Developing Fatigue Risk Management Guidelines in EMS
Background

- NHTSA Office of Behavioral Safety Research
- **Contract Number DTNH2215C00029**
  - [www.regulations.gov](http://www.regulations.gov)
- **Docket No. NHTSA-2015-0121**
Our project management team

National Association of State EMS Officials
- Dia Gainor and Kathy Robinson

University of Pittsburgh
- Daniel Patterson – Principal Investigator

INSTITUTES FOR BEHAVIOR RESOURCES, INC.
- Steve Hursh, Francine James, Lauren Waggoner

- Financial & Overall Project Management
- Meeting organization
- Dissemination
- EBG Creation Process Management
- Research Project Management
- Dissemination
- Optional Task: Biomathematical model of EMS fatigue & personnel scheduling tool
The National Association of State EMS Officials is the lead national organization for EMS, a respected voice for national EMS policy with comprehensive concern and commitment for the development of effective, integrated, community-based, universal and consistent EMS systems. Its members are the leaders of their state and territory EMS systems.

The University of Pittsburgh Medical Center (UPMC) is a non-profit organization and the largest non-governmental employer in Pennsylvania, operating more than 20 academic, community, and specialty hospitals. Its Department of Emergency Medicine and Center of Emergency Medicine of Western PA have received nationwide recognition for emergency medicine work in research, education, critical care transport, and clinical care.
Fatigue Management Programs

- Robust fatigue management programs and hours-of-service rules in many industries
  - Aviation
  - Rail
  - Motor Carriers

- Other industries working on issue
  - Transit (metro, busses)
  - Medicine (residents, nurses)
  - Mining
  - Oil
14 CFR part 117, § 117.7.

(a) No certificate holder may exceed any provision of this part unless approved by the FAA under a Fatigue Risk Management System that provides at least an equivalent level of safety against fatigue-related accidents or incidents as the other provisions of this part.

(b) The Fatigue Risk Management System must include:

1. A fatigue risk management policy.
2. An education and awareness training program.
3. A fatigue reporting system.
4. A system for monitoring flightcrew fatigue.
5. An incident reporting process.
Background – Do we need one in EMS?

Study Examines Effects of Sleep Deprivation on Shift Work

Medical professionals are beginning to call fatigue the number one problem in our field.

Study: Medics’ fatigue linked to higher injury rates

In the survey sample, more than half of the respondents were classified as fatigued.

Fatigue a factor in ambulance accident in Manitoba - Canada

Ambulance driver fatigue a danger

Distractions pose risks to patients, EMTs, traffic

By Lisa Zagaroli, and April Taylor / Detroit News Washington Bureau
Monday, January 27, 2003

Emergency medical technician Anne Lamberson thought she was doing her job when she got a priority dispatch, stepped on the ambulance’s accelerator and tried to make it to the scene as quickly as she could.

State Coroner: fatigue a factor in administering wrong drug

- In 2007 Coroner Peter White reported that while attempting to resuscitate a 78 year-old male cardiac patient a paramedic accidentally administered morphine instead of adrenaline.
- The Coroner said fatigue was a factor. “I am satisfied that both officers were affected by fatigue at the time of these incidents and that resulting error is always a possibility in such circumstances.”
- A positive outcome was unlikely but “the possibility that resuscitation may have been more effective given appropriate treatment cannot be excluded.”

Safer Drivers. Safer Cars. Safer Roads.
Greater than half report fatigue at work
Half get less than 6-hours sleep per day
Greater than half report poor sleep quality
Greater than 1/3rd report excessive daytime sleepiness
Half report poor to moderate recovery between scheduled shifts

Patterson et al, 2015 (recovery); Patterson et al; 2015 (textbook); Pirrallo et al, 2012
Fatigue linked to safety in EMS

FIGURE 2: Crude and cluster/confounding-adjusted odds of safety outcomes associated with poor sleep and fatigue. Adjusted odds ratios (ORs) are from Table 3. These ORs were adjusted for clustering within agencies and confounding. AE = adverse event; CI = confidence interval.

