Ni EMS Conference
March 24th, 2018

The Cutting Edge of Innovation in EMS Transport Safety

and You!

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CEO, Objective Safety, New York, USA
Chair, TRB, EMS Subcommittee, National Academies

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

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

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Your electronic Handout awaits you online at…

- www.objectivesafety.net

This WILL be FAST!!

No need to take any notes – all text slides will be awaiting you in your online Handout

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Your electronic handout link is at the back of the room please collect one

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Your electronic handout/resource link with all text slides

Or if you are > 45 years

www.objectivesafety.net/PDFHO.htm

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http://www.objectivesafety.net

Your Handout and Additional Resources

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Why are we here today

- 3,40,226 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

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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.

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Dr Subroto, 2018 EMS Safety Foundation Leadership Award

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Leading Change

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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.

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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

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Gartners Hype cycle 2013

Gartners Hype cycle 2017

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***

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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

*FARS/GES 2014 - http://www.naemt.org/Files/HealthSafety/2014%20NHTSA%20Ground%20Amublance%20Crash%20Data.pdf

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USA government stats…..

In the absence of a data capture system for EMS safety performance Government estimates can understate the situation

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EMS work environment!!

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<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

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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……

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

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What is a survivable impact ?

IRMRC

12 mph (20 km/hr)?

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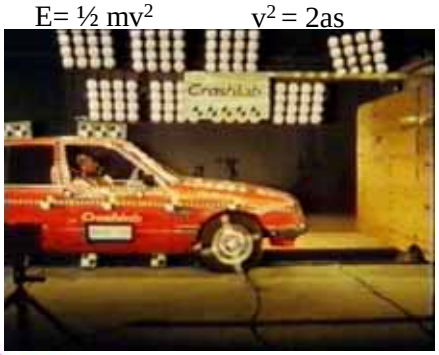
What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$



IRMRC

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What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

~ 30 mph - survivable

IRMRC

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What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

~ 60 mph – not survivable

IRMRC

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A survivable impact??

A serious problem…

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Firstly!

- An accident ?
- or

  a predictable and preventable event

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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

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

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EMS Safety's frontier -

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

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So what is safety?

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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

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Equipment hard to reach

Interior design exposes EMS to unnecessary automotive and ergonomic hazards

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'Workplace' Hazards

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

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this vehicle is safety crash tested by automotive experts

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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

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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

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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

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The Emergency Department (ED)

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An ambulance is not an ED /ICU on wheels

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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

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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

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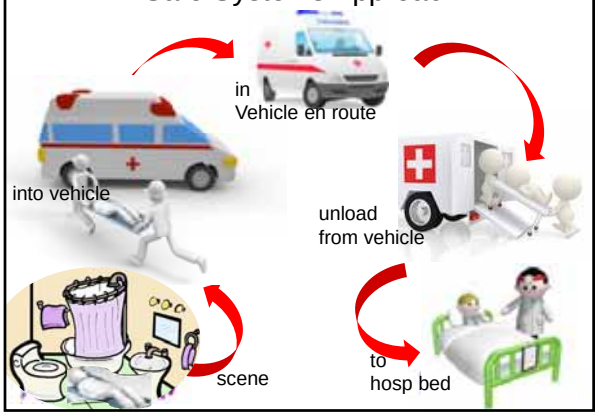
Safe Systems Approach



Safe Systems Approach

Source: Road Safety Branch, Infrastructure and Surface Transport Policy, Department of Infrastructure, Transport, Regional Development and Local Government, Australia.

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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

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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?

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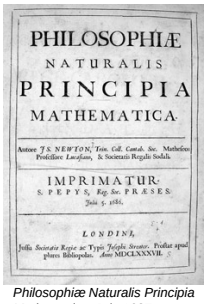
- This IS a Transportation and Automotive Safety issue

- Transport Medicine

Key elements to transport safety

- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

The Laws of Physics Prevail..


PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA
IMPRIMATUR
LONDINI,

Philosophiæ Naturalis Principia Mathematica, July 1687

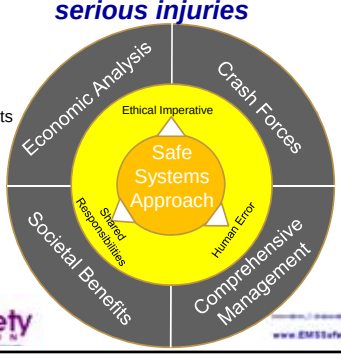
Safety Performance

- Measurement
- Outcomes
- Technical expertise

Vision Zero

A conscious decision to eliminate death and serious injuries

- Leadership
- Setting up targets
- Knowledge
- Community Engagement



Suboptimal design and practices result in bad outcomes for health care delivery and EMS service safety

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A tragic emergency health care intervention outcome

Rollover Crash Kills Medical Technician

Ambulance Runs Off I-66 and Rolls Over, Injuring Two Employees and a Patient

It does happen….

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But what about head protection?

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Testing the real world

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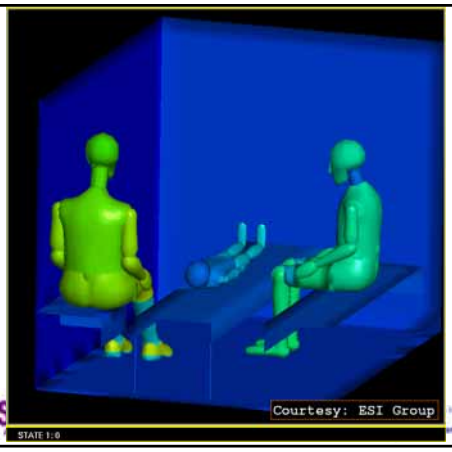
And this all takes place in 60 millisecs – the blink of an eye



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…

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

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Beware some provider restraint systems are dangerous

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

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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 sidefacing occupants are potentially lethal – and in NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE

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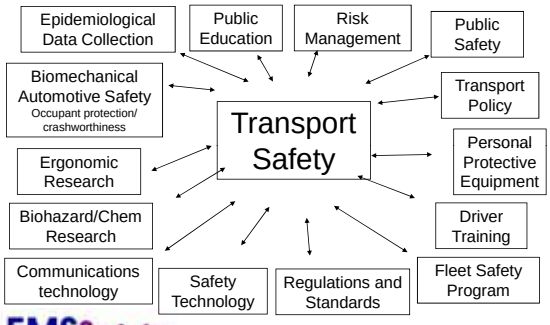
Ambulance Transport Safety IS Complex AND Multidisciplinary



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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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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

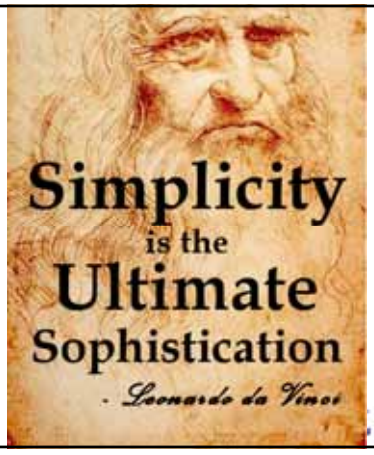
Core aspects

- 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

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http://www.rettmobil.org/index.php/en/

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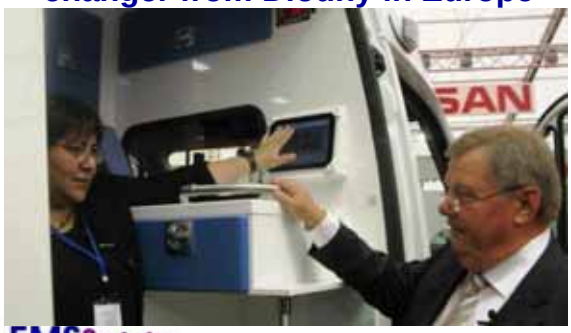
Sharing new approaches and technologies

Patient Transferring Slides

From Allan's iphone in Connecticut

Clever knowledge transfer, a game changer from Dlouhy in Europe



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The old expensive and not versatile

and the new…

Rapidly and game changing technology and cheaper, better, very versatile

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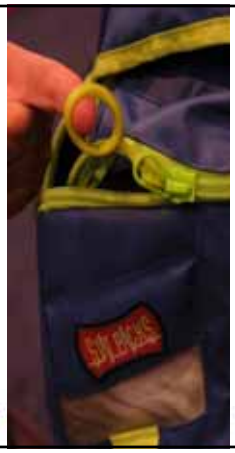

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Ambulance Safety Innovation Design Module 1.0

www.INDEMO.info

the future concepts you can have right now!!!

