



# Sleep quality in medical students: a comparison across the various phases of the medical course

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Submitted: 22 June 2016.  
Accepted: 14 April 2017.

Study carried out at the Faculdade de Medicina de Botucatu, Universidade Estadual Paulista Júlio de Mesquita Filho – FM-UNESP – Botucatu (SP) Brasil.

## ABSTRACT

**Objective:** To evaluate and compare subjective sleep quality in medical students across the various phases of the medical course. **Methods:** This was a cross-sectional study involving medical undergraduates at one medical school in the city of Botucatu, Brazil. All first- to sixth-year students were invited to complete the Pittsburgh Sleep Quality Index, which has been validated for use in Brazil. Participants were divided into three groups according to the phase of the medical course: group A (first- and second-years); group B (third- and fourth-years); and group C (fifth- and sixth-years). The results obtained for the instrument components were analyzed for the total sample and for the groups. **Results:** Of the 540 students invited to participate, 372 completed the instrument fully. Of those, 147 (39.5%) reported their sleep quality to be either very or fairly bad; 110 (29.5%) reported taking more than 30 min to fall asleep; 253 (68.0%) reported sleeping 6-7 h per night; 327 (87.9%) reported adequate sleep efficiency; 315 (84.6%) reported no sleep disturbances; 32 (8.6%) reported using sleeping medication; and 137 (36.9%) reported difficulty staying awake during the day at least once a week. Group comparison revealed that students in group A had worse subjective sleep quality and greater daytime dysfunction than did those in groups B and C. **Conclusions:** Medical students seem to be more exposed to sleep disturbance than other university students, and first- and second-years are more affected than those in other class years because they have worse subjective sleep quality. Active interventions should be implemented to improve sleep hygiene in medical students.

**Keywords:** Students, medical; Quality of life; Sleep.

## INTRODUCTION

Sleep quality has been studied among university students.<sup>(1-4)</sup> Such studies have shown impairments in sleep quality, which are even greater when it comes to medical undergraduates,<sup>(5)</sup> who have a heavy academic schedule and responsibilities in various activities, all of which significantly impact sleep quality.<sup>(6-9)</sup>

University students experience disturbances in their circadian cycle because of the stress of the academic environment,<sup>(1)</sup> which is increased by habits such as surfing the Internet, watching television,<sup>(2)</sup> and using alcohol and tobacco,<sup>(3)</sup> habits that are common in this population. Improved sleep quality is associated with engaging in sports and extracurricular activities.<sup>(8)</sup>

Since impairment in sleep quality directly affects academic performance<sup>(4)</sup> and also emotional aspects,<sup>(6)</sup> we emphasize the importance of measuring sleep quality in medical students and monitoring it across the various phases of the medical course. To that end, there are instruments for self-assessment of sleep quality in the literature, such as the Pittsburgh Sleep Quality Index (PSQI),<sup>(10)</sup> which has been validated for use in Brazil<sup>(11)</sup> and which, because of its high efficacy (high specificity

and high sensitivity), is recommended for use in clinical practice and research. The PSQI contains 19 items, which address sleep latency, usual bedtime and wake time, and sleep and nap quality.<sup>(10)</sup> Therefore, the objective of the present study was to evaluate and compare subjective sleep quality in medical students across the various phases of the medical course, by using the PSQI.

## METHODS

This was a cross-sectional study involving medical undergraduates at the Botucatu School of Medicine, located in the city of Botucatu, Brazil. All first- to sixth-year students (N = 540) were invited to participate. Data were collected over two months. The study was approved by the local human research ethics committee (Protocol no. 400/08). All participants gave written informed consent.

All students who completed the PSQI fully within the specified period were included in the study. The students who declined the invitation to participate in the study or who did not complete the entire questionnaire were excluded.

The research instrument selected was the PSQI<sup>(11)</sup> because this is an analysis instrument that is used

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Financial support: None.

worldwide and is validated for assessing sleep disturbances, as well as allowing assessment of questions in isolation or the overall result. Its seven components—subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbances; use of sleeping medication; and daytime dysfunction—were analyzed separately. The range of this instrument is from 0 to 21 points, and scores  $\geq 5$  signify poor sleep quality, indicating possible sleep disturbance. The sum of the seven component scores produces a global score.

