Welcome to the National Academies, TRB 92nd Annual Meeting
“Deploying Transportation Research - Doing Things Smarter, Better, Faster”

The National Academies
Transportation Research Board (TRB)
EMS Transport Safety ANB10(5)
January 2013 Subcommittee Meeting

Thursday January 17th 8-12.30
at Keck Center Room 101

The TRB and EMS

• TRB Mission:
  To provide leadership in transportation innovation and progress through research and
  information exchange, conducted within a setting that is objective, interdisciplinary,
  and multi-modal.

• Provides service to government, public, and scientific and
  engineering communities.

• TRB Goals:
  – Being prepared for challenges.
  – Conduct and promote knowledge.
  – Provide timely and informed advice.
  – Act as an effective and impartial forum.
  – Promote collaboration.
  – Contribute to the professional development
  – Conduct and promote communications efforts.
  – Contribute to public’s understanding.
  – A resource to the nation and to the transportation community worldwide

What is ANB 10 (5)?

Emergency Medical Services Safety Subcommittee, ANB 10 (5)
– Subcommittee of the Transportation Safety Management Committee ANB 10, of the
  Transportation Research Board of the National Academies

EMS Safety Subcommittee ANB10(5)

• Subcommittee supported by Transportation Safety Management ANB10
• Established July 2007
• First Subcommittee meeting – Jan 2008
• Chair, Nadine Levick MD, MPH
• Co-Chair, Eileen Frazer, RN
• Scope – Medical Transport Safety

Multidisciplinary research

• Encompassing all aspects of transportation
  • The expertise that EMS needs to address its transportation safety challenges includes:
    – Systems design
    – Transport systems safety
    – Human factors
    – Vehicles
    – Vehicle operations
    – Air medical transport safety
    – Impaired operators
    – Road design and egress and access
    – Highway and operational hazards
Fragmentation

- There are now numerous and variably sound or technically sophisticated events occurring sporadically on ambulance safety – none under a transportation umbrella

ANB10 (5) TRB EMS Subcommittee Mission

- 'Bridging the gap between what we do and what is known - Enhancing ambulance transport safety through shared knowledge of technical data'.

Integration

ANB10(5) is an independent platform for:
- Bringing fragmented information together
- Uniting diverse disciplines
- Focus on technically robust information

Safety Systems, Strategies and Solutions Summit Feb 2012
(synopsis to follow at 9.45 am EST)
- ~50 onsite – lead representatives
- Live online participation with international representation
- 7 focus areas and a panel
- >20,000 downloads of presentation handouts
- Multi-Media 'e-document' with 2D etags
- You tube overview

2012 Summit Synopsis on You Tube
http://youtube.googleapis.com/v/avFji06bYcY

http://www.emssafetyfoundation.org/2012TRBSummitAgendaWithLinks.pdf
March 2012 EMSSF TRB Synopsis Webinar
http://www.emssafetyfoundation.org/Recorded2012March15ICTEPWebinarloginInfo.htm

EMS Safety Systems, Strategies and Solutions Summit – February 29th 2012
Synopsis

• TRB 2012 Summit – addressed the key and interdisciplinary applied solutions issues, in one day – please seek that information out. www.objectivesafety.net/TRBSummit2012.htm
• There have been two prior TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise
• See www.trb.org, and for the Summit archives: www.objectivesafety.net/TRBSummit2008.htm
www.objectivesafety.net/TRBSummit2009.htm

Its out there NOW

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Path Forwards

• Disseminate technical information
• Enhance understanding of technical transportation issues
• Facilitate sharing of information as standards are developed
• Interdisciplinary Collaboration
• Support the formulation of a transportation focused research agenda

EMS Safety Systems Strategies and Solutions Summit, February, 29, 2012

• Bridging the gap between what we do and what is known
• Enhancing ambulance transport safety through shared knowledge of technical data
• Open access, all EMS related organizations notified and invited, and beamed live also!

