The Cutting Edge of Innovation in EMS Transport Safety and You!

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Much of what you shall hear today is thanks to the work of all of those in the:

and the National Academies of Science, Medicine and Engineering
Transportation Research Board's ANB10(5) EMS Safety Subcommittee

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Why are we here today

- 3,402,226 Factories in the country
- 23,090 are Major Accidental Hazard units, employing total 22,12,657 persons
- 25,173 injuries reported in 2014 of which 1,141 were classified as Fatal injuries.
- 4,275 in Indian factories 2010 and 2012 actual numbers could be at least 10 X higher
- EMS can be a safety system role model for the nation

What are we to do today?

- Ambulance safety principles and statistics
- EMS transport safety interdisciplinary and operational issues
- Guidelines and standards distributed by national and international organizations
- Video of ambulance crash testing will highlight important predictable and preventable automotive and occupant risks and outline strategies to enhance safety.
- Safety culture, safety development, personal protective equipment, vehicle design, fleet management, transport systems and policy
- New safety systems and technologies including AI augmented dispatch, fleet telematics and drone integrated systems with a review of what is on the horizon in.

Dr Subroto, 2018 EMS Safety Foundation Leadership Award

Leading Change

What concepts I hope to cover this morning

- Ambulance transport safety "is part of a system"
- Patient safety...and provider and public safety too?
- "It's an unsafe system...why?"
- Issues with Ambulance manufacturing
- Need for measurement for safer performance
- Creating a 'culture of safety' thru awareness, training, design, technology and incentive.

You’re also going to hear about

- Voice activated commands
- Drones
- Vertical take off vehicles
- Fleet mix
- Smart phone technology
- Wireless patient monitoring
- Connected health
- Health Information Exchange (HIE) Applications
- Virtual reality
- Artificial intelligence
Autonomous vehicles and drones

EMS Safety timeline
- Didn’t know it was an issue – 60’s-70’s
- Knew it was an issue – but didn’t really know what to do – 80’s-90’s
- Safety technical data rolls out – past 10 years
- Change and adoption challenges – we are here now

USA EMS transport safety data estimates
- Includes police report data* and estimates based on known data capture deficiencies
- ~ 81,000 vehicles
- upto 9,000 crashes a year
- ~ One fatality each week
  - ~ 2/3 pedestrians or occupants of other car
- ~10 serious injuries each day
  - >50% not ambulance occupants
- Cost estimates > $500 million annually

USA government stats.....
In the absence of a data capture system for EMS safety performance Government estimates can underestimate the situation
EMS work environment!!

<25 mph - A survivable impact??

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

Negative impact on system performance...
- BUT an EMS crash can kill all those involved AND wipe out a rural EMS system AND negatively impact a regions response capacity……

What is a safe speed and how do we identify that?

What is a survivable impact?
- 12 mph (20 km/hr)?
What is a survivable impact?

\[ E = \frac{1}{2}mv^2 \quad v^2 = 2as \]

~ 30 mph – survivable

~ 60 mph – not survivable

A serious problem...

Firstly!

- An accident?
- or
- a predictable and preventable event
Occupant protection......??

Medic Survivors

Medic Fatality

Safety in this vehicle...?

Single vehicle crash
rear compartment fatality

Safety is Good Business

Not just a USA problem

Safety is Good Business

Not just a USA problem

Safety is Good Business
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.

EMS Safety’s frontier -

- the interface of disruptive new tech and operational practice at all levels of the EMS system and across disciplines

So what is safety?
So what is safety?
- condition of being protected against undergoing or causing harm, injury or loss

And.. what is innovation?
- Something new, original and more effective

Emergency Medical Services (EMS)
An important and unique transport system
- Public safety, public health and emergency service
- Is there to save lives

EMS Safety Crisis
"The Chinese word for 'crisis' (危機) is made up of the words 'danger' (危) and 'opportunity' (機)"

Things can go wrong – but when there are sound safety policies and technologies in place, and the system is well prepared, you can minimize harm

EMS Transport Safety
- ‘patient safety’
  AND also
- ‘provider’ and ‘public safety’
  AND very different from the hospital patient safety models
Safety of the...

- Provider
- Public
- Patient

Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

Safety in EMS is INTERDISCIPLINARY

- clinical practice
- public health
- automotive safety
- impact biomechanics
- human factors
- fleet safety

So

- What's important
- What's not important

What's going to save your life
- What might take your life

What's going to hurt you
- What's going to protect you
- What is factual
- What is garbage

- What is new
- What is not new

- Innovation
- Collaboration
- Knowledge transfer

1980’s Then…
And NOW!…

USA 1980’s Then…
And 2018…

Safety challenges to address
- High per vehicle and per mile travelled fatality rates
- Vehicles essentially designed outside of the automotive safety and occupant protection arena
- Exempt from federal commercial fleet safety oversight (FMCSA) and most FMVSS
- Driven by drivers overrepresented in high risk group: under 25 years of age/male
- Dangerous driving practice: Travel at high speed and run red lights
Challenging design related Human Factors

Equipment hard to reach

Interior design exposes EMS to unnecessary automotive and ergonomic hazards

‘Workplace’ Hazards

In the USA there are more safety standards for moving cattle than for moving patients

this vehicle is safety crash tested by automotive experts
Unlike this vehicle

India in many ways is better positioned – and has less obstacles of ‘EMS tradition’
- Already has a very well structured Ambulance Standard
- Ambulance vehicles that are practical and efficient

