Program

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

## MEMS Road Safety Average Between Count Miles 2003/2005



## 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

## Air EMS is a role model for safety initiatives and focus



## Safety Management

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

## USA EMS Risk/Hazards

- ▶ Predictable risks
- ▶ Serious occupational hazard
- ▶ Predictable fatal injuries

## Current and Future Research

- ▶ Epidemiology
- ▶ Ergonomic hazards
- ▶ Bio/Chem/Radiation hazard
- ▶ PPE & Head protection
- ▶ 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

## Pre-impact CTD positioning



## Preparation of test vehicles



## EMS Safety

Policy that Reflects  
SCIENCE

## 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

**PREDICTABLE**  
**PREVENTABLE**  
and  
**NO ACCIDENT**

## Conclusion

- ▶ 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
- ▶ Enhanced cross disciplinary collaboration in development of safety initiatives now exist
- ▶ 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??**

<http://www.objectivesafety.net>

## Acknowledgements

- ▶ EMSC funding –Targeted Issues Grant, PED-SAFE-T
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