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# Sleep quality amongst medical students

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**ABSTRACT.** Sleep is a physiological-rhythmic state characterized by the loss of consciousness and responsiveness, during which crucial processes for learning and metabolism occur. Therefore, maintaining adequate sleep quality is essential. The objective of this study was to describe the sleep quality of medical students in Paraguay during the first semester of 2024. A descriptive cross-sectional study was conducted on medical students in Paraguay. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and analyzed with IBM SPSS Statistics v.23 software. A total of 466 students participated, with an average age of 21.30 years (SD ± 3.08); and 58.8% were male. The majority resided in Asunción (54.7%). 51.1% reported poor subjective sleep quality, primarily first-year students (59.5%). Sleep latency difficulties were noted by 33.9% weekly, while 42.1% slept 5-6 hours, and 27% less than 5 hours. Sleep efficiency exceeded 85% for 59.9%, and 48.9% experienced monthly sleep disturbances. Only 25% used sleep medication, which positively affected sleep quality (p = 0.02). Daytime dysfunction affected 35.8%, mainly among sixth-year students. Overall, 64.4% had moderate sleep quality, 27.5% had poor sleep quality, and only 8.2% reported good sleep quality. Medical students in Paraguay presented moderate to poor sleep quality, with first-year students being the most affected.

**Keywords**: Sleep quality; sleep deprivation; sleep disorders; sleep hygiene; academic performance.

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## Introduction

The word "sleep" refers both to the act of sleeping and the desire to do so, defined as a physiological rhythmic state of the circadian cycle that involves a gradual and reversible loss of consciousness. During sleep, essential processes for learning and metabolism occur, such as memory consolidation, thermoregulation, cell regeneration, and hormone release (Ayala et al., 2017; Buysse et al., 1989). Adequate sleep benefits energy levels, free radical elimination, cortical electrical activity, thermal and metabolic regulation, and immune activation (Villarroel & Maribel, 2014; Flores-Flores et al., 2021).

Sleep deprivation can cause drowsiness, fatigue, and decreased academic performance, as well as increase physical and psychiatric morbidity, and the risk of obesity (Carrillo-Mora et al., 2013). Alterations in sleep quality and quantity affect quality of life, causing stress, anxiety, and depression, and impairing memory and attention (Cheng et al., 2012). Sleep quality, understood as good nocturnal sleep that facilitates good daytime functioning, is affected by sleep duration, latency, and efficiency (Del Pielago et al., 2013a). In Latin America, many health students have poor sleep quality, affecting their academic performance and quality of life (Del Pielago et al., 2013b).

There is also literature reporting that a considerable number of medical students can be classified as poor sleepers (Gais et al., 2006), with a relationship between poor sleep quality and low academic performance (Gascón et al., 2015), the presence of depression, anxiety, or stress, and even associating female gender with a higher probability of poor sleep (Granados-Carrasco et al., 2013).

Exploring the existing literature in the field of higher education, studies conducted in Taiwan (Guo et al., 2016), Ethiopia (Howard, 2005), and China (Lemma et la., 2012) have reported disparate prevalences of poor sleep quality among university students (54.7%, 55.8%, and 14.3%, respectively), without differentiating by area of knowledge. Focusing on medical students, a study conducted in China reported that 27.8% of respondents had poor sleep quality (Leonardo, 2013). Another study in Pakistan, comparing the prevalence of poor sleep quality between medical students and students of other courses, found that scores were significantly higher in the former (Machado-Duque et al., 2015). Additionally, a study conducted in Mexico reported that 24.1% of first-year medical students had a severe sleep problem (Miró et al., 2006).

In Latin America, the figure of health students with poor sleep quality hovers around 76.4% and fluctuates, in the case of medical students, between 67.5% and 89.5% (Gascón et al., 2015; Guo et al., 2016; Nadeem et al., 2018). Specifically in Chile, it has been observed that 53.8% of these students sleep less than six hours a day, while 83.0% have been classified as poor sleepers (Neikrug & Ancoli-Israel, 2010).

Given the scarcity of studies on sleep quality among medical students from different universities in Paraguay, and the importance of good sleep quality when it comes to mental health and the learning process, we decided to conduct this study in various universities across the country during the first semester of 2024.

