**Disasters & Impact of Sleep Quality & Quantity on National Guard Medical Personnel**

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**ABSTRACT**

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Disasters & Impact of Sleep Quality & Quantity on National Guard Medical Personnel

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The voluntary, fully informed consent of the subjects used in this research was obtained by 32 CFR 219 and DODI 3216.02_AFI40-402
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Sleep-The HOT Topic

Navy Seeks Better Sleep For Crews With New Rest Guidelines, Special Glasses

Headlines from Army News Releases (October -December 2017)
Sleep deprivation countermeasures
Even with good habits, I still cannot sleep
Managing sleep & shift work

AARP Bulletin
Can’t Sleep? Join the crowd:
1/3 of Americans over 65 have trouble reaching the land of nod
Learning Objectives

- Participants will be able to compare methods of data collection for sleep studies.
- Participants will be able to discuss sleep research and the resulting implications for measuring operational performance.
- Participants will be able to recommend three strategies for nurse leaders and commanders for improving sleep hygiene.

Problem

- Sleep research
  - National guard personnel (more specifically, medical personnel) generally have civilian employment with potential for variable work shifts. Weekend UTA requirements are 0700-1600; but disaster response training can be 24/7 or at minimum of 12-18+ hour requirements. Very little transition time when responding to real-world disasters.
  - Measuring sleep, sleepiness and decision-making in the field
  - Limiting disruption of military training mission
  - Selecting appropriate critical skills assessment modality
Overview of Sleep Study Research with Air National Guard Medical Personnel

Disaster response mission
Goal: to evaluate, describe sleep health of medical personnel who have civilian jobs and perform military roles in National Guard.

Overview of sleep study
• Pilot study of critical skills and proxies (BSN and DNP students) for military medics and medical personnel (RNs, PAs, NPs, MDs, Pharmacists, CRNAs)
• Recruitment from base 1
• Completion of Rand self-reported sleep survey
• Wearing of Readiband to record actigraphy data
• Sending critical skills questions and KSS (sleepiness) question 4 times/day
• Recruitment from base 2
• Repeated measures

Background
• Sleep is critically important for human functioning
• Chronic sleep loss can cause long-term health problems
• Acute sleep loss impairs cognitive performance (errors, accidents etc.)
• National Guard medical personnel are required to respond to disasters that could severely restrict their sleep
• A better understanding of the extent and nature of sleep restriction during disaster preparedness exercises will guide interventions that protect our service members and civilians
Lessons from Sleep Science

• Sleep is a fundamental and basic human need
• Sleep loss interferes with our ability to deal with complex, stressful situations
• Fatigue impairs cognitive functioning, narrows perception, increases hostility, and elevates anxiety
• Medical errors are currently the third leading cause of death in the US
• Fatigue contributes to 70% of errors
• Interventions are critical

Purpose

Aim 1: Estimate the extent of sleep restriction, deprivation, and fragmentation on National Guard members participating in disaster training.

Aim 2: Assess the impact of sleep restriction, deprivation and fragmentation on operational performance during disaster training.
Method

**Design:** Longitudinal repeated measures design

**Participants:** N=77 (two Air Force/ANG Bases)

**Procedure:** Wrist actigraphy was used to objectively monitor sleep:
1. ~7-day baseline period (civilian)
2. 2-day transition period
3. 5-day disaster training period

**Materials:** Readiband v3 by Fatigue Science

**Analysis:** Differences in sleep over time were analyzed using generalized linear mixed (GLM) models

Measures:
- RAND Self-report survey (demographics, military history)
- Sleep health
  - Actigraphy (civilian, transition, during)
  - Self-reported Karolinska Sleepiness Scale (KSS)
    How sleepy do you feel right now?
    1 = extremely alert  to 9 = extremely sleepy
Methods

• **Measures**
  - Critical skills questions
    - Medication calculations ➔ Licensed
    - Basic Life Support (BLS) ➔ Non-licensed
  - Different question sent four times a day
    - 08:00, 12:00, 16:00, 20:00
  - Qualtrics Survey Research Suite™
    - Sent link via text message

Analysis:
Associations between sleep health, fatigue and demographics with performance were analyzed using generalized linear mixed modeling (multi-level modeling)
- Random intercept model
- Unstructured covariance matrix
- Interactions specified

Accuracy: all observations included
Normed response time: correct responses only
Descriptive Data Results

Description of each exercise time period

• Exercise 1: Base 1 only: extended military weekend, cadaver training, skills training, work with local response personnel

• Exercise 2: Both bases preparing for Exercise Evaluation (EXEVAL) of readiness by evaluators, so both bases conducted a small training exercise

• Exercise 3: Actual EXEVAL 5 days-convoys to site of training; early morning report time for medical personnel to conduct pre-assessments on ALL personnel (upwards of 250-500 personnel from Air and Army National Guard)

• Comparisons of demographics for two military National Guard units

Participant Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Base 1 (n=37)</th>
<th>Base 2 (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td></td>
<td>36.0 (9.1)</td>
<td>35.6 (9.2)</td>
</tr>
<tr>
<td>Sex:</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Female</td>
<td>13 (35.1%)</td>
<td>18 (45.0%)</td>
</tr>
<tr>
<td>Male</td>
<td>24 (64.9%)</td>
<td>22 (55.0%)</td>
</tr>
</tbody>
</table>
Participant Military History

