

# Evaluation and Optimization of Inpatient Sleep Quality

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## Introduction

- Sleep disruption is common among hospitalized patients due to psychological, physiological, and environmental reasons including illness, pain, anxiety, invasive interventions, frequent monitoring, and stimuli, especially noise and light.<sup>1,2,3</sup>
- The AASM has published guidelines for the use of actigraphy in the outpatient setting, but there is a paucity of literature evaluating the validity of actigraphy in inpatients.<sup>4</sup>
- There is growing support for the use of actigraphy in the inpatient setting in certain patient populations, especially traumatic brain injury, during the postoperative window, and patients undergoing cancer treatment.<sup>5-7</sup>
- The aim of our study is to evaluate sleep in hospitalized general medicine patients undergoing sleep medicine consultation using actigraphy and qualitative surveys.

## Methods

- A single-site prospective study in hospitalized medicine patients. Patients were observed with a Fitbit® Charge3 wrist actigraphy device overnight, then administered 7 surveys:
  - Richards-Campbell Sleep Questionnaire (RCSQ), qualitative questionnaires assessing sleep history, sleep hygiene, barriers to sleep, STOP-BANG, Epworth Sleepiness Scale (ESS), and Patient-Health Questionnaire-2 (PHQ-2).
- Actigraphy data including total sleep time, slow wave sleep time, and number of awakenings was compared with patient-reported data.

## Results

- 18 patients met inclusion criteria and were enrolled
  - They underwent sleep medicine consultation, overnight actigraphy, and completed 7 surveys
  - 3 excluded because actigraphy did not record. 1 excluded due to unrelated medical condition
  - Average age= 59 ± 15 years; 50% Male
- Survey Results
  - Average STOP BANG was 5 with all patients scoring at least a 3 "intermediate risk" and 63% (n=10) with a score ≥ 5 "high risk"
  - Average ESS was 13.2, with 40% (n=6) with a score 16-24 indicating severe excessive daytime sleepiness
  - 63% (n=10) screened in for depression → primary care team notified

