**Modeling Healthcare Operations III**

**Innovation in Operational Modeling of Ambulance Design - the INDEMO Project**

Nadine Levick, MD MPH  
Research Director, EMS Safety Foundation  
CEO, Objective Safety, New York, NY  
Ronald Rolfsen, University Oslo, Norway, EMSSF  
Chris Fitzgerald, CEO RIMS and Director of Human Factors, EMSSF  

Thanks to:  
and our colleagues of the Innovation Consortium

---

**What is the scope of EMS?**
- Emergency care, public health, public safety and patient transport  
- Bridge between the community and the hospital  
- Volunteer – professional  
- Urban – rural  
- Disaster response  
- Majority of transports NOT critical or life threatening

---

**EMS Transport Surprising FACTS**
- 97% of transports are routine  
- ONLY <3% are life threatening critical  
- 25% of calls NO Patient is TRANSPORTED

---

**We now have**
- Disruptive technologies  
- Design innovation  
- New tools  
- Lean platforms

---

**Why??**
Ambulance Safety design modeling?

---

**Outcomes are of concern**
- EMS operations are identified to be high risk.  
- High fatality rates in vehicle crashes and decelerations  
- High injury rates in patient handling in and around the vehicle.

---

**Some adverse outcomes**

---

**Key EMS Safety Dimensions**
- Safe systems – CRM / transport system safety  
- Risk perception  
- Fleet and operations management  
- Vehicle design safety  
- Occupant protection and ergonomics  
- Scene safety  
- Patient Handling  
- Health and wellness
Vehicle Design Safety
This presentation covers just one aspect of the systems engineering safety approach to addressing the key determinants of the safe operation of an EMS system.

How to design an operational environment where the EMT can safely do the work that is key to improving patient outcomes??

Ask the end user...?
- Well obviously YES – but they are health care providers and are trained to make do with what they have
- They know what they are required to do, and they have wish lists based on their experience – both good and bad

BUT THEY ARE NOT TRAINED IN AUTOMOTIVE OCCUPANT PROTECTION OR HUMAN FACTORS AND ERGONOMICS!
- User involvement is key BUT in combination with technical expertise in those specialist areas

Core safety concepts have been clear for many years now.. And accessible to the industry gratis.. But ignored even in this setting of high morbidity and mortality

Letter to Abe Lincoln – 1864 re: safety of ambulance design

1864 Ambulance Design Patent and diagrams
Almost 150 years ago

The Emergency Department (ED)

An ambulance is not an ED / ICU on wheels
The Laws of Physics Prevail...

Philosophiæ Naturalis Principia Mathematica, July 1687

USA 1980's Then.... And NOW!...

And now almost 40 years later...

Real world crash performance...

Equipment hard to reach

..cutting edge in ambulance safety

Innovation Yes Now...

Europe and Scandinavia
But avoid repeating old mistakes!

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

Key concept re: design of ambulance vehicle interiors
- Involves interrelationship of transportation safety and the human factors and ergonomic aspects for the patient, provider and public

There appeared to be a need for a different tool to engage and educate the end user and to be providing a platform for change within a service/industry

Based on technically sound scientific principles

And what is the loading height of your ambulance??

Size matters.... Less than 27 inches will save your back!!!
the result of the frequency analysis, green dots mark equipment used every time the ambulance is driven, orange is used every day, red every week and so on

Innovation Design Module (INDEMO) 1.0

- A full scale interactive physical model
- Change in ambulance design based on technically sound automotive and ergonomic science
- Improvement potential could be developed, visualized, demonstrated and evaluated.

Vehicle Crashworthiness Performance
Sprinter v Ford Transit crash test
http://www.youtube.com/watch?v=C3kN6WF5vAA&feature=related

this vehicle is safety crash tested by automotive experts

Unlike this vehicle

Vehicle dimension selection was based on automotive safety testing parameters

Interior layout based on integrating pilot task analyses with a range of ergonomic technical data across a spectrum from seating to reach parameters and across body size range.

Integrated Systems Engineering

- System of safety - a central part of the operational process, not a parallel aspect

Process

- Vehicle dimension selection was based on automotive safety testing parameters
- Interior layout based on integrating pilot task analyses with a range of ergonomic technical data across a spectrum from seating to reach parameters and across body size range.
Our initial tools—
from some interdisciplinary, and international collaboration and design input

EMS Safety Foundation
New Ambulance Safety Innovation Design Module
INDEMO 1.0

EMS Safety Foundation
www.EMSsafe.org
Go to the target audience

- Bring the INDEMO 1.0 project to EMS conferences, national and regional
- Install PTZ cameras to share the concept remotely
- Make friends with EMS Media
- Publish in scientific journals
1) safety must be inherent to operational process design
2) engagement of appropriate interdisciplinary expertise in systems design 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.

Your electronic presentation handout/resource link

http://www.objectivesafety.net
Your Handout and Additional Resources

Thank you!
Any Questions??
Electronic handout available online
http://www.objectivesafety.net