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Base 1 (n=37)</th>
<th>Base 2 (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Number of OCONUS deployment:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never deployed</td>
<td>17 (46.0%)</td>
<td>16 (40.0%)</td>
</tr>
<tr>
<td>1-3</td>
<td>17 (46.0%)</td>
<td>18 (45.0%)</td>
</tr>
<tr>
<td>4-7</td>
<td>2 (5.4%)</td>
<td>5 (12.5%)</td>
</tr>
<tr>
<td>8 or more</td>
<td>1 (2.7%)</td>
<td>1 (2.5%)</td>
</tr>
<tr>
<td>Months home since recent deployment:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months or less</td>
<td>1 (5.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>12-18 months</td>
<td>0 (0.0%)</td>
<td>1 (4.2%)</td>
</tr>
<tr>
<td>More than 18 months</td>
<td>19 (95.0%)</td>
<td>23 (95.8%)</td>
</tr>
</tbody>
</table>

Wrist Actigraphy

- Non-invasive and objective measure of sleep
- 92% accurate compared to polysomnography
- Readiband by Fatigue Science is FDA approved
- Algorithms calculate sleep quantity, quality, and "cognitive effectiveness" (calculated based on prior sleep, time since last sleep, and time of day)
Results

- Participants averaged 7.16 hours of sleep per 24h period during the baseline measurement period.
- Average baseline sleep quality was 85% and their cognitive effectiveness score was 91%.
- During the disaster exercise period, participants' sleep duration dropped significantly to 5.9 hours (F=39.22 (1,74); p=<0.0001).
- During the disaster exercise period, cognitive effectiveness also dropped significantly to 87% (F=19.61 (1,58); p<0.0001).
- Sleep quality did not vary significantly across measurement periods.

| Ex 1: 4 Days; n=24 participants; 16 skills questions |
| Base 1 | 55% | 9.5 (5-13) |
| Ex 2: 3 Days; n=52 participants; 12 skills questions |
| Base 1 and Base 2 | 37% | 4 (3-6) |
| Ex 3: 5 Days; n=61 participants; 20 skills questions |
| Base 1 and Base 2 | 34% | 6 (3-10) |

IQR=interquartile range
RESULTS and TRENDS

Figure 1a: Average Change Across Time

Figure 1b: Accuracy

Figure 2: Standard Depressed Scale (SDS)

RESULTS

Figure 2a: Average Change Across Time

Figure 2b: Average Change Across Time, Adjusted Depression Score

Figure 2c: Autocorrelation of Depression Score
Results: GLMM Regression Analysis

Pooled Across Exercises (n=70 participants; 858 skills)

• KSS associated with lower accuracy
  • $F(\text{df}_1,\text{df}_2)=23.68$ (1,856); $p<0.001$

• Licensure associated with higher accuracy
  • $F(\text{df}_1,\text{df}_2)=19.25$ (1,57); $p<0.001$

• Increasing age associated with higher accuracy
  • $F(\text{df}_1,\text{df}_2)=5.50$ (1,54); $p=0.02$

• Base 2 associated with higher accuracy
  • $F(\text{df}_1,\text{df}_2)=6.26$ (1,64); $p=0.01$

No significant associations with response time

Challenges

• Conducting research in a military field setting during actual exercises
  • very fluid environment

• Identification of a non-disruptive way to measure operation performance

• Cell service can be unreliable

• Consider measuring activity level
Implications

- For researchers:
  - Coordination of data collection under field conditions
  - Need for flexibility or alternate plans for data collection that is dependent on WiFi connections.

- For participants:
  - Practice good sleep hygiene before & during training and real-world disaster responses.
  - For real world responses, safety is primary focus for service member as well as patients/victims.

- For military commanders:
  - Consider rest & down time environments (noise, comfort)
  - Plan for longer rest/sleep periods

- For military nurses:
  - Sleep hygiene briefings 2-3 months and immediately before training & real-world responses
  - Assessing environment with recommendations to commanders if trends noted in field.
  - Encourage service members who work night shifts in their civilian jobs to coordinate schedules with employers for time off to acclimate before planned disaster training exercises.

Implications

- Making medical decisions during mass casualty events, disaster events, & in field settings can be impacted by sleep quality & quantity.

- Finding the best tool to measure critical skills is an on-going challenge
  - Must be skill specific
  - Must be valid & reliable
  - In military field settings, need to consider impact of research on mission.
Implications for Nursing Science

• National Guard medical personnel were significantly sleep restricted during a disaster training exercise and this significantly affected their cognitive effectiveness.
• Disaster training exercises are likely to be a conservative estimate of real world disasters.
• Given the connection between fatigue and medical errors, targeted interventions to improve sleep are critical.
• The need to safeguard our service members and the civilians they protect is clear.

Dissemination

Commanders' briefings: November 2017 and January 2018
Participant briefings of results with implications for science of sleep and sleep hygiene recommendations: November 2017 and March 2018
Western Institute of Nursing Conference April 2018
Manuscripts:
James, L., Smart, D., Odom-Maryon, T., Honn, K., & Rowan, S. (2018). Sleep deprivation in Air National Guard medical personnel responding to a simulated disaster training exercise. (awaiting PAO approval; submitting to *Military Medicine*).
References


THANK YOU

QUESTIONS????