The Annual Resuscitation Conference

Loren Marshall Foundation and Anchorage Fire Department
2nd Annual Anchorage Resuscitation Conference
Anchorage, Alaska, June 7-8th, 2008

Ambulance Transport Safety - The Essentials

Nadine Levick, MD MPH
Research Director, EMS Safety Foundation
CEO, Objective Safety
New York, NY

- To quote Steve "Sid" Caesar – Director IHS ES

"We want everyone to get home safely each day"

A tragic emergency health care intervention outcome

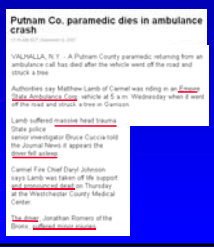
Rollover Crash Kills Medical Technician

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……

… Nov 8th's Fatality



Putnam Co. paramedic dies in ambulance crash

VALHALLA, N.Y. – A Putnam County paramedic returning from an ambulance call has died after the vehicle went off the road and struck a tree

Authorities say Matthew Lamb of Carmel was riding in an Empire State Ambulance Corp. vehicle at 5 a.m. Wednesday when it went off the road and struck a tree in Garrison.

Lamb suffered massive head trauma.

State police senior investigator Bruce Cuccia told the Journal News it appears the driver fell asleep.

Carmel Fire Chief Daryl Johnson says Lamb was taken off life support and pronounced dead on Thursday at the Westchester County Medical Center.

The driver, Jonathan Romero of the Bronx, suffered minor injuries.

Transport Science…

Science behind Policy

- "For successful technology, reality must take precedence over public relations, for Nature cannot be fooled."

Richard P. Feynman 1988

EMS Transport Safety

- 'patient safety'
  AND also
- 'provider' and 'public safety'

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

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

http://www.objectivesafety.net

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?

Outline

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

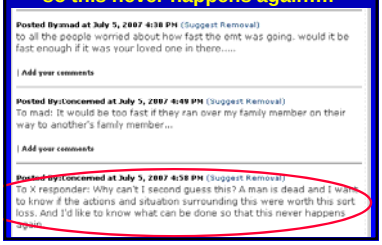
IV. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient transport

Thursday July 5th 2007……

NEWS CENTER

Paramedic Killed In Turner Ambulance Crash

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


Posted By:mad at July 5, 2007 4:38 PM (Suggest Removal)
to all the people worried about how fast the emt was going. would it be fast enough if it was your loved one in there.....

| Add your comments

Posted By:Concerned at July 5, 2007 4:49 PM (Suggest Removal)
To mad: It would be too fast if they ran over my family member on their way to another's family member...

| Add your comments

Posted By:Concerned at July 5, 2007 4:58 PM (Suggest Removal)
To X responder: Why can't I second guess this? A man is dead and I want to know if the actions and situation surrounding this were worth this sort loss. And I'd like to know what can be done so that this never happens again.

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

Five Killed in Crash of Ambulance and Semi

July 21, 2007 08:20 AM EDT

VAN WERT, OHIO (AP) -- The Ohio State Highway Patrol continues to investigate the crash of an ambulance that killed five people Friday night, including three emergency medical technicians. Troopers say the ambulance was broadsided by a semitrailer in Crane Township, about 65 miles southwest of Toledo.

The ambulance, with four Antwerp Emergency Medical Services workers aboard, was taking two victims from an earlier car crash to a hospital. Troopers say it was broadsided by a tractor-trailer at the intersection of County Road 176 and County Road 87. The ambulance then burst into flames.

The Highway Patrol says three EMS workers were killed. They were identified as 64- year-old Sammy Smith, 31-year-old Heidi McDougall and 25-year-old Kelly Ragar. The two patients were also killed. They were identified as 64-year-old Robert Wells 60-year-old Armelda Wells of Hicksville.

Another emergency medical technician, Matt McDougall, and the truck driver, Gerald Chapman, Jr. of Indiana, were both taken to the hospital. It's not yet clear whether they suffered any injuries.

Authorities have not said who had the right of way at the rural intersection nor have they said if the ambulance's emergency siren and lights were turned on.

Antwerp fire chief says, 'They were doing what they loved...'

Lisa Nicely

By LISA NICELY

ANTWERP – They were heroes until the end.

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

"That's one of our worst scenarios when it's one of our own," said Con Shuherk of the Payne Fire Department.

"Everyone is a brotherhood," said Friend. "Everybody looks after everybody."

Randy Shaffer, director of Paulding County Emergency Management Agency, said the accident has had a deep impact.