Better, safer and cheaper

INDEMO 1.0

POWERED BY EMS SAFETY FOUNDATION

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Based on technically sound scientific principles

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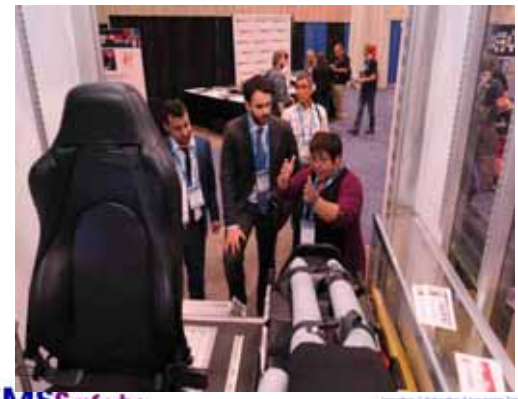
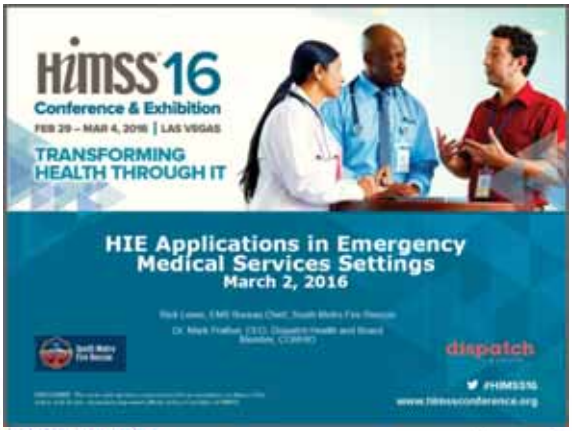


Big Data and Mobile Health



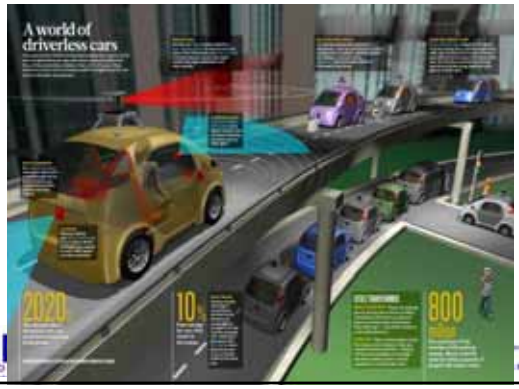
Chief Rick Lewis – South Metro Fire Rescue

Wearable tech..

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

Clever fleet management tools

2020 Transport



Unique regional traffic flow challenges

Regional connected/ autonomous vehicle challenges

AI and EMS Dispatch

www.iRescU.info

Virtual Reality - EMS Education

SAE: Future Vehicles

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The ambulance response vehicle of the future?

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And even now AED Drones!

Ambulance Drone Delivers Defibrillator by Air (VIDEO)

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Unmanned Ambulance drones

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Manned Drones

ogodesign's drone ambulance quickens emergency response

eHang passenger drone

? The ambulance of the future

First passenger drone makes its debut at CES

A Chinese company claimed a world first on Wednesday by unveiling a drone capable of carrying a human passenger.

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Urban Aeronautics – vertical take off drone

startup Urban Aeronautics is developing an unmanned flying ambulance called the "AirMule" that combines the in-and-out agility of a helicopter with the ability to perform rescues in dense urban environments that are difficult to maneuver through in a rotor-based vehicle.

In a post last month, Gizmodo's Andrew Tarantola described the vehicle's capabilities.

The Urban Aeronautics "AirMule."

AirMule drone ambulance makes maiden flight

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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

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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

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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

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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.

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