### Statistical analysis

The data from the completed questionnaires were entered into tables using Microsoft Excel, one of which showing the results for the total sample and the others showing the results for each undergraduate class year. The class years were then grouped according to the traditional phases of the medical course (initial phase, pathophysiology phase, and clinical clerkship phase) and participants were divided into three groups: group A, with first- and second-year students; group B, with third- and fourth-year students; and group C, with fifth- and sixth-year students. The results were described for the total sample and for the groups, and among- and between-group comparisons were conducted.

Analysis was performed using the proportions of different responses as a function of each component. In the inductive analysis, the chi-square test was used for among-group comparisons of the seven components of the PSQI, whereas the Wilcoxon test was used for between-group comparisons of the components and the Student's t-test was used for between-group comparisons of the global score. Values of  $p < 0.05$  were considered significant.

## RESULTS

Of the total of 540 students who were invited to participate in the study, 372 (68.9%) completed the PSQI, being distributed by class year as follows: 72, first-years; 53, second-years; 86, third-years; 67, fourth-years; 30, fifth-years; and 64, sixth-years. As for gender distribution, there was a larger proportion of females (Table 1).

The results for the seven components of the PSQI were analyzed for the total sample and for the three study groups (Table 2). Of the total sample, 39.5% of the participants classified their sleep quality as

either very or fairly bad, and 29.5% reported taking more than 30 min to fall asleep two or more times a week. The average number of hours slept per night ranged from 6 h and 14 min among fifth-years to 6h and 34 min among second-years. Inductive statistical results showed no significant differences among the three groups regarding subjective sleep quality, sleep latency, or sleep duration.

A more thorough analysis of subjective sleep quality, by using the classification of this quality as "very good" as a reference, revealed that only students in group A were statistically significantly likely to have "very bad" subjective sleep quality (Figure 1). Habitual sleep efficiency was considered adequate in 87.9% of the total sample, and the frequency of sleep disturbances was considered low in 84.6% of the total sample. In the group analysis, neither component showed significant differences.

Of the total sample, 8.6% of the participants reported using sleeping medication at least once a week, and 87.4% reported having difficulty staying awake during the day at least once a week. In addition, 50.4% reported having trouble engaging in daily activities at least once a week, and 70.6% reported dozing; of the latter, 47.7% did not intend to doze and 44.0% regarded dozing as necessary. In the group analysis,  $p$  values = 0.72 were obtained for use of sleeping medication, whereas, for daily dysfunction, group A showed a significant difference ( $p = 0.006$ ; Figure 2).

The mean global PSQI scores for groups A, B, and C were, respectively,  $6.62 \pm 2.55$ ,  $6.20 \pm 2.65$ , and  $6.66 \pm 2.64$ , and 12.9% of the total sample had scores  $< 5$  (Table 3). Analysis by undergraduate class year revealed scores  $< 5$  in 5.5% of first-years, 7.6% of second-years, 15.9% of third-years, 10.1% of fourth-years, 10.0% of fifth-years, and 9.4% of sixth-years. Logistic regression, considering results  $> 5$  (1) and  $\leq 5$  (0) for assessing group influence, revealed no significant intergroup influence ( $p = 0.24$ ).

In addition, the mean scores on the seven components of the PSQI were compared between groups, and no significant differences were found between any of the groups (Table 4).

## DISCUSSION

Sleep quality among medical students is a subject that has been studied worldwide because of its repercussions on the academic routine and personal life of this population. Therefore, investigating sleep quality by means of an instrument that has been validated for use in Brazil and allows quantification, such as the PSQI,<sup>(11)</sup> is extremely important for the monitoring of sleep health in such students, aiding in the planning of interventions aimed at raising awareness of this problem. By this means, we found that aspects of sleep quality were altered in our sample, with 12.9% of the participants having scores  $< 5$ , which indicate significant impairment in sleep quality.

**Table 1.** Sample distribution by group and gender.

Sample characteristics		Students, n (%)
Group	A	125 (33.6)
	B	153 (41.1)
	C	94 (25.3)
Gender	Male	138 (37.1)
	Female	234 (62.9)

A: first- and second-year students; B: third- and fourth-year students; and C: fifth- and sixth-year students.

**Table 2.** Results for the Pittsburgh Sleep Quality Index components as a function of the number (considering each of the three study groups) and proportion (considering the total sample) of students who selected each response option.