"It has affected every emergency personnel in the county," he said. "We know it could happen at any time. We read about it in our newsletter. We just don't think it's going to happen to us."

Shaffer said when a call came in that an ambulance was involved in an accident Friday, "I think every squad in the county activated."

April 20, 2008..??

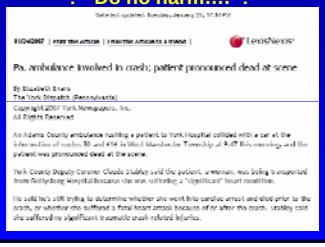
HERALD

State News

Child injured after being struck by ambulance

Springfield boy hit by ambulance dies

An interhospital transport ? “Do no harm….”?



Pa. ambulance involved in crash; patient pronounced dead at scene

By Elizabeth Evans
The York Sunpaper (Pennsylvania)

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An Adams County ambulance hauling a patient to York Hospital collided with a car at the intersection of routes 30 and 494 in Mount Joy Township at 9:47 this morning, and the patient was pronounced dead at the scene.

York County Deputy Coroner Claude Stabley said the patient, a woman, was being transported from Gettysburg Hospital because she was suffering a "significant" heart condition.

He said he's still trying to determine whether she went into cardiac arrest and died prior to the crash, or whether she suffered a fatal heart attack because of or after the crash. Stabley said she suffered no significant traumatic crash related injuries.

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

Drunken ambulance driver killed 2 in car crash - Pennsylvania

A 22-year-old ambulance driver drank before her shift and was impaired when she collided with a car in Marshall, killing two men instantly, Allegheny County District Attorney Stephen A. Zappala Jr. said today.

Shanea Leigh Climo, 22, of Evans City, is charged with two counts of homicide by vehicle and involuntary manslaughter, driving under the influence and several traffic offenses in the Sept. 23 collision at Perry Highway and Brush Creek Road. She was arrested this morning, arraigned and released on her own recognizance, authorities said.

Police said an on-board camera system in the ambulance helped them decide to file charges. The camera allegedly shows the face of the driver, Shanea Climo.

Zappala said Climo was traveling south on Route 19, transporting a patient with a do-not-resuscitate order to UPMC Passavant, when she ran a red light and hit a Chevrolet Cavalier driven by Douglas Stitt. Stitt and a passenger, Phillip Bacon, were killed.

The patient later died, but his death was not believed to be related to the crash, Zappala said.

Firstly!

- An accident ?
- or
  a predictable and preventable event

In a nutshell

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

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??

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 health care 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

Fatalities and funerals

Funeral Services Held For Marble Falls Paramedic

New Information 2007-2008

- Enhanced Safety of Vehicles (ESV), June 2007
- APHA, Nov 2007
- AMD Engineering Public Comments, July 2007
- KKK-F, August 2007
- OSHA September 11, 2007 Federal Register
- SAFETEA-LU, 2006 (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) - State Strategic Highway Safety Plans, October 2007
- American Society Safety Engineers (ASSE), June 2007 - 2008
- EMS Safety Foundation Jan 2008
- NAEMSP Jan 2008
- Transportation Research Board – EMS Safety Subcommittee, Jan 2008
- ICEM 2008
- SAEM Regional New York, New England, April 2008
- RETTmobil May 2008
- International Ergonomists Association (IEA), June 2008
- State EMS Council Policies
- SAE - October 2008
- OSHA EMS best practices late 2008
- Worker visibility Act, to be implemented, Nov 2008

Can no longer say – "I didn't know…."

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

New paradigm - Integration of EMS

- Public health departments
- Social service agencies
- Community outreach
- Hospitals
- Health care networks / Insurers
- Industry

Challenges to Optimizing EMS Transport Safety

- Disparate and fragmented safety infrastructure
- Lack of a centralized EMS Safety oversight or data
- A large number of small groups of end users, with a mix of volunteers and professionals
- Ambulances are hybrid non-standard vehicles, a truck chassis and an after market box or a modified van
- EMS vehicle safety is not integrated as a part of the transport safety industry

1960 to 2007

Some recent adverse outcomes

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

Clinical Care? Occupational Health and Safety…..?

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

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

TIME & PLACE

The Emergency Department (ED)

An ambulance is not an ED /ICU on wheels

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

*FARS/BTS 2005-6

Is it your service's tragic year?

