

Exploring the Sleep Patterns of Students in a Medical Sciences Baccalaureate Program using Self-Reported Data and Visual Analytics

Gargi Rajput¹, Andy Gao¹, Ching-Tzu Tsai^{1,2}, Jennifer R.V. Molano, MD¹, Danny T.Y. Wu, PhD, MSI¹

¹University of Cincinnati College of Medicine, Cincinnati, OH, ²DAAP School of Design

Introduction

Sleep is known to play a vital role in general health and development, yet poor sleep patterns continue to associate with college students. Current literature has explored overall patterns in college students, with one study demonstrating that only 34.1% of college students display good sleep quality based on Pittsburgh Sleep Quality Index (PSQI) scores¹. However, no studies have focused on assessing pre-medicine (pre-med) college students, who tend to have more rigorous coursework and academic commitments relative to other majors. A gap in knowledge also exists in how students perceive their sleep versus their actual sleep patterns. Therefore, this pilot study aimed to 1) explore sleep patterns in pre-med students through self-reported survey data, and 2) develop interactive visualizations to support the data exploration and statistical analysis, to offer practical value towards sleep analysis.

Methods

An anonymized well-being and sleep pattern survey was distributed to pre-med college students of the Medical Sciences Baccalaureate Program (MSBP) at the University of Cincinnati College of Medicine (UCCoM). This survey included PSQI items (I-IV)² followed by questions about the students' cohort, perceived sleep quality, and stress level for December 2021. To achieve our first aim, the survey responses were statistically analyzed to compare 1) Cohort and sleep quality, 2) Perceived sleep quality and Global PSQI score, and 3) Perceived stress impact and Global PSQI score. To achieve our second aim, an interactive dashboard was created in R-Shiny to allow for comparison along with corresponding charts for visualization and statistical analyses. Dashboard options include an x variable (e.g., cohort or perceived sleep quality), a y variable (e.g., number of students or PSQI score), grouping (by PSQI or none), and the ability to select chart type. Additionally, certain combinations of x and y variables in the dashboard restrict the selections that can be made for grouping and chart type to yield meaningful visualizations.

Results

The survey responses (n=103) demonstrated that pre-med MSBP students sleep an average of 7.1 hours each night with 81.3% habitual sleep efficiency (average hours slept versus hours spent in bed, as defined in PSQI). Those who experienced trouble sleeping commonly expressed reasons such as: not being able to sleep within 30 mins, waking up in the middle of the night or early morning, anxiety, stress, and restless mind. Using the dashboard, a comparison between cohort (x variable) and the number of students (y variable) and grouping by PSQI (Figure 1) reveals that the proportion of students who had poor sleep was not significantly different between the cohorts (p=0.4888). The comparison of PSQI scores between cohorts (not shown in the figure) revealed that average sleep quality improved only from Year 1 to Year 2 students (mean of 7.48 versus 5.48, p=.006). When observing perceived sleep quality (x variable) versus the number of students with PSQI grouping (Figure 2), 50% of students (n=14) who perceived "no problem at all" with their sleep quality, and 74.4% (n=32) who considered sleep quality "only a slight problem", had a Global PSQI score equal or larger than 5 (poor sleep). Finally, another notable comparison between perceived stress impact (x variable) and PSQI (y variable) with no grouping displayed a general positive correlation between perceived stress levels and average global PSQI scores (Figure 3).

Discussion

Despite being exposed to rigorous academic demands, pre-med college students in the MSBP program seem to have an adequate amount of sleep (n = 7.1 hours) on a surface-level in relation to the recommended eight or more hours regiment². However, only 25.2% indicated good sleep quality via PSQI scores, which is lower than previously conducted study on college students in general (34.1%). Additionally, sleep quality seemed to improve from Year 1 to Year 2, with no major trends over the rest of the years. This can be explained by Year 1 serving as an adjustment period, which allows students to have smoother and more consistent transition Year 2 and onwards. Furthermore, there was a high discrepancy between the perceived sleep quality by the student versus what their PSQI scores reflected. The poor sleep quality experienced by unaware students points to the need for self-monitoring through wearables, such as Fitbit devices, to increase sleep quality awareness. Lastly, a comparison of stress effect on sleep with PSQI scores establishes that stress is not the only dominant factor on PSQI. Students who perceived stress to play no role in their sleep still displayed a wide range of PSQI scores above and below 5. In future studies, we hope to address these sleep quality discrepancies and determine a feasible solution for sleep hygiene improvement in pre-med students.