## Materials and methods

A cross-sectional descriptive observational study was conducted with non-probabilistic consecutive data collection sampling. The sleep quality of medical students from the first to the sixth year in various universities in the country was evaluated using the Pittsburgh Sleep Quality Index (PSQI) (Lemma et al., 2012). All first and sixth-year medical students who were willing to participate in the study and correctly answered all the questions in the data collection instrument designed for this study were included. Those who were not in the medical program, did not answer most of the questions, or did not wish to participate in the study were excluded.

The sample size was calculated considering approximately 700 students per medical school in the country, with an expected prevalence of 54.7% (Guo et al., 2016), a 95% confidence level, and a 5% margin of error, resulting in a minimum sample size of 247 students.

A questionnaire was created using the Google Forms platform (Google Questionnaire), and the questions in the Pittsburgh Sleep Quality Index were included. This index contains 18 self-administered questions related to qualitative and quantitative characteristics of sleep quality, considering information from the month prior to the response. It was divided into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of hypnotic medication, and daytime dysfunction. Each component is scored from 0 to 3, resulting in a global score ranging from 0 to 21. Based on the total score, the individual's sleep quality is classified as follows: 0 to 4 indicates good sleep quality, 5 to 10 indicates moderate sleep quality, and 11 to 21 indicates poor sleep quality (Lemma et al., 2012).

To calculate the sleep efficiency (SE), responses to questions one and three were used (Lemma et al., 2012).

The data were processed using IBM SPSS Statistics v.23 software. The results are presented with frequencies and percentages. Mean and standard deviation values were used for quantitative variables (age, average test scores, time of arrival at the hospital, time of waking up and going to bed, sleep latency, sleep duration, and sleep efficiency). For the variable association, chi-squared was used for the qualitative variables, considering a $p < 0.05$ when seeing the association. The study was approved by the ethics committee of the University of the Pacific. Informed consent was obtained from all participants, ensuring the confidentiality and anonymity of the collected data.

## Results

Out of 470 eligible participants, four declined to participate in the survey, leaving us with 466 participants. The average age of the participants was 21.30 years (SD ± 3.08). Regarding gender, 58.8% (247/466) were male, and 41.2% (192/466) were female. Of these participants, 54.7% (255/466) resided in Asunción, 41.2% (192/466) in the Central Department, and the remaining 4% (19/466) lived in various parts of the country. Regarding commute time and its implication with the quality of sleep of the participants, there is an evident prevalence of poor sleep quality in those whose commute last > 30 minutes to two hours (35.2% and 33.3% ($X^2$ = 9.6, $p < .05$)). (Table 1).

**Table 1.** Sociodemographic characteristics and sleep patterns of the students. n = 466.

| | N (%) |
|---|---|
| Gender | |
| Male | 274 (58.7) |
| Female | 192 (41.2) |
| Location | |
| Central | 255 (54.7) |
| Asunción | 192 (41.2) |

| | | |
|---|---|---|
| Other departments | 19 (4) | |
| Commute time | | χ2-statistic (P-value) |
| 10 to 30 minutes | 147 (31.5) | 9.6 (0.001) |
| 30 minutes to 1 hour | 155 (33.3) | |
| 1 to 2 hours | 164 (35.2) | |
| Time slept in the last month (in hours) | | |
| 4 | 126 (27) | 36.92 (0.0000001) |
| 5 | 196 (42) | |
| 6 | 98 (21) | 82.2 (0.00000) |
| 8 | 46 (9.9) | |

Regarding its components, 51.1% (238/466) of participants reported poor subjective sleep quality, with the majority being first-year students (59.5%, 94/158). For sleep latency, which measures how long it takes for them to fall asleep, 33.9% (158/466) of students had trouble once or twice a week. In terms of sleep duration across different years, 42.1% (198/466) slept 5-6 hours, primarily third-year students, while a notable 27% (126/466) of the population slept less than five hours. In terms of sleep efficiency, most of them (59.9%, 279/466) showed an efficiency greater than 85% throughout. When it comes to sleep disorders, almost half of them 48.9% (228/466) reported that it happens at least once a month. The use of sleep medication, despite only being used by the minority (25%, 117/466), has shown positive effects on the overall sleep quality of the students who take them ($X^2$ = 5.2, $p$ = 0.02). Additionally, 35.8% (167/466) of the population experienced daytime dysfunction, predominantly among sixth-year students (Table 2).