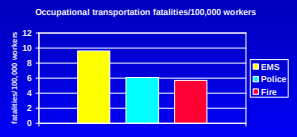
- ~ 50 fatalities a year
- 15,000 EMS services
- Each year one in 300 services experiences a fatality

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 2.5 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#
- 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, Pirrallo RG, Kuhn EM. Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9
**Becker, Zaloshnja, Levick, Li, Miller, Acc Anal Prev 2003
***Maguire, Hunting, Smith, Levick, Annals Emerg Med Dec 2002
##NIOSH, 2002
#Ray AM, Kupas DF, Prehosp Emerg Care 2005 Dec; 9:412-415

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*

'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: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002*

What do ambulance crashes really cost ?

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

June 2007

A problem

2007 Insurance data –

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

- "Ambulance transport has a death toll…. "

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

Nascar Safety Expert

- On ambulance patient compartment

"It is a death vault"

Tom Gideon,
Head of Safety, GM Nascar

Policy makes a difference…

Organizational policy and other factors associated with emergency medical technician seat belt use

"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*

Vehicle Operations Position Statement

Emergency Vehicle Operations

Position Statement

October 2007

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

EMS Transport Safety Strategies - 2006-2007 New York State Strategic Highway Safety Plan

State Strategic Highway Safety Plans

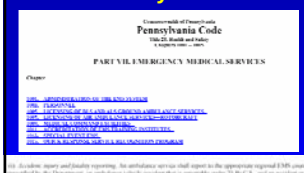
- Required as part of the SAFETEA-LU legislation
  - (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users)
- Effective October 1st 2007
- Focus is the 4 'E's
  - Engineering
  - Education
  - Enforcement
  - Emergency Medical Services
- EMS is a core theme

State SHSP EMS Focus*

STATE SHSP	AREA of EMS FOCUS
New York EMS Section 6 of 43 pages	1. Emergency Medical Services Dispatch Services 2. Emergency Medical Services Partnerships 3. Pre-hospital Training Programs 4. Road Condition and Incident Response 5. EMS Responder Crash Prevention
Montana EMS Section 4 of 36 pages	1. Establish EMS Legislation and Regulation 2. Provide EMS Funding 3. Enhance Capabilities for Medical Response to Disaster 4. Expand EMS Human Resources 5. Enhance EMS Education System 6. Expand EMS Services 7. Facilitate EMS Communications 8. Conduct EMS Public Education and Information Programs 9. Conduct Injury Prevention Public Awareness Efforts 10. Enhance Medical Direction 11. Provide Enhanced Trauma System and Facilities 12. Establish an EMS Information System 13. Evaluate and Monitor EMS Programs
Alabama EMS Section 8 of 47 pages	1. Identify and Analyze Performance Data 2. First Responders 3. Identify Crash Location 4. Statewide assessment and Plan 5. Improve EMS Rural Access

**Cordi H, Levick N, Strategic Highway Safety Plans –Where is EMS?, Jan 2008*

Pennsylvania Code



Commonwealth of Pennsylvania

Pennsylvania Code

Title 25. Health and Safety

PART VII. EMERGENCY MEDICAL SERVICES

Chapter

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

Accident Cost Table

REVENUE NECESSARY TO PAY FOR ACCIDENT LOSSES

THIS TABLE SHOWS THE DOLLARS OF REVENUE REQUIRED TO PAY FOR DIFFERENT AMOUNTS OF COSTS FOR ACCIDENTS

It is necessary for a motor carrier to generate an additional $1,250,000 revenue to pay the cost of a $25,000 accident, assuming an average profit of 2%. The amount of revenue required to pay for losses will vary with the profit margin.

YEARLY ACCIDENT COSTS	PROFIT MARGIN				
	1%	2%	3%	4%	5%
$1,000	100,000	50,000	33,000	25,000	20,000
5,000	500,000	250,000	167,000	125,000	100,000
10,000	1,000,000	500,000	333,000	250,000	200,000
25,000	2,500,000	1,250,000	833,000	625,000	500,000
50,000	5,000,000	2,500,000	1,667,000	1,250,000	1,000,000
100,000	10,000,000	5,000,000	3,333,000	2,500,000	2,000,000
150,000	15,000,000	7,500,000	5,000,000	3,750,000	3,000,000
200,000	20,000,000	10,000,000	6,666,000	5,000,000	4,000,000

