Naturalistic safety evaluation of a medic’s work environment during rural emergency response

Primary Investigator
Laura Stanley, PhD, CPE
Assistant Professor, Mechanical & Industrial Engineering Department
Montana State University – Bozeman
laura.stanley@ie.montana.edu

External Project
Robin Kline
USDOT/Research and Innovative Technologies Administration, Office of Research, Development, & Technology

Project Objectives
Biomechanical/Ergonomic Assessment

Increase medic and public safety through collection and analysis of data associated with emergency medical care providers during transport, specifically:

1. Determine the rate of restraint use by EMS workers.
2. Determine significant causes leading to medics being unrestrained.
3. Identify medic activities and physical hardships imposed by their equipment or procedures.
4. Determine biomechanical forces experienced by medics during patient transport.
5. Identify factors which influence ambulance travel in emergency mode.
Data Collection

Video of rear patient compartment while in motion:
- Medic posture
- Reach analysis
- Medic position
- Restraint behaviors
- Patient care patterns

Example Vehicle Data:
- Velocity
- GPS position
- G-force
- Other data:
  - EMS call logs
  - EMS patient care records
  - Focus groups
- Accelerometer data:
  - Peak forces
  - RMS acceleration
  - Crest factors

Preliminary Results

- **Restraint usage:** average of 2.6% time restrained per trip.
  - Self-reported restraint rates: a median of 10% restraint rates in the rear, median of 100% restraint usage in the front.

- **Reach analysis:** 20 unique reaches identified - reaches were from bench seat to: the electrical panel (23% of reaches), shelving on opposite wall (20%), pass through window to driver (10%), and linen/blankets storage (9%)
  - Longest repeated reach was toward the pass-through window to communicate with driver (18.7s average).

- **Vibration Exposure:** Does not violate ISO STD 2361 health guidance caution thresholds.
  - Comfort is in the “fairly uncomfortable” range, which can affect efficacy of patient care in procedures requiring fine motor control (intubation, IV sticks)
Rural EMS Worker Restraint Usage and Feasibility in Emergency Response Vehicles

By Tawny Hoyt1, Dr. Laura Stanley1, Nels Sanddal2, and Teri Sanddal2

Western Transportation Institute – Montana State University Bozeman and Critical Illness and Trauma Foundation, Bozeman, MT

Objective
This study observed EMS worker restraint usage feasibility while performing the most common patient care procedures in an ambulance. The primary cause of transportation-related fatalities among EMS workers is ejection from the ambulance (3). Ejection associated with an EMS worker’s 4 times higher than that of the general public. Sixty percent of the fatality rate 1. Of these fatalities, 74% of them are transportation related. Thus, a need exists for improved and feasible restraint systems. Methods
A Pareto analysis was conducted to determine restraint feasibility during transport situations. This was used to understand the common procedures in transport situations. This analysis was conducted inside a Ford F-150 model ambulance. Results
A reach envelope was created for each of the common procedures in transport situations. The envelops were then laid over the overhead drawing of the ambulance to assess restraint feasibility. The software used was AutoCAD 2007, which is a computer aided drawings program. A Pareto analysis was conducted inside a Ford F-150 model ambulance. Analysis was conducted inside a Ford F-150 model ambulance. Feasibility varies by population percentile. So why are medics riding unrestrained during emergency transport situations? Medical reports the inability to access patient and provide proper care as the primary reason; in this way it is the procedures that are required of the EMS worker. Procedures may cause them to ride unrestrained. Only wear on rides

Current Work

- Publications to follow
- Redesign and Policy Recommendations
- Industrial Engineering Graduate Students Competition
  “Improving restraint feasibility through ambulance layout redesign”

Student Safety Technology Design Competition 2011
22nd International Technical Conference on the Enhanced Safety of Vehicles
June 13th-16th, 2011, Washington, DC