The Sleep Habits of Students and Junior Residents Working in the Emergency Department

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**Purpose**

- Fatigue in Medicine – Cumulative/Consecutive Hours
- EM = Shiftwork
  - Attention
  - Memory
  - Cognitive Skills
  - Communication
  - Dexterity

To determine factors which influence fatigue in those working in Emergency Medicine

To study the effects of shiftwork on **clinical decision making** in Emergency Medicine

Pilot study - Pilots suffer from shiftwork/life and death decision making
Are doctors similar to pilots – jet lag effects.
Many studies on individual aspects of
Memorized muscle skills? i.e intubations, Central Lines
Concentration/Vigilance

The reduction in performance after 24 hours of sleep loss has been equated to the effect of a .1% blood alcohol concentration.

Experts previously viewed work-related fatigue as a linear construct that increased with more "time on task," but this model has given way to a more sophisticated one, where fatigue is related to time on task and time of day.

Factors – chronotype, workload, shift schedules, exercise
Real – ethics.
Question we had for this pilot study was – does this method have external validity, what about evaluator variability.

MS: the down arrow on presentation variability no longer fits on the same line, else good—may want to emphasize also that by asking them to commit their answers to paper (an order sheet) we decreased evaluator variability...

Assume control of the video.
Clinical Decision Making Assessment

Videotaped 4 minute example simulations (poor/good/excellent) used for prior simulation study calibration

- STEMI
- Dialysis Patient with Bradycardia/Hyperkalemia
- Syncope/GI Bleed/PEA

Scored globally (0-100) based on their expected management by 2 blinded, independent evaluators
Orders - Resuscitation Measures/Bloodwork/Investigation/Physical Exam Maneuvers /Consults/Therapeutic Actions (drugs/procedures)
Results

- 35 Participants
  - 8 PGY1-2 FM Residents
  - 12 PGY1-2 Off-Service Residents
  - 15 Medical Clerks

- 66 Sleep Logs of 80 Hours Each
  - 217 days of sleep/work data

- 16 Participants Participated in ≥ 2 sessions.

- 38% of participants had at least 1 non-circadian sleep within 80 hours of testing
  - Non-Circadian Sleep = <4 hours of Sleep Between 0000-0600.
Orient people first
Students 20.07 4.7
Off-Service 21.36 Std 5.2
EM 16.4 Std 5.55.
More senior trainees reported poorer quality sleep (R=0.71; P<0.01)
EM residents tended more towards an evening chronotype than off-service residents and students, scoring 16.5±5.5 vs 20.6±4.9 out of 32 (P<0.05).

6-10 strong evening chronotype 11-15 moderate evening chronotype 16-22 between evening and morning types 23-27 moderate morning chronotype 28-32 strong morning chronotype

The EM residents' eveningness preference, ability to overcome drowsiness, sleep flexibility, younger age, and having no children at home were all associated with greater shiftwork tolerance. Steele, 2000
A global PSQI score greater than 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, p less than 0.001) in distinguishing good and poor sleepers (from paper). Global PSQI Scores above 5 resulted in a sensitivity of 98.7% and specificity of 84.4% to persons with sleep disturbances versus controls (Backhaus et al., 2002).

Population had mean of 5.7 in CARDIA Study (Knutson et al, 2006)

We had 5/7 EM residents >5. Difference between EM and Students. Means 3.5 std, 1.88, 5.2 std 2.3, 7.14 std 2.4 Normal (except EM too small)

Sleep quality was worse in EPs (mean PSQI = 4.8, SD ± 2.5) compared to the normal population, with 31% of subjects reporting poor sleep quality. (From Machi et al, 2012)

EMS workers; The mean (± standard deviation) PSQI score was 9.2 (± 3.7). A CFQ score ≥4, indicating severe mental and physical fatigue, was present in 44.5% of the subjects. The mean PSQI score was higher among those reporting severe fatigue (11.3 ± 3.2) than among those not reporting fatigue (7.5 ± 3.0, p < 0.0001

he PSQI is designed to assess sleep quality during the past month and con- tains 19 self-rated questions from which 7 component scores are calculated and summed into a global score.1