Patterson et al, 2012; PMID 22023164
Shiftwork linked to Safety

An observational study of shift length, crew familiarity, and occupational injury and illness in emergency medical services workers

Matthew D Weaver,1,2,3 P Daniel Patterson,4 Anthony Fabio,5 Charity G Moore,6 Matthew S Freiberg,7 Thomas J Songer2

Figure 4. Number of shifts of a given length needed to observe harm

Number Needed to Harm (NNH)
Calculation involves:
1: Incidence in exposed
2: Incidence unexposed
3: Relative risk
4: Attributable risk
5: Inverse of AR
Equals # of shifts needed before observing an injury

Findings Under Peer-Review as of May 2015.
Citation: Weaver MD, Patterson PD, Fabio A, Moore CG, Freiberg MS, Songer TJ. An observational study of shift length, crew familiarity, and occupational injury and illness in emergency medical services workers. (UNDER PEER REVIEW)
Outcomes expected

- National EMS Stakeholder Meeting
- **EBG Expert Panel and Research Questions**
- Letter Report
- Literature Review
- Evidence Table
- EBG Development
- Performance Measures
- Dissemination
- Experimental Study
- Biomathematical Scheduling Tool
Forming the Expert Panel

- Inclusive of academics/researchers, clinicians, EMS administrators, as well as fatigue and sleep scientists

  - Panel charged with:
    1. Developing questions to guide the literature review
    2. Reviewing synthesis of literature provided by research team
    3. Reviewing draft recommendations offered by research team
    4. Rating relevancy and clarity of draft recommendations
    5. Rating relevancy, clarity, and feasibility of draft performance measures proposed by research team

- The GRADE Methodologist (Dr. Eddy Lang)
  - Will educate/train the research team and panel in use of GRADE methodology (so all are on the same page)
Creating the guidelines

• First Meeting of Panel - APRIL 26-27, 2016 at DOT HQ
  – Defining questions that guide literature review

• Second Meeting of Panel
  – Review synthesis of findings by research team
  – Review / help edit draft recommendations by research team
  – Review / help edit draft performance measures proposed by the research team (rate relevancy, clarity, and feasibility)
Why the GRADE methodology?

- Used previously for numerous EMS/emergency medicine topics
- Accepted, recognized, adopted by the EMS industry
Why the GRADE methodology?

- The GRADE process uses a formalized, transparent, and reproducible system to assess level of evidence to specific questions.
- Results in clear, executable recommendations designated as either strong or weak.
- Makes clear separation between quality of evidence and strength of recommendations
  - (for example: quality of evidence may be weak, but benefits of a recommendation may far out weigh risk, thus an expert panel may offer a strong recommendation).
Literature Review & Evidence Table Creation

- Guided by questions from expert panel
- We will use established methods for reviewing and rating quality of literature (i.e., GRADE methodology)

GRADE: an emerging consensus on rating quality of evidence and strength of recommendations

Guidelines are inconsistent in how they rate the quality of evidence and the strength of recommendations. This article explores the advantages of the GRADE system, which is increasingly being adopted by organisations worldwide.
Creating the guidelines

- What will the guidelines look like?
- How can they be used and by whom?

### A clinical example:

**How best to treat seizure patients?**

**Treat hypoglycemia?**

**How should we administer medication?**

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<table>
<thead>
<tr>
<th>Original PICO Question</th>
<th>Derivative PICO Question</th>
<th>Recommendations</th>
<th>Evidence Quality</th>
<th>Recommendation Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>In patients &lt;18 years of age who are actively seizing in the prehospital setting...?</td>
<td>In patients &lt;18 years of age who are actively seizing in the prehospital setting...?</td>
<td>We suggest that children with convulsive status epilepticus in the prehospital setting should have glucometry performed to assess for hypoglycemia, especially if they have diabetes.</td>
<td>Very Low</td>
<td>Weak</td>
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<tr>
<td>PROCEDURES</td>
<td>Glucometry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does glucometry or empiric glucose administration facilitate rapid resolution of seizures while minimizing adverse events?</td>
<td>Should glucometry be performed on all patients?</td>
<td>We suggest that children with prehospital seizures should have capillary blood glucose checked; a venous check would be a less preferred alternative to assess for hypoglycemia.</td>
<td>Low</td>
<td>Weak</td>
</tr>
<tr>
<td>If glucometry is performed, does a capillary or venous specimen yield more accurate results?</td>
<td>We recommend that children with prehospital hypoglycemia should be treated with either Intravenous (IV) dextrose or Intramuscular (IM) glucagon.</td>
<td>Low</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>What are the most effective drug and route to treat seizures due to hypoglycemia?</td>
<td>Should patients who have been successfully treated for hypoglycemic seizures be transported to the hospital?</td>
<td>We suggest that patients found to be hypoglycemic in the prehospital setting should be transported, regardless of whether they return to baseline mental status after treatment.</td>
<td>Low</td>
<td>Weak</td>
</tr>
</tbody>
</table>
Creating the performance measures