EMS Safety Systems Strategies and Solutions Summit, February, 29, 2012

• How do we measure system safety
• What metrics drive safety decision making
• What are the safety hazards this system faces
• How do we balance the system safety for the patient provider and public
EMS Safety Systems Strategies and Solutions Summit, February 29, 2012

- How much should a medic lift
- What is a safe speed
- How many hours are safe before we are impaired
- How many hours of EVOC makes the system safer
- What are the cost and risk benefits of simulators

EMS Safety Systems Strategies and Solutions Summit, February 29, 2012

- What benchmarks in other industries are relevant to EMS
- What are the determinants of system safety
- What technologies enhance system safety performance
- How do we reach out to all personnel levels
- What strategies work best with reaching out to each generation

EMS Safety Systems Strategies and Solutions Summit, February 29, 2012

- What are global best practice models
- Making it happen
- How can we translate global interdisciplinary best practice initiatives to North American EMS

Making it happen

- How can we translate global interdisciplinary best practice initiatives to North American EMS
Its out there NOW

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National Academies Transportation Research Board
2012 EMS Safety Summit

- One Day event, 30 presentations
- Held in Washington DC, Keck Center
- Simulcast Live to EMS Today
- Live Webinar Access - globally
- Over 100 participants live across 3 continents
- Greater that 10,000 downloads of handouts within the first week!!

 Opening Address – AJ Heightman

Thank you to all our speakers and moderators

The 2012 TRB EMS Safety Summit

- Opening Address: A.J. Heightman
- Safety Developments Update – N. Levick
- Research needs assessment forms explained – E. Frazer
- Data and Recent Initiatives
- Transport, Human Factors - Bridging Diverse Disciplines
- Testing and Standards
- New systems safety technology solutions & telematics
- Fleet management strategies
- Innovative Vehicle Design
- Operationalizing Safety
- Panel: How to optimize the safety of your existing fleet
- Wrap up – from Prof. Art Cooper

Open access, all EMS related organizations notified and invited, and beamed live gratis also!
Smartphone navigation devices

1980’s Then....
And NOW!...

1980’s Then....
And 2009...

Now...

Rules/Policies Addressing Known Hazards
• Federal Motor Carrier Safety Administration (FMCSA)
  – Cell phone use – November 2011
  – Hours of Service – December 2011
New Fleet Operations Standards
- ISO 39001
- ANSI/ASSE Z.15

New Vehicle Standards
- NFPA 1917

New Equipment Mounting Testing Standards
- SAE 2917, 2956

Change and Innovation
- Improved data systems for injury
- Enhanced data on denominator
- New technologies
- New policies/standards
- Interdisciplinary collaboration

New Safety Data
- TRB 2012
- 2011 National EMS Assessment
- 2011 NFPA
- TZD EMS
- NCHRP 17-51
- FARS/MMUCC
- NEMSIS
- BLS

National EMS Assessment
December 2011
NFPA Data Systems Analysis

November 2011

Survey of Occupational Injuries and Illnesses (SOII)—Nonfatal data

- Data obtained from an establishment survey based on OSHA recordkeeping logs.
- National data prior to 2008:
  - Cover private wage and salary workers only
  - Exclude volunteers unless compensated
- Data for 2008 and beyond:
  - Include paid State and local government workers
- Case and demographic characteristics:
  - Available for cases with days away from work only

Number of days away from work among EMTs and paramedics, 2010

<table>
<thead>
<tr>
<th>Days Away from Work</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>10%</td>
</tr>
<tr>
<td>2 days</td>
<td>10%</td>
</tr>
<tr>
<td>3-5 days</td>
<td>16%</td>
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<tr>
<td>6-10 days</td>
<td>14%</td>
</tr>
<tr>
<td>11-20 days</td>
<td>10%</td>
</tr>
<tr>
<td>21-30 days</td>
<td>4%</td>
</tr>
<tr>
<td>31 or more</td>
<td>24%</td>
</tr>
</tbody>
</table>

Total cases = 8,360

Median = 6 days away from work


Contact info

- Website: http://www.bls.gov/iif/home.htm
- Data request telephone: (202) 691-6170
- Data request e-mail: iifstaff@bls.gov
- E-mail: Windau.Janice@bls.gov
Federal Agency Update

- NTSB – www.NTSB.gov
- FEMA - www.FEMA.gov
- DHS/NIST/NIOSH – www.NIST.gov
- NHTSA/NEMSAC - www.EMS.gov
- CDC – www.CDC.gov

EMS SAFETY COURSE
National Association of Emergency Medical Technicians

Course Design

- One-day program
- Interactive lecture, discussion, group activities
- Case studies using real incidents
- 8 hours continuing education credit (CECBEMS)
- Presented in 8 modules

