Ambulance Patient Compartment Design Standards

NASEMSO
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Agenda

• Project Background
• Overview of Effort
• Impacts to Community
WHEN AMBULANCES CRASH
EMS Provider & Patient Safety

DATA COLLECTED BETWEEN 1992-2011

4,500
vehicle traffic crashes involving an ambulance per year
ESTIMATED ANNUAL AVERAGE

34%
resulted in injuries

33
people killed per year

84%
OF EMS PROVIDERS IN THE PATIENT COMPARTMENT WERE NOT RESTRANDED

ONLY 33%
OF PATIENTS WERE SECURED WITH SHOULDER AND LAP RESTRAINTS

44%
of patients were ejected from the cot in serious crashes

61%
restrained with lateral belts only

38%
shoulder harnesses were available but were not used

SIT DOWN & BUCKLE UP!
Secure Your Patients. They Rely on You!

This safety message brought to you by NHTSA's Office of EMS.

ems.gov
EMS Need

- Inherent conflict between need to care for patient and personal safety while in moving ambulance
- High injury risk to both EMS worker and patient during accidents
- Recognized need for better patient compartment design with respect to EMS performance and safety
- Lack of data-based standards that address human performance and safety
Project Goal

Goal: Provide foundation for a uniform standard for ambulance design and construction based on scientific data.

Address
- Worker performance, ergonomics
- Worker and patient safety

Deliverables
- Input to Standards Organizations & Design Guidebook
Project Partners and Roles

• Duration: April 2011 – September 2014
• Partners:
  – Department of Homeland Security (DHS) Science & Technology (S&T) Resilient Systems Division (RSD) and First Responders Group (FRG): Sponsor
  – BMT Designers & Planners (D&P): Human factors design requirements, concepts for user interfaces, compartment arrangement and layout
  – National Institute of Standards & Technology (NIST): Requirements analysis and developing/evaluating design concepts through modeling and simulation
  – National Institute for Occupational Safety and Health (NIOSH): Developing and testing concepts for ambulance crashworthiness
Requirements Gathering

**User Research**
- Literature survey
- Ride-alongs
- Interviews
- Standards gap analysis

**Focus Groups**
- Manufacturers
- Practitioners

**Nationwide Web Survey**
- 2537 EMS Workers, Trainers

**Workshop**
- Practitioners
- Practitioner Organizations
- Government Agencies

**Issues for focus group moderator guide**

**Inform survey questions**

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**Initial design requirements**

**Validate survey results, prioritize requirements**
Key Human Performance Requirements

• The EMS provider shall be able to reach the patient’s body from head to knee while in a seated and restrained position.

• The EMS provider shall be able to reach common and critical equipment/supplies from a seated and restrained position.

• The EMS provider is able to face and interact with the patient while in a seated and restrained position.
Design Needs

• Seating
  – Easily access the monitor and controls
  – Easily access equipment, supplies, and medicines
  – Enable seat positioning to provide adequate eye contact with the patient
  – Ride and perform all tasks in “ergonomically safe” manner

• Restraint systems
  – Buckle and unbuckle easily
  – Access patient while remaining restrained
  – Access monitor, equipment, and medicine while restrained
  – Perform patient care safely while restrained

• Working environment
  – Transport and care for more than one patient
  – Allow appropriate lighting
  – Allow appropriate communication
  – Have enough power for equipment
  – Secure equipment while keeping them accessible
  – Have enough working room
  – Safe and easy access and egress
  – Avoid sharp edges and corners
Conceptual Design – Not the Standard
Roadside Seat
Curbside Seat
Computer Simulation Analysis

- Create virtual model of new design concepts
- Virtual human models replicate patient care tasks
- Used 5% female through 95% male mannequins
- Benefits
  - Eliminates the need to construct physical prototypes
  - Allows for the evaluation of many design concepts faster, cheaper
Modeling with Mannequins
Key Human Performance Requirements

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These items are the foundations of many of the items incorporated into new and existing standards.
Standards – you have choices!

Over 30 states currently adopt the GSA KKK-A-1822 purchase specification.

In the near future, each state will need to determine what standard they will adopt for ambulance design.

Please do your homework and determine what is most appropriate for your state.

SAE Standards (J3044/J2956/J2917/J3026/J3027/J3043 – covers seating, cots and equipment)
Ambulance Design Guidebook

- Ambulance Design Guidebook covers best practices, recommendations, and ergonomics.
  - Available at DHS site – www.firstresponder.gov
  - Intended to be a practitioner guide/tool and not a standard
  - Covers steps to take to develop design requirements
  - Also addresses some best practices or recommendations in the following areas:
    - Equipment layout and workflow
    - Lighting, noise, HVAC
    - Storage
    - Ingress/egress (patient and EMS worker)
    - Labeling
    - Communications and information technology
    - Restraints and seating
    - Surfaces and materials (incl. decontamination)
Understand the entire ambulance

- Who are users?
- What tasks will be performed?
- Design for most frequent and critical patient care scenarios
- Design total system and not just part of the system (e.g., look at how entire compartment comes together not just seats)
- Keep design simple, incorporate features that are required for a task
- Do a trade-off analysis (human performance/technology/costs)
- Design to minimize training requirements
- Design to reduce human errors
- Standardize the design as much as possible
- Consider the size of your providers
  - how much space is needed
  - how they will reach patients/supplies/equipment
Questions to ask when designing an Ambulance

• How many runs a year?
• Types of runs?
• # of patients typically transported?
• Supplies typically used?

Helpful Tips

• Mock up a workstation in an empty office
• Use boxes/tables/chairs – draw general concept
• Measure your equipment/supplies
• Look at other services and ask questions
NIST and NASEMSO…the partnership continues

- NIST awarded a 12 month grant to NASEMSO
- Compile all documents/resources related to ambulance design on one site
- One-stop-shop for resources and will aid in your decision of standards adoption
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Questions?