REVENUE REQUIRED TO COVER LOSSES

Safety saves time, lives AND money Canada, Nova Scotia

- Since 2000 working towards a goal of zero loss ratio with insurance provider
- 10 million kilometers per year
- 150 emergency response ambulance units
- Collision claim history measured in dollars per 100,000 kilometers traveled:
  - 2000/2001 $ 1725.00
  - 2001/2002 $ 1049.00
  - 2002/2003 $ 751.00
  - 2003/2004 $ 416.00
  - 2004/2005 $ 229.00

Very Scary insurance data

Year	Payroll $million	Modified Premium $1,000	Incurred Indemnity $1,000	Incurred Medical $1,000	Total Claims #
2003	14.1	540	885	9,925	93
2002	12.6	547	266	255	78
2001	11.3	454	88	128	55
2000	10.6	420	63	194	89
1999	10.1	405	115	117	56
1998	9.6	411	13	30	51

Workers Compensation Rate increased by 26.5 %
Was $5.86/$100 payroll in 2005-2006
Now it is $7.41 for 2006-2007

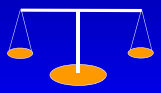
Benefit of Safety

- 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

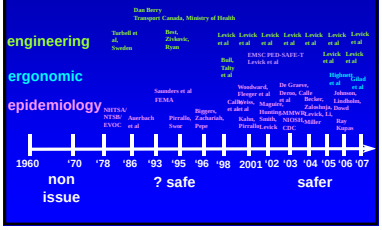


- Response and transport time
- Clinical care provision
- Occupant safety/protection
- Public Safety

Goals

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

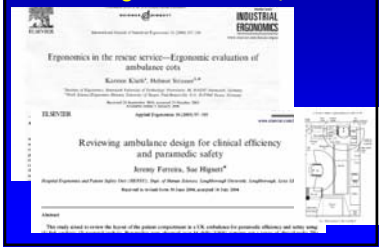
Ambulance Safety Research: A New Field



Priorities…… Research papers in the past 30 years

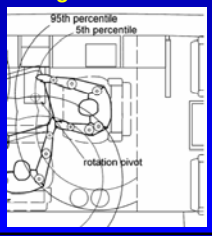
- EMS Safety
  - 40 papers - on ambulance safety
  - 2 papers - on ambulance ergonomics
  - 1 paper – on stretcher ergonomics
- Computer Workstations
  - 30,000 papers – on ergonomics of computer work stations
- Erectile Dysfunction
  - 100,000 papers – on Erectile Dysfunction

EMS Ergonomics 2005, 2006



December 2007 Prof Issachar Gilad

Range of reach



Safety for emergency transport

Policy that reflects SCIENCE

Ambulance Manufacturer Division (AMD) Standards

Public Comment, July 2007

http://www.objectivesafety.net/PublicComment-EMSSF-2007-AMD%20DRAFTStandards001-025.pdf

Engineering Analysis, Jan 2007

http://www.objectivesafety.net/abstracts.htm

ICEM 2008

TRB 2008

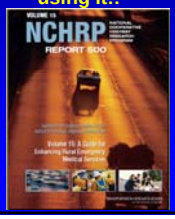
Increasing awareness …

Risk/Hazards

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

EMS Best Practice, Sept 2006

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



It does happen….

But what about head protection?

New EMS helmet prototypes for 2008

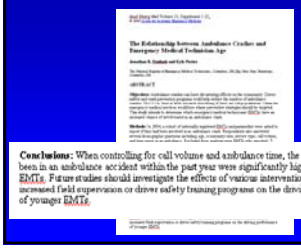
What are the solutions?

- 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

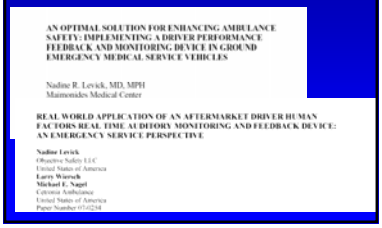


The Relationship between Ambulance Crashes and Emergency Medical Technician Age

Conclusions: When controlling for call volume and ambulance time, the odds of having been in an ambulance accident within the past year were significantly higher for younger EMTs. Future studies should investigate the effects of various interventions such as increased field supervision or driver safety training programs on the driving performance of younger EMTs.

Which is best, how many hours…??

What about changing driver behavior in the real world??