• Research team will produce draft performance measures
  – Expert panel will review and rate the relevancy, clarity, and feasibility of each measure proposed
  – Edits made where necessary – followed by additional ratings of relevancy, clarity, and feasibility – to gain and quantify consensus

• We will develop measures
  – with consideration to what data may already be available / collected by EMS systems
  – creating standardization – thus opportunities for comparisons across systems

• What can we or others do with them
  – Evaluate effectiveness/impact of FRMPs
Public input welcome

- **Emerging themes**
  - Reliance on overtime hours & multiple jobs
  - Preference for extended shifts thus extended time off
  - UHU
  - Work intensity
    - Time on task
  - Affect on rural areas
Dissemination

- Identify national conferences for presentation
- Targeted press releases and webinars:
  - State EMS Offices
  - National EMS Organizations
  - EMS Stakeholders
  - EMS Agencies
  - Consumers
- Article(s) for trade publication
- Produce pamphlet for wide distribution
Optional Task 2: Evaluation Study

- Test n=1 or more EBGs from main task for intervention

- Measures of potential interest
  - Point prevalence of fatigue
  - Sleep health / quality over time
  - Inter-shift recovery
  - Safety Culture
  - Work-related injury
  - (Performance Measures from EBG/Performance Measure process)
Optional Task 3 – Biomathematical Model

- **Goals**
  - Sample sleep patterns of EMS clinicians to customize sleep inputs to model-based analyses
  - Validate a biomathematical model for use in scheduled EMS operations
  - Develop a model-based tool to assist personnel managing fatigue risk associated with scheduled EMS operations
## Milestones and Deliverables Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>1-6 months</th>
<th>6-12 months</th>
<th>12-18 months</th>
<th>18-24 months</th>
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<tbody>
<tr>
<td>C.3.2</td>
<td>Revise Work Plan</td>
<td>Meeting: EBG Panel</td>
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<tr>
<td>C.3.3</td>
<td>Letter Report</td>
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<td>C.3.4</td>
<td>Literature Review</td>
<td>Evidence Table</td>
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<td>C.3.5</td>
<td>Meeting: Guidelines Panel</td>
<td>Letter Report</td>
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<td>C.3.6</td>
<td>Performance Measures</td>
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<td>C.3.7</td>
<td>Draft Report</td>
<td></td>
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<tr>
<td>C.3.8</td>
<td>Final Report</td>
<td>Briefing-DOT</td>
<td>Dissemination</td>
<td></td>
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</table>
EMS Expert Panel

- David Becker (Fire-Based EMS)
- Daniel Buysee, MD (Sleep Scientist)
- Bradley Dean (Paramedic)
- Dennis Eisnach (Consumer Representative)
- Frank Guyette, MD (Air Medical Physician Director)
- J. Stephen Higgins, PhD (NHTSA)
- Douglas Kupas, MD (EMS Physician and Researcher)
- George Lindbeck, MD (State EMS Medical Director)
- P. Daniel Patterson, PhD NRP, Principal Investigator
- Josef Penner (EMS Agency Director)
- Ron Thackery (EMS Risk Manager)
- Hans VonDongen PhD (Transportation Safety)
- John Violanti PhD (Sleep Scientist)
Complete Project Team

- Steve Higgins, PhD – NHTSA
- Dia Gainor – NASEMSO
- Kathy Robinson – NASEMSO
- Daniel Patterson, PhD – UPMC Principal Investigator
- Charity Moore, PhD – Statistician
- Caroline Axthelm – Medical Librarian
- Jon Studnek, PhD, NRP – Carolinas / MEDIC
- Allison Infinger, MSPH – Carolinas / MEDIC
- Laura Barger, PhD – Harvard
- Eddy Lang, MD – University of Calgary
- Christian Martin-Gill, MD -- Prehospital Guidelines Consortium
- Steve Hursh, PhD – Institute for Behavior Resources, Inc.
- Francine James, PhD – Institute for Behavior Resources, Inc.
- Lauren Waggoner, PhD – Institute for Behavior Resources, Inc.