First-year Progress
(Course Rollout @ EMS Today, March 2011)

- 11 State and National Courses conducted
- 214 Local & Regional courses held
- 1,445 EMS Practitioners trained
- 401 Instructors certified
- Active programs in 30 states

Japanese Paramedic Association
Tokyo, Japan
December 17, 2011
NAEMT EMS Safety Course

For more information about the course, including how to find a class in your area or to sponsor a class:

call 1-800-346-2368 (1-800-34NAEMT)

or email info@naemt.org

Culture – “the way we do things around here”
Organizational culture is defined by its mission, vision and values

Organizational Safety Culture: we want a culture that inspires employees and managers to work together to achieve organizational goals and expectations in a cohesive, safe and progressive manner.

Key elements of organizational safety culture:
• I. Informed Culture
• II. Just Culture
• III. Flexible Culture
• IV. Learning Culture

In Summer 2012 – ASHGATE will publish a CAMTS reference entitled:
“Safety and Quality in Medical Transport Systems: Creating an Effective Culture”

Bridging Ergonomics
Operational Task Analysis and Automotive Safety

• Definitions
• Automotive Safety Technology
• The Ambulance Challenge
• Bridging the Gap
• Opportunities

ACTIVE SAFETY
AVOIDS THIS:
Seated and Restrained, But can you get the job done?

BASIC PRINCIPLES:
- Ergonomics
  - Maintain Health (Safety) and Productivity
- Auto Safety
  - Prevent Accidents, Minimize Consequences

BASIC PRINCIPLES:
- Ergonomics
  - Bio Metric Range of Customers
  - Seated when traveling
- Auto Safety
  - Passive Safety
  - Restrain occupants in seats
  - Maintain seat integrity
  - Maintain passenger compartment integrity
  - Minimize deceleration forces
  - Provide crush zones
  - Provide friendly surfaces at impact zones
  - Maintain force levels below injury levels
  - Singular events

BRIDGING the GAP

Bridging Ergonomics, Operational Task Analysis and Automotive Safety

Chris Fitzgerald (Ergonomist)

Task analysis – what people do
- Operational task analysis
  - Defining what people (paramedics) do
  - Develop and test designs that optimize paramedic / patient / equipment placement and performance
- ... in practical terms tasks analysis defines the system
- Can be conducted prospectively for all known or anticipated interactions (you end up with a lot of data)
- Once task behaviours are known design consideration for safety and efficiency can be made and tested
- Task analysis should involve “operators” and represent a true description of what is done

Anthropometry – Body Size
- Who are we designing for?
  - Patients
  - Paramedics and other occupants
  - Need to accommodate full range of the population
  - Gender (to reflect workforce participation rates)
  - Body size
  - Functional task performance and biomechanics
Gender / Body Size

Two Women:
Same Sitting Height (1-D)

Side View 3-D Scans

Images courtesy of Dr Kathleen Robinette
US Airforce

Automotive Safety the basics

• Ergonomics design to occur within the context of automotive occupant safety principles:
  • Forward / rearward facing seats
  • No side facing seats (during transit)
  • Restraint of all persons at all times
  • Restraint of equipment (at least 10 G in all directions + 20 G in forward direction)
• Design challenge:
  • Fitting the users, occupants and equipment
  • Create accessibility to equipment / tasks
  • Retaining these occupant safety principles
  • Ultimately, this requires mobility with the ambulance

Summary

Systems
• Effective application of ergonomics can help to define the system in a meaningful and useful way

Strategies
• Task analysis
• Anthropometry
• Functional task performance / biomechanics
• In the context of inherent automotive safety and occupant protection needs

Solutions
• Creative designs that orient the users and occupants safely, provide mobility within the ambulance while people and objects are restrained.