Component	Group A n = 125 (33.6)	Group B n = 153 (41.1)	Group C n = 94 (25.3)	Students, n (%)	p*
<i>Subjective sleep quality</i>					
Very good	10	15	10	35 (9.4)	<
Fairly good	65	68	57	190 (51.1)	0.0001
Fairly bad	43	67	24	134 (36.0)	
Very bad	7	3	3	13 (3.5)	
<i>Sleep latency</i>					
≤ 15 min	32	52	20	104 (28.0)	0.07
16 to 30 min	63	47	48	158 (42.5)	
31 to 60 min	25	40	11	76 (20.4)	
> 60 min	5	14	15	34 (9.1)	
<i>Sleep duration</i>					
> 7 h	24	17	18	59 (15.9)	0.10
6 to 7 h	78	110	65	253 (68.0)	
5 to 6 h	19	16	10	45 (12.1)	
< 5 h	4	10	1	15 (4.0)	
<i>Habitual sleep efficiency</i>					
> 85	108	132	87	327 (87.9)	0.58
75 to 84	14	19	7	40 (10.8)	
65 to 74	2	2	0	4 (1.1)	
< 65	1	0	0	1 (0.3)	
<i>Sleep disturbances</i>					
0	8	6	4	18 (4.8)	0.29
1 to 9	104	122	71	297 (79.8)	
10 to 18	13	25	19	57 (15.3)	
19 to 27	0	0	0	0 (0)	
<i>Use of sleeping medication</i>					
Not during the past month	115	142	83	340 (91.4)	0.72
Less than once a week	5	7	4	16 (4.3)	
Once or twice a week	2	1	3	6 (1.6)	
Three or more times a week	3	3	4	10 (2.7)	
<i>Daytime dysfunction</i>					
1 to 2	10	34	3	47 (12.6)	<
3 to 4	46	55	30	131 (35.2)	0.0001
5 to 6	32	53	54	139 (37.4)	
Every day	37	11	7	55 (14.8)	

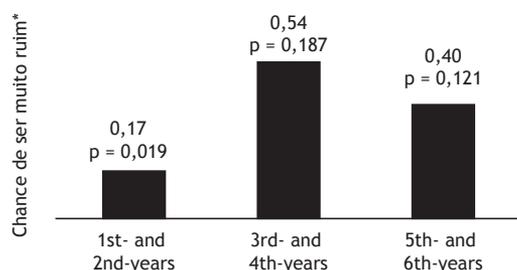
A: first- and second-year students; B: third- and fourth-year students; and C: fifth- and sixth-year students. \*Chi-square test.

Adherence in this study was nearly 70%, which is consistent with literature findings on the rate of return of this type of questionnaire (73.3%).<sup>(7)</sup> In terms of participation by gender, we found a female predominance in effective participation in the study, which is not true for other studies that used this instrument with medical students, in which there was a predominance of males—73%<sup>(8)</sup> and 54.7%.<sup>(9)</sup>

Nearly 40% of the students in our sample classified their sleep quality as either very or fairly bad, a proportion that is lower than that reported in the literature, with findings of poor sleep quality in 61.5%<sup>(12)</sup> and 61.9%,<sup>(7)</sup> specifically among medical students. The poor sleep quality observed in group A is consistent with reports from other studies, which also observed these findings in incoming students, emphasizing the

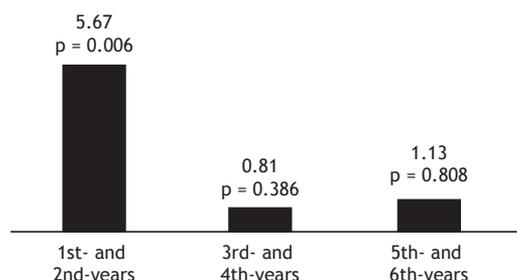
correlation between poor sleep quality and first-year undergraduates, in whom poor sleep hygiene habits, such as Internet surfing at night, poor social life, and bad eating habits, are found to be aggravating factors.<sup>(13)</sup> Poor sleep quality is associated with excessive daytime sleepiness.<sup>(7,9)</sup> In the present study, daytime dysfunction was reported by 36.9% of the participants, who had difficulty staying awake during the day at least once a week. This is consistent with the literature, although there are variations across studies in the proportion of medical students reporting daytime sleepiness: 31%<sup>(7)</sup>; 42.1%<sup>(12)</sup>; and 63%.<sup>(6)</sup> Therefore, students in group A experienced greater deleterious effects on subjective sleep quality and daytime dysfunction than did those in the other groups, with daytime dysfunction showing a trend toward a significant