**Table 2.** Components of the Pittsburgh Sleep Quality Index. n = 466.

| | | | Medical school year | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1st | 2nd | 3rd | 4th | 5th | 6th | |
| Subjective sleep quality | | n(%) | 158(33.9%) | 115(24.7%) | 89(19.1%) | 37(7.9%) | 16(3.4%) | 51(10.9%) | 466(100%) |
| | Very good | n(%) | 2(1.3%) | 4(3.5%) | 6(6.7%) | 3(8.1%) | 0(0.0%) | 6(11.8%) | 21(4.5%) |
| | Fairly Good | n(%) | 42(26.6%) | 35(30.4%) | 30(33.7%) | 10(27.0%) | 7(43.8%) | 20(39.2%) | 144(30.9%) |
| | Fairly bad | n(%) | 94(59.5%) | 56(48.7%) | 43(48.3%) | 19(51.4%) | 7(43.8%) | 19(37.3%) | 238(51.1%) |
| | Very bad | n(%) | 20(12.7%) | 20(17.4%) | 10(11.2%) | 5(13.5%) | 2(12.5%) | 6(11.8%) | 63(13.5%) |
| Sleep latency | Not during the past month | n(%) | 30(19.0%) | 19(16.5%) | 11(12.4%) | 5(13.5%) | 1(6.3%) | 6(11.8%) | 72(15.5%) |
| | Less than once a week | n(%) | 47(29.7%) | 41(35.7%) | 20(22.5%) | 8(21.6%) | 8(50%) | 13(25.5%) | 137(29.4%) |
| | Once or twice a week | n(%) | 53(33.5%) | 32(27.8%) | 34(38.2%) | 12(32.4%) | 4(25%) | 23(45.1%) | 158(33.9%) |
| | Three or more times a week | n(%) | 28(17.7%) | 23(20.0%) | 24(27.0%) | 12(32.4%) | 3(18.8%) | 9(17.6%) | 99(21.2%) |
| Duration | > 7 hours | n(%) | 16(10.1%) | 13(11.3%) | 7(7.9%) | 4(10.8%) | 1(6.3%) | 5(9.8%) | 46(9.9%) |
| | 6-7 hours | n(%) | 31(19.6%) | 23(20.0%) | 20(22.5%) | 7(18.9%) | 6(37.5%) | 11(21.6%) | 98(21.0%) |
| | 5-6 hours | n(%) | 63(39.9%) | 50(43.5%) | 43(48.3%) | 13(35.1%) | 5(31.3%) | 22(43.1%) | 196(42.1%) |
| | < 5 hours | n(%) | 48(30.4%) | 29(25.2%) | 19(21.3%) | 13(21.3%) | 4(25.0%) | 13(25.5%) | 126(27.0%) |
| Sleep efficiency | > 85% | n(%) | 101(63.9%) | 73(63.5%) | 55(61.8%) | 26(70.3%) | 6(37.5%) | 18(35.3%) | 279(59.9%) |
| | 75-84 % | n(%) | 42(26.6%) | 30(26.1%) | 22(24.7%) | 4(10.8%) | 9(56.3%) | 18(35.3%) | 125(26.8%) |
| | 65-74 % | n(%) | 13(8.2%) | 12(10.4%) | 12(13.5%) | 7(18.9%) | 1(6.3%) | 14(27.5%) | 59(12.7%) |
| | < 65 % | n(%) | 2(1.3%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 1(2.0%) | 3(.6%) |
| Sleep disturbance | Not during the past month | n(%) | 62(39.2%) | 42(36.5%) | 40(44.9%) | 22(59.5%) | 7(43.8%) | 23(45.1%) | 196(42.1%) |
| | Less than once a week | n(%) | 78(49.4%) | 60(52.2%) | 44(49.4%) | 13(35.1%) | 8(50.0%) | 25(49.0%) | 228(48.9%) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Once or twice a week | n(%) | 14(8.9%) | 12(10.4%) | 5(5.6%) | 1(2.7%) | 1(6.3%) | 2(3.9%) | 35(7.5%) |
| | Three or more times a week | n(%) | 4(2.5%) | 1(.9%) | 0(0.0%) | 1(2.7%) | 0(0.0%) | 1(2.0%) | 7(1.5%) |
| Use of sleep medication | Not during the past month | n(%) | 115(72.8%) | 86(74.8%) | 64(71.9%) | 29(78.4%) | 13(81.3%) | 42(82.4%) | 349(74.9%) |
| | Less than once a week | n(%) | 24(15.2%) | 12(10.4%) | 10(11.2%) | 1(2.7%) | 2(12.5%) | 4(7.8%) | 53(11.4%) |
| | Once or twice a week | n(%) | 11(7.0%) | 10(8.7%) | 4(4.5%) | 5(13.5%) | 1(6.3%) | 4(7.8%) | 35(7.5%) |
| | Three or more times a week | n(%) | 8(5.1%) | 7(6.1%) | 11(12.4%) | 2(5.4%) | 0(0.0%) | 1(2.0%) | 29(6.2%) |
| Daytime dysfunction | Not during the past month | n(%) | 22(13.9%) | 19(16.5%) | 13(14.6%) | 1(2.7%) | 1(6.3%) | 4(7.8%) | 60(12.9%) |
| | Less than once a week | n(%) | 32(20.3%) | 28(24.3%) | 23(25.8%) | 10(27.0%) | 6(37.5%) | 12(23.5%) | 111(23.8%) |
| | Once or twice a week | n(%) | 49(31.0%) | 42(36.5%) | 33(37.1%) | 14(37.8%) | 6(37.5%) | 23(45.1%) | 167(35.8%) |
| | Three or more times a week | n(%) | 55(34.8%) | 26(22.6%) | 20(22.5%) | 12(32.4%) | 3(18.8%) | 12(23.5%) | 128(27.5%) |