Figure 1. Interactive dashboard display of student responses based on *Good Sleep* (Global PSQI < 5) and *Poor Sleep* (Global PSQI ≥ 5) across different MSBP cohorts.

Table 1. Chi-Square Test of Data in Figure 1

Observed			
Cohort	# Students w/ Good Sleep	# Students w/ Poor Sleep	Total
Year1	6 (5.8%)	27 (26.2%)	33 (32%)
Year2	9 (8.7%)	16 (15.6%)	25 (24.3%)
Year3	5 (4.8%)	15 (14.6%)	20 (19.4%)
Year4	6 (5.8%)	19 (18.5%)	25 (24.3%)
Expected			
Cohort	# Students w/ Good Sleep	# of Students w/ Poor Sleep	
Year1	8.330097087	24.66990291	
Year2	6.310679612	18.68932039	
Year3	5.048543689	14.95145631	
Year4	6.310679612	18.68932039	
Chi-Square Test	P value = 0.488815616		

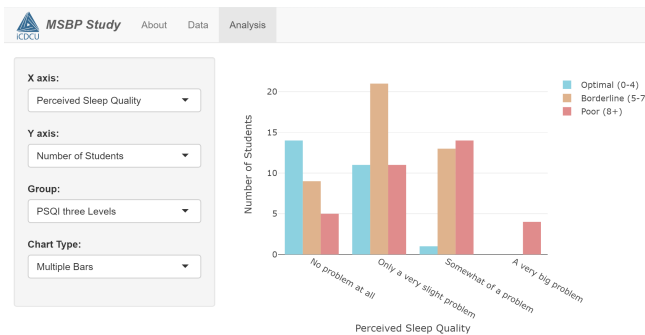


Figure 2. Dashboard display of perceived sleep quality by students compared to their actual Global PSQI score categories; (0-4) = Good Sleep, (5-7) = Borderline poor, (8+) = Poor.

Table 2. Chi-Square Test of Data in Figure 2

Observed				
	0-4	5-7	8+	Total
No Problem at all	14 (13.6%)	9 (8.7%)	5 (4.9%)	28 (27.2%)
Only a very slight problem	11 (10.7%)	21 (20.3%)	11 (10.7%)	43 (41.7%)
Somewhat of a problem	1 (0.96%)	13 (12.6%)	14 (13.6%)	28 (27.2%)
A very big problem	0	0	4 (3.9%)	4 (3.9%)
Total	26 (25.3%)	44 (42.6%)	34 (33.1%)	103
Expected				
	0-4	5-7	8+	
No Problem at all	7.0679	11.9611	9.2427	
Only a very slight problem	10.8543	18.3689	14.1941	
Somewhat of a problem	7.0679	11.9611	9.2427	
A very big problem	1.0097	1.7087	1.3203	
Chi-Square Test	P-value = 0.00018097			



Figure 3. Dashboard display of perceived stress effect on sleep by students compared to their Global PSQI scores.

Table 3. Turkey Post-hoc Test of Data in Figure 3

Comparison	Abs. Mean Difference	Q Critical Value
No problem vs. Slight problem	0.1607	1.9873
No problem vs. Somewhat problem	2.5648	1.7775*
No problem vs. Very big problem	3.7143	2.3753*
Slight problem vs. Somewhat problem	2.4041	1.4418*
Slight problem vs. Very big problem	3.5536	1.7104*
Somewhat problem vs. Very big problem	1.1495	1.5711

* Significant difference (Abs. Mean Difference > Q Critical Value)

References

- Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of Adolescent Health*. 2010;46(2):124–32.
- Hirshkowitz, Max et al. “National Sleep Foundation’s updated sleep duration recommendations: final report.” *Sleep healthvol.* 1,4 (2015): 233-243.