Rapid integration of innovation

Emergency Medical Service
- What are the transport safety issues that pertain to this important public service and public safety industry?
- What do we know of the risks and hazards and how can we measure these?
- How can the safety of this transport system be optimized?
- What can we learn from and share with our international colleagues
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

The Emergency Department (ED)

An ambulance is not an ED/ICU on wheels

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

Systems safety of:

- Dispatching a vehicle
- Getting you, your patient and equipment to, in and out of the vehicle
- Providing patient care inside the vehicle
- Occupant protection in crash and near miss situations
- Public safety
Safe Systems Approach

**System Design Constraints**

- Do the clinical work that is required and essential
- Not get hurt or killed
- Not hurt or kill anyone else
  
  So...

  - Clinical need
  - Human tolerance of injury

When is it safe to do what...?

- What are your policies???
  - If your patient is pink, warm and talking?
  - Are you required to notify the driver if you are out of your seat belt?
  - Are 'routine procedures' putting you at risk?
This IS a Transportation and Automotive Safety issue

Key elements to transport safety
- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

The Laws of Physics Prevail..

Philosophiae Naturalis Principia Mathematica, July 1687

Safety Performance
- Measurement
- Outcomes
- Technical expertise

Vision Zero
A conscious decision to eliminate death and serious injuries

- Leadership
- Setting up targets
- Knowledge
- Community Engagement
- Economic Analysis
- Clean Forces
- Ethical Imperative
- Safe Systems Approach
- Social Benefits
- Comprehensive Management
Suboptimal design and practices result in bad outcomes for health care delivery and EMS service safety

A tragic emergency health care intervention outcome

Testing the real world

But what about head protection?
And this all takes place in 60 milliseconds – the blink of an eye.

A harness is NOT a solution it will just break your neck at speeds that you would otherwise not have an injury.

PPE from the stationary environment can be highly hazardous in the automotive setting.
**NOT new technical data…**


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

**Beware some provider restraint systems are dangerous**


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

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**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 over both shoulders for side-facing occupants are potentially lethal – and in NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE

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**Optimize the safety of your present environment**

- Wear your seat belts – remove only for critical intervention and notify the driver
- Secure all your equipment effectively
- Minimize use of risky driving practice
- Don’t run red lights!!!

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**Design solutions to minimize provider hazard**

- Optimized design of ambulances so you can reach your patient and equipment without getting out of your seat
  - Forward and rear facing seating
  - A laterally sliding stretcher platform
  - Equipment stored on the curbside wall

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**Ambulance Transport Safety IS Complex AND Multidisciplinary**

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**Transport Safety**

- Transport Safety
- Safety Technology
- Regulations and Standards
- Public Safety
- Driver Protective Equipment
- Transport Policy
- Public Education
- Risk Management
Safety concepts out there now

- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies – ITS
- New platforms for interdisciplinary exchange
- New Safety Standards

Core aspects

- Ambulance transport safety "is part of a system"
- Patient safety...and provider and public safety too!
- New developments and safety initiatives
- Need for measurement for safer performance
- Creating a 'culture of safety' thru awareness, training, design, technology and incentive.

Goals

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

Innovation

Clever innovation can be very simple, yet cost efficient
Malaysian Ambulances

- Modern automotive vans
- No disruption of vehicle integrity
- Clever and data driven interior layout
- Structured system of policy

Sharing new approaches and technologies

Patient Transferring Slides
From Allan’s iphone in Connecticut
Clever knowledge transfer, a game changer from Dlouhy in Europe

The old expensive and not versatile
and the new...
Rapidly and game changing technology and cheaper, better, very versatile

Ambulance Safety Innovation
Design Module 1.0
www.INDEMO.info
the future concepts you can have right now!!!
Better, safer and cheaper
Based on technically sound scientific principles
Big Data and Mobile Health

Chief Rick Lewis – South Metro Fire Rescue

Wearable tech..
http://www.visimobile.com/visi-product-info/

Clever fleet management tools

2020 Transport

Unique regional traffic flow challenges
The ambulance response vehicle of the future?

And even now AED Drones!

Unmanned Ambulance drones

Manned Drones
eHang passenger drone

? The ambulance of the future

First passenger drone makes its debut at CES

Urban Aeronautics – vertical take off drone

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

What do we know works...

- Tiered dispatch
- Vehicle Operations Safety Policies
- Forward and rear facing seating
- Laterally sliding stretcher
- Securing equipment
- Validate/Integrate disruptive technologies
- Fleet management electronic technical devices
- Safety awareness
- Cultural change
Technical Collaboration is key

- We are NOT the experts in this science
- We cannot afford to play the silo game here, it is costing lives, time and money
- We MUST have a meaningful evidenced based approach to design, operations and policy
- We must be outcomes driven

Conclusion

1) Safety must be inherent to operational process design
2) Engagement of appropriate interdisciplinary expertise in systems design, transport safety human factors and safety analysis is essential
3) An understanding of the complex interplay between patient, provider and public safety from a systems perspective and culture is key to addressing effective and safe operational EMS performance.