AN OPTIMAL SOLUTION FOR ENHANCING AMBULANCE SAFETY: IMPLEMENTING A DRIVER PERFORMANCE FEEDBACK AND MONITORING DEVICE IN GROUND EMERGENCY MEDICAL SERVICE VEHICLES

Nadine R. Levick, MD, MPH
Maimonides Medical Center

REAL WORLD APPLICATION OF AN AFTERMARKET DRIVER HUMAN FACTORS REAL TIME AUDITORY MONITORING AND FEEDBACK DEVICE: AN EMERGENCY SERVICE PERSPECTIVE

Nadine Levick
Objective Safety LLC
United States of America
Larry Weirsch
Michael E. Nagel
Cetronia Ambulance
United States of America
Paper Number 05-0234

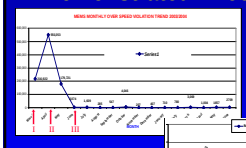
Purpose of 'Feedback box' Program

- 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

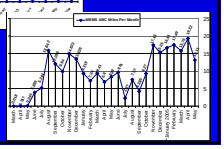
Demonstrated Effectiveness



I – blind data, no growls

II – growls & tones ON unidentified data capture

III – identified data



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
- Administratively burdensome
- 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

And very Predictable…

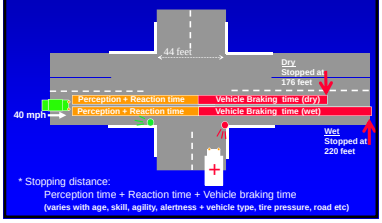
- Intersections are lethal environments

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…..

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)

Dynamic vs. Static

Safety Testing

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 – ie. sled test

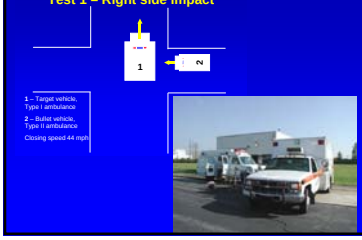
If we know this – and its published…

Levick NR, et al. Development and Application of a Dynamic Testing Procedure for Ambulance Pediatric Restraint Systems, SAE Australasia 1998;58:2:45-51

Why do we do this?

Full Vehicle Crash Testing

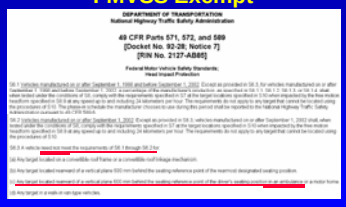
Test 1 – Right side impact



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

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

USA Ambulances: FMVSS Exempt



DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration

49 CFR Parts 571, 572, and 589
[Docket No. 92-28; Notice 7]
[RIN No. 2127-AB86]

Federal Motor Vehicle Safety Standards;
Head Impact Protection

Propaganda that kills…

AMBULANCE MANUFACTURERS DIVISION of
The National Truck Equipment Association

AMD Position Statement on Ambulance Safety and Occupant Protection

Ambulances must comply with some of the strictest safety and performance standards applicable to vehicles in the United States. All motor vehicles operated on public roads and highways must conform to Federal Motor Vehicle Safety Standards (FMVSS) contained in Title 49 of the Code of Federal Regulations Part 571. Ambulances are no exception. FMVSS are the most visible and vigorously enforced safety standards governing the design, engineering and production of such vehicles. Nearly all government purchased ambulances, and the overwhelming majority of those sold to the public, also must be certified to the safety requirements of the Federal Star of Life Specification for Ambulances, KKK-A-1822, promulgated by the federal government. These requirements are in addition to FMVSS.

Occupant protection……?? July 2007

USA ambulance purchase specifications GSA:KKK-A-1822F, Aug 2007

- 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 !!??

No 'a'… then NO 'F' !!!!!

- $F = ma$

where F – force
m – mass
a – acceleration

Sir Isaac Newton (1642-1727), Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy), published in 1687. http://en.wikipedia.org/wiki/Newton's_laws_of_motion

FMVSS exempt……

Most trucks, SUVs do poorly in whiplash test

54 current models - or two-thirds of all the vehicles in the test - fail to adequately protect occupants in rear-end collisions.

July 3 2007: 10:17 AM EDT

NEW YORK (CNNMoney.com) – Two-thirds of pickups, vans and sport-utility vehicles don't provide acceptable protection against whiplash in rear-end collisions, according to tests by the Insurance Institute for Highway Safety (IIHS).

Some 54 models were rated "marginal" or "poor" by the Institute in tests that involved measurements of seats and head restraints and, in some cases, simulated rear-end collisions.

Vehicle seats and head restraints are first measured to determine if the headrest, because of its shape and angle, is likely to provide adequate protection.

IIHS: Top Safety Picks

Seats that are deemed likely to provide good protection are then tested in a simulated crash. The seat is attached to a moving platform that is struck from behind at 20 miles per hour. The Institute then measures impact forces on a crash test dummy riding in the seat.