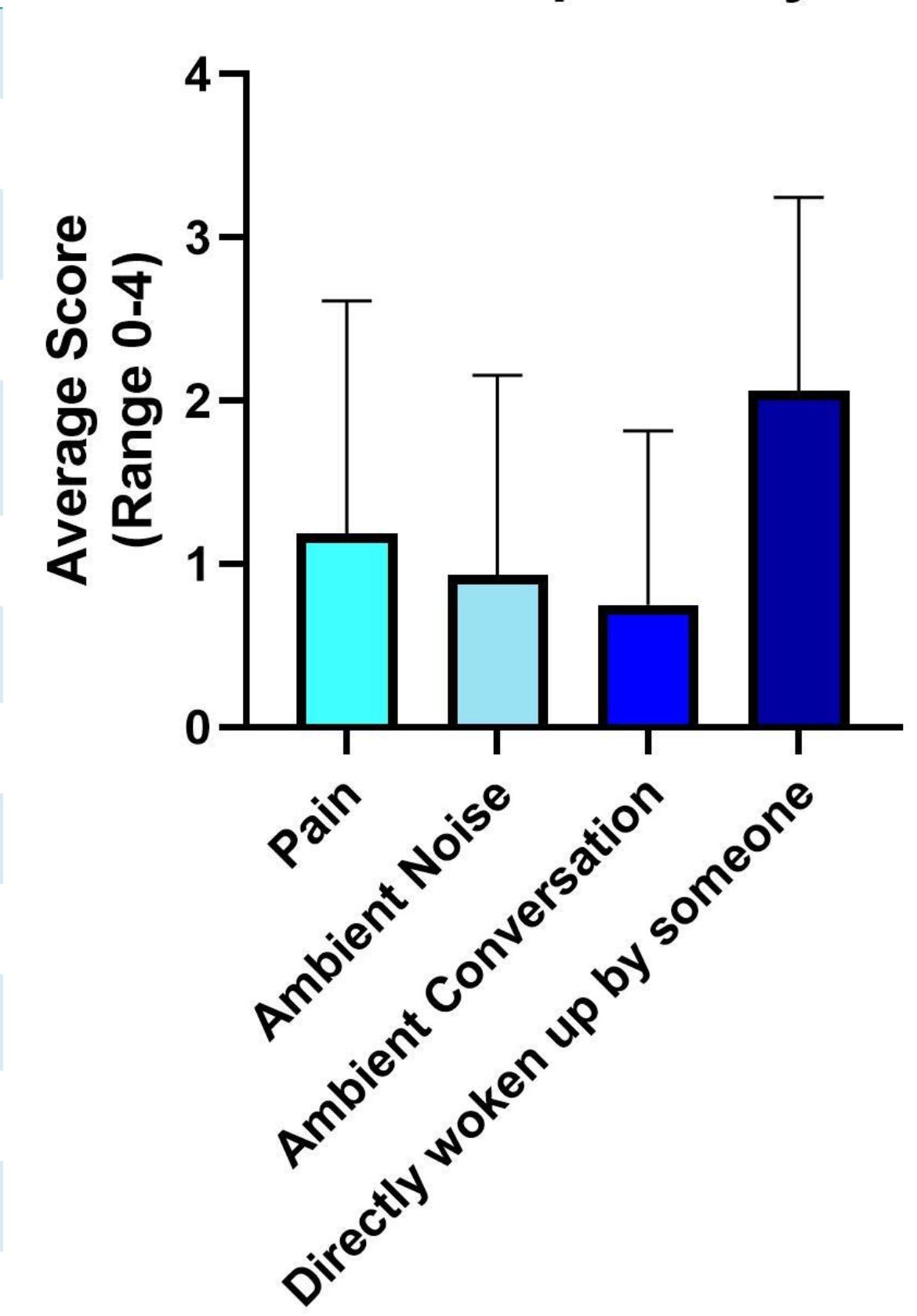
### Survey Results

| Sleep History Intake:          |                 |
|--------------------------------|-----------------|
| Average Bedtime                | 8:51 PM         |
| Average Sleep Latency          | 43 min ± 34     |
| Average Wake up time           | 6:04 AM         |
| Average Total Sleep Time (TST) | 401.6 ± 186 min |
| Average # Awakenings           | 4.33 ± 3        |
| Average Time Back to Sleep     | 51.6 ± 68 min   |

### Sleep Hygiene:

|                           |                      |
|---------------------------|----------------------|
| Phone/Electronics in bed? | Yes 69% (n=11)       |
| TV in bed?                | Yes 75% (n=12)       |
| Read in bed?              | Yes 31% (n=5)        |
| STOP-BANG:                | 5.1 ± 1.3 (out of 8) |
| ESS:                      | 13.2 ± 6 (out of 24) |
| PHQ-2:                    | 63% (n=10) screen IN |