Knutson (2006) - 20 mean ±SD PSQI score was 5.7 ± 3.1 in Year 1 and 5.9 ± 3.1 in Year 2. We found that a nontrivial percentage of the population is dif- ferently classified for poor
sleep quality (24%)


MS: I think I understand the bubble, but you need to be sure that it lines up perfectly with the “5” on the x-axis, and doesn’t go beyond “30”. This might be my powerpoint doing it, but you don’t know how the laptop tomorrow will handle the issue. The best thing is to “group together” objects like the graph and the bubble: CTRL-click on the two objects to select both, then Home>Drawing>Arrange>Group Objects (in PPT 2010) to make them a single object so that rescaling to fit doesn’t move things around.
No Significant Difference on 1-way anova. Overall Average – 8.5 hrs/day

A orientation towards an evening chronotype was correlated with longer sleep duration (R= -0.66; P<0.01).

MS: OK, order not a huge deal if difficult. You have made the SEM bar thicker, but now one doesn’t see the hash mark. Can you make it wider?
MS: Again, SEM would be nice for CAEP.
Anesthesia working night shifts had 1 less hours of sleep than day. Cheeseman 2011 (CJ Anes) Use of a new task-relevant test to assess the effects of shift work and drug labelling formats on anesthesia trainees’ drug recognition and confirmation.
1 – very alert; 3 – alert, 5 – neither alert nor sleepy, 7 – Sleepy but with no difficulty staying awake (fatigued but not strained); 9 – Very sleepy, fighting against sleep (Very fatigued, exhausted and incapable of mental strain)

Kaida et al, 2006 - **Validation of the Karolinska sleepiness scale against performance and EEG variables.** The KSS was closely related to EEG and behavioral variables, indicating a high validity in measuring sleepiness.
Czeisler 2009. Score of ~1 on KSS was difference between armodafinil, 150 mg and placebo in those with Shiftwork sleep disorder
The changes observed in the EEG/EOG with drowsiness do not usually appear until KSS scores reach 7 and higher

**Sleep and recovery in physicians on night call: a longitudinal field study;** found Mental Fatigue Scale mental fatigue was significantly higher on the first post-call evening compared with the other days (1.0-1.3 difference in scores).

Number of Trues for non-circadian by day -3, -2, -1, 0 respectively = 8,9,9 6
Number of XY Pairs 59 Pearson r 0.8442 95% confidence interval 0.7503 to 0.9047 P value (two-tailed) < 0.0001 P value summary *** Is the correlation significant? (alpha = 0.05) Yes R square 0.7126

MS: Good. It would be nice to have the x-axis and y-axis the same length, since (unlike most of the time when you calculate a correlation) you are measuring on the same scale. So the graph should be a square, not a rectangle. We could also show a Bland-Altman plot, but not for tomorrow...
To account for repeated measurements of participants we used a mixed effects model with random effects for participant and scenario to examine the association between various factors and the score while controlling for EM training.

~50% of variance in scoring was based on level of training.

Scenario did not make a difference.

<table>
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<tr>
<th>MEAN + SD</th>
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<tbody>
<tr>
<td>55.24</td>
<td>19</td>
</tr>
<tr>
<td>41.75</td>
<td>16</td>
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<tr>
<td>30.08</td>
<td>13</td>
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</table>
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- Per increasing point in sleepiness:
  - +1.56 (±1.33) increase in score
Conclusions

- EM Residents differ from other groups in Chronotype and Sleep Quality
- ≥1 Non-Circadian Sleep within 80 hours of testing was correlated to increased fatigue/sleepiness and decreased hours of sleep.
- Evaluators had strong correlation
- Method was robust
  - Method can discriminate performance by EM training level
  - Scenarios had no effect on the variance
- Easy to scale up to a larger sample to determine how fatigue influences clinical reasoning in EM

Standardizable.
Portable
Acknowledgements

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