In the overall results of the sleep quality index, 64.4% (300/466) have moderate sleep quality, followed by 27.5% (128/466) with poor sleep quality and only 8.2% (38/466) who reported good sleep quality (Table 3).

**Table 3.** Pittsburgh's Sleep Quality Index results. n = 466.

| Year | Good sleep quality | χ2-statistic (P-value) | Moderate sleep quality | χ2-statistic (P-value) | Poor sleep quality | χ2-statistic (P-value) | Total |
|---|---|---|---|---|---|---|---|
| 1st | 11(28.9%) | 0.2 (0.62) | 108(36.0%) | 1.3 (0.23) | 39(30.5%) | 0.7 (0.3) | 158 |
| 2nd | 12(31.6%) | 0.6 (0.4) | 72(24.0%) | 0.1 (0.73) | 31(24.4%) | 0.0004 (0.9) | 115 |
| 3rd | 7(18.4%) | 0.0 (1.0) | 58(19.3%) | 0.002 (0.9) | 24(18.8%) | 0.0 (1.0) | 89 |
| 4th | 3(7.9%) | 0.0 (1.0) | 20(6.7%) | 1.4 (0.23) | 14(10.9%) | 1.6 (0.2) | 37 |
| 5th | 0(0%) | 0.5 (0.45) | 12(4.0%) | 0.4 (0.52) | 4(3.1%) | 0.0 (1.0) | 16 |
| 6th | 5(13.5%) | 0.03 (0.8) | 30(10.0%) | 0.5 (0.4) | 16(12.5%) | 0.2 (0.6) | 51 |
| Total | 38(8.2%) | | 300(64.4%) | | 128(27.5%) | | 466 |

## Discussion

A significant proportion of students surveyed in this study exhibited moderate sleep quality, surpassing the figures reported in a study at the Universidad Católica Santo Toribio de Mogrovejo (USAT) in Peru, which included 247 health students with an average age of 20.0 years (of whom 89 were medical students), and reported that 89.5% had moderate sleep quality (Preišegolavičiūtė et al., 2010). Likewise, a study in the Universidad Tecnológica de Pereira, in Colombia, found similar results (Roa et al., 2016). The higher proportion of students with moderate sleep quality in Paraguayan medical schools compared to those in Peru and Colombia may be due to the fact that the Paraguayan students were not in an examination period, but analyzing the methodological details of each study is also essential to fully understand the reasons for these differences.