Information and Technology Transfer

• New Tools
• New Collaborations
• New Platforms
• New Events
• New Organizations
• Webinar, Podcasts, Blogs, Skype and Twitter

Increasing focus

• TRB - ANB10(5)
• RITA/ITS/DOT
• Traffic Records Forum
• DHS/NIST/NIOSH
• TIMS
• ASSE
• SAE
• EMS Safety Foundation

Interdisciplinary Innovation Consortium

EMS Safety Foundation
Innovation, Collaboration & Knowledge for All

www.EMSSafetyFoundation.org
Rettmobil 2011 – May 11-13th

Summary

- Collaboration
  - Interdisciplinary
  - Interagency
  - International

Fleet and Vehicle Standards

- Fleet
  - FMCSA/Exemptions
  - ANSI/ASSE Z.15
  - ISO 39001 – December 2012

- Vehicle
  - AMD
  - KKK
  - NFPA
  - ASTM
  - FMVSS
  - SAE
  - International - CEN/ASA

Federal Motor Carrier Safety Administration - FMCSA

- http://www.fmcsa.dot.gov/

NFPA 1917

SAE Ambulance Equipment mounting testing standards

Frontal Impact SAE 2917, published May 2010
Side Impact SAE 2956, published June 2011
Vehicle Safety Dynamic Testing Types

• Deceleration Sled Tests (not usually a full vehicle) – no intrusion
• Barrier impact tests – intrusion
• Full vehicle to vehicle tests – intrusion
• Computer predictive modeling - must be based on real world injury and vehicle crashworthiness data

International Ambulance Design Safety and Occupant Protection Standards

In existence since 1999

• Australia – ASA
• Europe - CEN

Types of Testing for Ambulance Safety

• A Comparison of Standards and Testing
  – Automotive
  – Medium Truck
  – Ambulance

Ambulance Standards and Testing

• KKK A 1822F: Purchasing Guideline
  – “Minimum Specification and performance parameters”
• AMD-001-025: Manufacturing Guideline
• ASTM F2020-02a: Standard Practice
• NFPA 1917 Standard for Automotive Ambulances: 2013 Edition
  – Soon to be released

Ambulance Standards and Testing

• Interrelated – mostly paraphrasing each other’s requirements
• Self certified

Dispatch Systems, Basic to Cutting Edge

• IT and Communication System
• Direct Relationship to Safe Vehicle Operations
• Community Needs
• Public Safety Integrated Systems
• Reporting Integration
• Instruction Help to Callers
Emergency Use is Predictable, and Increasing Based on an Aging Population

Walk-ins to ED 335 / 1000 Population
EMS Demand 100/1000 Population
Transport 80%

Total use 415 / 1000 Population
17% Walk-ins
73% Transport

Transfer 2%
Admit 17%
Treat/Go 81%

Major Challenges

- Unpredictable Callers
- Time Limitations
- 911 Calls in the Public Domain (should be Privileged and Confidential)
- Call Locating with the Challenge of Mobile Phones
- Can’t use Text, SMS, Twitter…

Solutions

- Call Taking Assistance
- Resource Management to Reduce Time to Response and Get Appropriate Response with Minimal Duplication
- Support for Medical Mgt and Transport
- Training the Community

Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)

Linda D. Dodge
ITS Joint Program Office, US DOT
EMS Subcommittee of the TRB ANB10(5)
EMS Transport Safety Summit
February 29th, 2012

Overview

- USDOT ITS Program Background
- Traffic Incident Management & ITS
- Mobility Program
- NG9-1-1 Status
- R.E.S.C.U.M.E. Status and Plans

ITS Research Program
**Next Generation 911 Initiative**

**Long Term Goal:**
To enable the general public to make a 911 “call” (any real-time communication – voice, text, or video) from any wired, wireless, or Internet Protocol (IP)-based device, to the PSAP, and enable data sharing with the emergency communication network

**Major Milestones:**
- National architecture and high-level design for NG911 System
- Proof of Concept Demonstration
- Transition plan for NG9-1-1 implementation

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**Medavie EMS**

**Island EMS**

**Code 1 Speed Restriction Policy**

- Medavie EMS implemented a policy for its staff that restricted paramedics from drive no more than 10 km over the speed limit during an emergency call except when in four lane 100 series highways were they were permitted to exceed the speed limit by 20 km/h over the posted speed limit.
- One of the main reasons that the policy was implemented was that the evidence showed responding to emergencies with higher speeds meant greater risk, and the time saved was not worth the risk to the staff, patients, and public.

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**The reactions**

Paramedics worried by speed limit

News Media

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**The Arbitration Decision**
Solution?
- Better Communication to stakeholders, staff and members of the public
- Education on the risks of vehicle safety
- System Solutions not just policies
- Time – remember when this was normal?