Twenty-one current models - or 24 percent of those tested - earned the best possible rating of "Good." Twelve models earned an "Acceptable" rating, the second-best rating.

"In stop-and-go commuter traffic, you're more likely to get in a rear-end collision than any other crash type," says IIHS's David Zuby. "It's not a major feat of engineering to design seats and head restraints that afford good protection in these common crashes."

Video

CNN's Greg Hunter reports on the latest testing of seats and head restraints in SUV's.

Sponsored Links

2007 Car Reviews & Quotes
Edmunds.com - Get Free Car Reviews

Its not magic… what is safe is known and understood

NOT new technical data…

Richardson S.A., et al, Int. J. of Crash., 4:3, 239 – 259, 1999

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

The Ride of Your Life….

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 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

NO automotive safety engineer
NO crashworthiness engineer
NO ergonomist
NO reference to ANY existing or relevant automotive safety or crashworthiness technical publications….
yet multiple occupant fatalities and injuries annually….

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

Innovation

Safety concepts out there now

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

The EMS Safety Foundation

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

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
  - TRB 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

TRB Jan. 16th 2008

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 event for EMS innovation
Fulda, Germany
http://www.rettmobil.com/

Australia, Melbourne

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

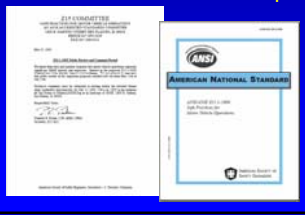
Securing equipment

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

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

News we don't want to see

Jan 22, 2007 6:39 am US/Eastern

Caught On Video: EMT Struck By Car

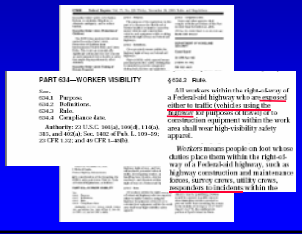
Lou Young
Reporting

(CBS) BRONX The car hit 46 year-old Capt. Steven Quirindongo so violently it smashed the vehicle's windshield and sent him flying through the air.

Quirindongo, a 19-year veteran of the city's emergency medical services, was on the scene of a fire on Riverdale Avenue in the Bronx Sunday afternoon when a civilian car moved past police barricades and caught him from behind. Chief Wayne McPartland was on the scene as the damaged health food store where his men had successfully put out the flames.

"We had two firefighter minor injuries," he told us, "and they were taking care of our men and when he (Quirindongo) was walking back to the ambulance he was struck by the civilian vehicle.

Worker visibility Act: Help is on the way !! November 24th 2008



PART 634—WORKER VISIBILITY

Sec.
634.1 Purpose.
634.2 Reflectors.
634.3 Rule.
634.4 Compliance date.

Authority: 23 U.S.C. 101(a), 109(d), 114(a), 315, and 402(a); Sec. 1402 of Pub. L. 109-59; 23 CFR 1.32; and 49 CFR 1.48(b).

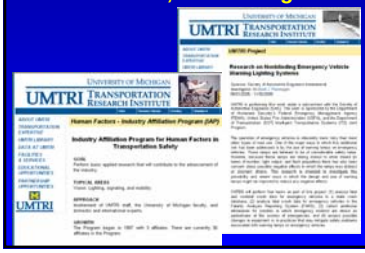
§ 634.3 Rule.

All workers within the right-of-way of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel.

Workers means people on foot whose duties place them within the right-of-way of a Federal-aid highway, such as highway construction and maintenance forces, survey crews, utility crews, responders to incidents within the

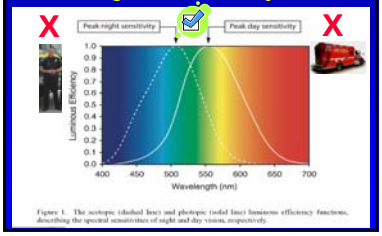
There are grants to assist you..

Science not, next best guess



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

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

March 2007 - FHWA

Tips for Emergency Vehicle Operations

USFA Emergency Vehicle Safety Initiative

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

Coming Soon!
Traffic Incident Management Systems (TIMS)

- USFA report to be released any day
- Research and writing by IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents
- Will be available in a downloadable format

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

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 (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

Be ready for..

- New Infrastructure
- New information
- New collaborations
- New events
- Innovation in safety technologies, strategies and policy
- Knowledge transfer
- Unacceptable mythology
- Challenges to advancing EMS transport safety

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