The majority of students with moderate sleep quality, 70.8%, were concentrated in the first (71.5%) and third years (38%), contrasting with the findings of Ayala et al. (2017), who surveyed 860 medical students from the first to the fourth year in the District of Columbia and found moderate sleep quality in the first and fourth years (Salazar Carrillo et al., 2013). This disparity could be due to the varying coursework demands and potentially heavier workloads for Paraguayan medical students.

When analyzing the components of the PSQI separately, it was found that sleep latency, or the time it takes to fall asleep, showed that most students (74.9%) did not experience disorders in the last month. This contrasts with the findings of Sierra et al., (2002), who reported disturbances once or twice a week. This difference might be because most Paraguayan medical students surveyed were in their first and second years, adjusting to their study and rest schedules.

Regarding sleep efficiency, positive responses were higher in the first (59.9%) and second years (26.8%) in this study, while Sierra et al. (2002) reported higher concentrations in the third and fourth years. This difference might be because the initial years focus more on theoretical knowledge, which has different demands compared to the later years that emphasize clinical practice, and increase physical and mental demands.

Sleep disturbances varied across different years of study, with the highest positive responses in the first (39%), second (36%), and sixth year (45%). This differs from the findings of Sierra et al. (2002) and Del Piélago Meoño (2013a), who found better sleep efficiency scores in the second and third years. This difference could be attributed to efficient rest times due to exhaustion and established routines, maximizing the rest time available to medical students.

Daytime dysfunction had the highest negative score in this study for first-year students (34.8%), similar to a study by Del Piélago Meoño et al. (2013b) in Peru, where 85.6% of first-year students experienced daytime dysfunction three or more times a week This could be due to high academic demands, exams, and the pressure to learn and retain extensive information. Contrary findings have been reported in other studies, such as a study at the Universidad de los Andes Mérida-Venezuela (Villarroel & Maribel, 2014), which found that only 13.6% of 427 students experienced daytime dysfunction three or more times a week. Similarly, Preisegolaviciūtė et al. (2010) in Lithuania reported only 9.4% of 138 students experiencing this level of dysfunction (Wamsley & Stickgold, 2011). These differences could be due to more flexible schedules that better accommodate study and personal activities.

It is worth noting the effect, positive as it may seem by the results on our students using hypnotics, of the positive association between good sleep quality and the use of sedative-hypnotics such as zolpidem and others. This has been already shown by many authors, such as Satheesh et al. (2020).

There has also been a positive association between commute time and overall sleep quality, where those who spend more than 30 minutes to one hour of commute have worse sleep quality compared to those who spend less than 30 minutes to go to the hospital or university. Regarding the time slept, people who slept on average less than five hours per night the past month showed worse sleep quality. Both factors can be tied together in a way that if they have a long commute ahead, they tend to wake up earlier, therefore, sleep less time and have moderate to poor sleep quality, and all of the problems that this brings along (Gascón et al. 2015).

This study has limitations, including the use of non-probabilistic sampling and potential issues with generalizability. Self-assessment of sleep quality may also be subject to response biases. Our findings suggest that academic load might be linked to deteriorating sleep quality among students, particularly with increased hours in clinical practice or a higher number of subjects per semester. Additional demands such as working could further exacerbate this, negatively impacting health and academic performance (Wang et al., 2016; Wolkove et al., 2007).

## Conclusion

In conclusion, most students showed moderate sleep quality. This could be due to the intense academic load and the extensive schedule of theoretical and practical classes, exacerbated by the need to work while studying. For the future, a longitudinal follow-up of the students is recommended to assess the impact of variables such as stress, evaluations, the number of subjects, and clinical hours per semester on sleep quality. Additionally, the implementation of institutional interventions to address this issue is suggested.

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