Impaired/Distracted Driving/
Hours of Service
1. Driver Fitness – background checks and driver selection standards – goal rule out unfit drivers
2. Impairment – not just drugs/alcohol also fatigue and distraction
3. Hours of Service- learn from FRA, TRA & DOT limits
4. Distracted Driving – focus on driving

Distracted Driving
- Distracted driving is any activity that could divert a person’s attention away from the primary task of driving.
- Effects of cell phone use:
  ✓ delays reaction time as if you had .08 blood alcohol concentration,
  ✓ increases crash chances by - 4X for handheld phone & 23X by Texting

Types of Distraction:
- Visual – takes your eyes off road.
- Cognitive - takes your mind off the road
- Manual - takes your hands off the wheel
- Auditory - takes your focus off the road

• Tasks that can be a driving distraction often fit into more than one category.

DOT HOS Rules
- Limits established for on-duty hours
- Establishes minimum levels of off-duty time- 8 hours if on duty less than 12 hours FRA or if over 12 hours then 10 hour off-duty time
- Commercial airline pilot can fly up to 100 hrs/month
- Adopts 60/70 hour weekly maximum for truck drivers, 10 hour off-duty time

Summary
- Systems –
  – Evaluate your level of fleet safety systems in your service for Fatigue Mgmt, Driver Fitness, & Focused Driving
- Strategies –
  – Increase focus on fleet safety to same level as patient and employee safety
- Solutions –
  – Audits, Perception Survey to address behavior change in all levels of organization, Education, & use of Technology
A lot is now possible and for less!

- Driver behavior
- Vehicle behavior
- Roadside ITS
- Fuel consumption/Economics
- Resource modeling

Fleet Management technologies

- ACETech/Ferno
- FleetEyes – Intermedix
- Zoll rescuenet and roadsafety fleet management systems
- Marvlis
- Telematicus
- Optima
- Northrop Grumman

Spectrum of dimensions

- CAD
- Resource allocation
- Fleet performance –
  - Monitoring: System that gives management data of vehicle efficiency and use
  - Feedback: Directly to drivers at the wheel
- Public Alerts

Fleet Safety Solutions

Monthly Driver Reports

- Identifies high risk behaviors
- Provides real time feedback to driver
- Provides reports for employee evaluation

Measuring Our Success at Sunstar Paramedics

- 5 Year Road Safety Report - Unsafe Reverses
Call Details

Summary

Through these technologies:

- We realized dramatic change in our drivers’ attitude toward safety
- We have evidence based data to use for individual driver training and refresher courses
- We are able to identify drivers that fail to align themselves with our mission of safety

Niagara – Acetech Integrated Vehicle Intelligence System

Fully integrated, vehicle performance monitoring and control system with on-board intelligence.

- Safety Systems
- Eco-Run Module Benefits
- Asset Protection Benefits

Safety System (Integrated into AVI)

- Speeding infractions, Unbelted, Unsecured occupants
- Lights and siren compliance
- Create Driver Safety Reports- provide feedback to employees
- Set pre-defined speed limiters

Niagara EMS Decrease in Speeding Infractions

Innovative vehicle technical aspects

- Sprinter Ambulances Provide Safer Environment/Retain Automotive Safety Features
- Forward Facing Seats Critical
- Reach Patients from Belted Position
- Leadership, Communicate, Culture, Vehicle, Accountability
- Science & Data Based
Interiors Based on European and Canadian Specs Which Meet Gov’t Safety Standards

The Motorcycle Medic

Ambulance Sparing

• In almost ¼ (23.5%) of all motorcycle missions ambulance use was avoided!

Nakstad AR, Bjelland B, Sandberg M. Medical emergency motorcycle – is it useful in a Scandinavian Emergency Medical Service? Scand J Trauma Resusc Emerg Med. 2009 17(1)

Integrating Ergonomics, Automotive Safety and Cost Efficiency
“designing medical interiors for optimal safety”

Chris Fitzgerald (EMS Ergonomist)

“Systems” approach

• Incorporation of ergonomics in ambulance design reflects a systems approach
• Accommodation of people, equipment and resources occurs in the context of a range of interactions and a need to establish and maintain minimum safety
• Ergonomics and automotive safety requirements can be use to define the system
• Efficient, safe and functional design should deliver cost efficiencies (vehicle operation, human resources and equipment)
Seating – beside patient

• Forward facing seats only
• Mobility of the seat forward / rearward and sideways (if needed) and stretcher an advantage
• Paramedic restrained
• Paramedic can access equipment and patient during transit while restrained
• Head impact zones avoided or minimised