difference when comparing groups A and C ( $p = 0.05$ ). This can be explained by the fact that incoming students go through a transitional period of change from attending preparatory courses for college entrance examinations and/or attending high school to attending an undergraduate course, which is characterized by too many academic activities and irregular daily routines, which vary too much because of the class load, shifts, breaks, and free study periods. It should also be emphasized that attending a medical course requires a high level of dedication and selflessness, signifying harmful lifestyle changes,<sup>(14-16)</sup> such as sleep deprivation and poor sleep hygiene habits.<sup>(16,17)</sup> After the second year of the undergraduate course, there may be accommodation and better adaptation to the routine of studies and visits.



\*Reference: very good

**Figure 1.** Inductive statistics for the subjective sleep quality component and corresponding p values. Chi-square test.



**Figure 2.** Inductive statistics for the daytime dysfunction component and corresponding p values. Chi-square test.

**Table 3.** Global Pittsburgh Sleep Quality Index (PSQI) scores as a function of the number of students (total sample).

Global PSQI scores	Students, n (%)	p*
≤ 4	48 (12.9)	0.27
5-8	207 (55.6)	
9-16	117 (31.5)	

\*Chi-square test.

**Table 4.** Values of p\* for between-group comparisons of the seven components and the global score of the Pittsburgh Sleep Quality Index.

Groups	COMPONENTS							Global score
	1st	2nd	3rd	4th	5th	6th	7th	
A vs. B	0.59	0.19	0.70	0.21	0.68	0.78	0.10	0.37
A vs. C	0.40	0.90	0.53	0.65	0.19	0.37	0.05	0.10
B vs. C	0.19	0.26	0.73	0.09	0.37	0.22	0.74	0.37

A: first- and second-year students; B: third- and fourth-year students; and C: fifth- and sixth-year students.

\*Wilcoxon test for the components and Student's t-test for the global score.

The results for the sleep latency component showed that sleep latency was slightly altered in 29.9% of the participants, whereas the results for the sleep duration component revealed that 68.0% of the participants reported sleeping 6-7 h per night, which is similar to the variation from 6 h and 55 min to 7 h and 25 min found in one study<sup>(18)</sup> and the average of 6.48 h reported by students at the *Universidade Adventista del Plata*,<sup>(19)</sup> but different from the average of 5.8 h of sleep per night reported by students at the Saudi Medical School.<sup>(20)</sup>

Frequent use of sleeping medication was identified in 8.6% of the participants in the present study, but this proportion is lower than that found in a study involving medical students in Saudi Arabia, which identified that 17% of those students used drugs for sleep induction; this fact indicates the need for early intervention programs targeting poor lifestyle habits.<sup>(21)</sup>

Global PSQI scores > 5 were observed in 87.1% of our total sample, surpassing the literature findings of 59.4%<sup>(5)</sup> and 20.7%.<sup>(22)</sup>

When we analyzed mean global PSQI scores, we found results between 6 and 7 in the different groups, values that are lower than those reported in another study (8.1).<sup>(23)</sup>

In summary, we investigated sleep quality in medical students at one medical school in the city of Botucatu, Brazil, and found impairments in certain PSQI components, which suggests that investigations should continue in different regions of the country and the world, in order to monitor the profile of such students and encourage the translation of findings into health promotion practices. Our results are in agreement with literature findings of a high frequency of altered aspects in sleep quality, a high frequency that is not regarded as a problem or disorder, which may have harmful effects on health.

Since the most substantial results were obtained for the sleep quality and daily dysfunction components, a limitation of the present study was that we did not use other instruments, such as the Epworth Sleepiness Scale, which could provide details on daytime sleep dysfunction. In addition, specific protocols for assessing sleep habits could have been used to better compare student behaviors across the various phases of the medical course, given that students in group A had greater problems regarding subjective sleep quality and daytime dysfunction than did those in groups B and C.

There is a need for health promotion measures, such as proposals of changes in adopted health behaviors specifically related to good sleep hygiene, among the population of higher education students. Such proposals are found in the literature and are targeted at the general population,<sup>(24,25)</sup> but they are also applicable to and indispensable for populations such as that of the present study.

We therefore conclude that poor subjective sleep quality was high for students in all class years of the undergraduate medical course. The comparison across the various phases of the course showed that first- and second-years (group A) reported worse sleep quality and greater daytime dysfunction than did those in other class years (groups B and C).

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