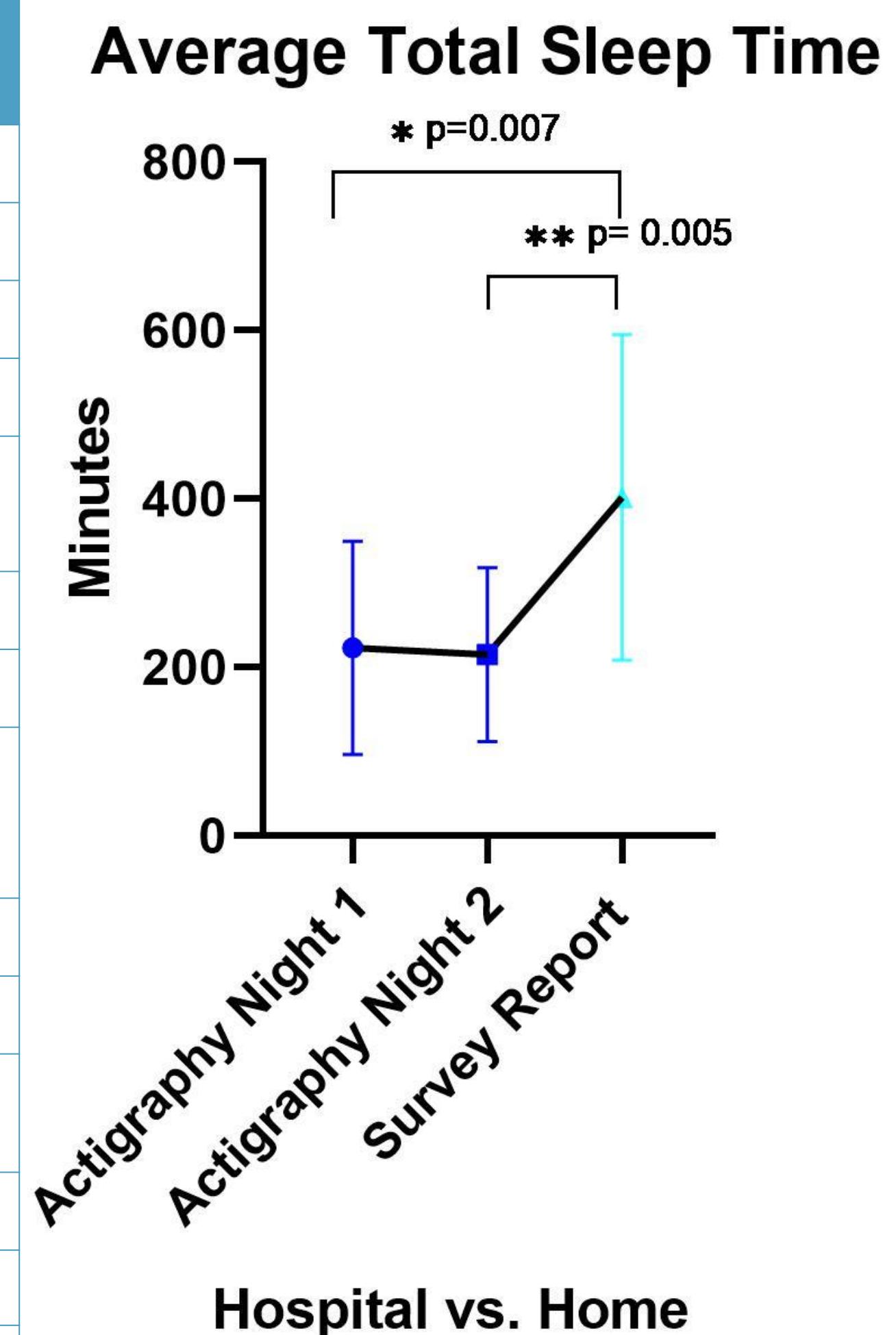
### Barriers to Sleep Survey Results



## Results

| RCSQ Question Prompts   | Average Response |
|---|------------------|
| My sleep last night was:<br>light sleep (0) ----- deep sleep (100).   | 52.6 ± 25.9      |
| Last night, the first time I got to sleep, I:<br>just never could fall asleep (0) ----- fell asleep almost immediately (100). | 54.8 ± 25.9      |
| Last night, I was:<br>awake all night long (0) ----- awake very little (100).   | 71.4 ± 20.1      |
| Last night, when I woke up or was awakened, I:<br>couldn't get back to sleep (0) ----- got back to sleep immediately (100).   | 56 ± 30.4        |
| I would describe my sleep last night as:<br>a bad night's sleep (0) ----- a good night's sleep (100).                         | 61.6 ± 28.4      |
| I would describe the noise level last night as:<br>very noisy (0) ----- very quiet (100).                                     | 56.7 ± 33.8      |

| Parameters (means)             | Actigraphy Results: |                  |
|--------------------------------|---------------------|------------------|
|                                | Night 1             | Night 2          |
| Bedtime                        | 10:11 PM            | 8:08 PM          |
| Wakeup time                    | 3:39 AM             | 2:56 AM          |
| TST (min)                      | 223 min ± 122 min   | 233 min ± 81 min |
| Restless time                  | 76 ± 55 min         | 65.6 ± 62 min    |
| Number of times restless       | 6 ± 3               | 5.4 ± 4          |
| Awake time                     | 24 ± 2 min          | 25 ± 31 min      |
| Awake time %                   | 13 ± 9%             | 14 ± 9%          |
| Number of nocturnal awakenings | 2.4 ± 2             | 2.3 ± 2.4        |
| REM time (min)                 | 59 ± 34 min         | 48 ± 37 min      |
| REM %                          | 14 ± 10%            | 15 ± 10%         |
| Light sleep time (min)         | 219 ± 89 min        | 207 ± 49 min     |
| Light sleep %                  | 60 ± 15%            | 64 ± 12%         |
| Deep time (min)                | 27 ± 22 min         | 12.5 ± 9 min     |
| Deep sleep %                   | 7 ± 6%              | 4 ± 2%           |



## Discussion

- Average TST at home is nearly double TST in the hospital
- Total sleep time was significantly reduced in the inpatient setting compared to patient's normal sleep schedule at home (223 vs. 401.6 minutes, p=0.007)
- Given high incidence of positive STOP-BANG and ESS screening results, sleep disordered breathing could be a contributing factor to patients' disrupted sleep. Average ESS for our patients was 13.2 indicating a baseline elevated level of daytime sleepiness, which further indicates possible presence of SDB among our study population.
- On average, patients went to bed around the same time as they do at home, however they woke up much earlier (3:17 AM in hospital vs. 6:04 AM at home) which further indicates how hospital environment can interfere with normal sleep patterns.
- Patients' total sleep time was predominately light sleep as per actigraphy, around 62% across both nights. This can be due to what patients perceived as affecting their sleep quality.
- Interestingly, the average number of awakenings of around 2 as detected by actigraphy is lower than subjectively reported average of 4 awakenings overnight by patients.
- Factors cited by patients as affecting their sleep quality in the hospital include:
  - Pain (either chronic or secondary to one of the reasons they were admitted)
  - Being woken up for vital signs or lab draws
  - Noise in the hallways or from monitors
  - Difficulty falling back asleep after being woken up for healthcare related interventions.

## Conclusion

- Restorative sleep warrants consideration alongside complex medical care during hospitalization.
- Patients experience decreased total sleep time while in the hospital compared with their subjective estimates of sleep at home.
- Actigraphy provides a non-invasive and reliable way to monitor some sleep parameters in the inpatient setting.
- Patient-identified barriers to sleep are targets for quality improvement.
- Future studies should compare inpatient actigraphy data to polysomnographic data and the effect of sleep-directed interventions on sleep quality in the hospital.



Fitbit report of overnight actigraphy data from 2 separate patients.

## References

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