Seating – at head end of patient

• Forward facing seats only
• Mobility of the seat forward / rearward
• Paramedic restrained
• Paramedic can access equipment and patient during transit while restrained
• Head impact zones avoided or minimized

Summary

Systems
• Effective application of ergonomics can help to define the system in a meaningful and useful way

Strategies
• Consider operational tasks away from the ambulance to ensure equipment is accommodated
• Consider operational tasks and equipment use within the ambulance for design success
• Design within the context of inherent automotive safety and occupant protection needs

Solutions
• Creative designs that orient the users and occupants safely, provide mobility within the ambulance and enable people and objects to be restrained.

Peds and Neonate Transport

• Special population
• Unique challenges
• Potential pitfalls
• Innovative approaches
  – USA
  – Internationally

It is a SYSTEM!

• Child in a vehicle with other occupants and equipment
• Vehicle in a Fleet
• Fleet in a region
Melbourne, Australia Neonatal Ambulance – in transit mode

Pittsburgh, Pediatric Transport Ambulance USA

Oslo and Akershus ambulance service
New Sprinter 319

Safety
• Vehicle
  – All electronic safety systems:
    • A-ESP, ABS, etc.
  – Crashworthiness:
    • Original chassis
    • Seat belt tensioner
  – Internal passive safety
    • Impact zones
    • No sharp edges
    • Securing equipment

User friendly
• All necessary equipment should be reach from the seats without loosing the seat belt

• The stretcher platform can be moved into 3 different positions
What Air Medical Can Teach Us

I. Policies and Practices
II. Learning for Our Mistakes
III. Fatigue Mitigation
IV. Safety Management Systems
V. AMRM

Air Medical Resource Management - AMRM

CRM specific to air crews and includes:
- Communication processes and Decision Behavior
  - Briefings
  - Inquiry/advocacy/assertion
  - Crew self critique
  - Conflict resolution
- Team Building and Maintenance
- Workload management and Situation Awareness

Summary

We can learn from each other: Ground and Air - we are all moving while caring for patients. Safety vigilance for ground is just as important as for air. We need the data for ground incidents and accidents in one strategic location so we can track, trend and analyze as we do for air accidents to mitigate the risks and hazards.

Untapped Opportunities: Resource Utilization

- GPS systems
- Regionalized systems of emergency care and response
- Identification of high risk roadways and intersections
- Mass casualty incident emergency response plans/drills
- Telemedicine: Prehospital/Interfacility

DATA: EMS IS NOT AN ISLAND

- Impact of formally trained emergency medical dispatchers on resource utilization and patient outcomes
- Impact of mandatory restraint use on EMS personnel and patient injury patterns
- Fatalities
- Inclusion of EMS in traffic incident management plans/drills
Relative benefit: Data Sharing Between PSAPs, the Scene, Emergency Response and Hospitals

- Predictors of Injury Severity
- Mobile Apps
- Route selection & guidance

Model Inventory of Emergency Care Elements “MIECE”

Example of how a MIECE color-coded road map might appear:
- Green: High level of emergency care resources
- Yellow: Medium level of emergency care resources
- Red: Low level of emergency care resources

BENEFITS SQUARED

- Improvements to EMS overall as a transportation mode
- Improved outcomes for patients with time-urgent conditions
- Advancements in telemedicine & teletrauma
- Benefits Cubed: Counterbalancing the rural disparity

The Panel

Wrap Up

- What’s old in EMS safety?
  - Inadequate funding (old equipment)
  - Inadequate training (esp volunteers)
  - “We’ve always done it this way”
- What’s new in EMS safety?
  - Exponential growth in teleinformatics
  - Better vehicle, system engineering
  - Increasing awareness, safety culture
Wrap Up

• “Signal” research we can do now
  – Which calls truly need a hot response?
    • High performance simulators may help
  – How much time do L&S really save?
    • Apocryphal California “Yellow cab trial”
  – True cost benefit analysis of L&S use
    • How many lives/dollars are saved/lost?
  – Which patients may be eligible for T&R?
    • Leverage HCP-EMT telecommunications

Summary

• Systems
  – Physical Factors
  – Human Factors
• Strategies
  – Imagination, Innovation
  – Leadership, Followership
• Solutions
  – Vehicles, Ergonomics
  – Informatics, Telematics