ORIGINAL ARTICLE

# Cross-sectional Study on the Correlation of Stress and Sleep Quality of Learning Unit III (1st Year) to VII (5th Year) Medical Students from the University of the Philippines College of Medicine

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## ABSTRACT

**Background and Objective.** Due to their academic load, medical students are highly susceptible to stress. Stress is one of the factors that can alter sleep quality which may consequently affect the cognitive performance of medical students. There has been a lack of published local literature that looks into the association between stress and sleep quality, especially during the COVID-19 pandemic. With this, the general objective of this study is to determine the effect of stress on the sleep quality of medical students from the University of the Philippines Manila - College of Medicine (UPCM).

**Methods.** A cross-sectional study was conducted using a stratified random sample of 273 males and females of Learning Unit (LU) III (1st year) to VII (5th year) medical students from a college of medicine based in the Philippines, UPCM, during the second semester of the academic year 2021-2022. A self-administered questionnaire was distributed to assess sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and stress level using the Kessler Psychological Distress Scale (K10). Kruskal-Wallis was used to test statistical differences between stress scores and the sleep quality of students from different year levels. Spearman's Rho was used to determine the correlation between stress and sleep, and a binary logistic regression was employed to study the association of stress with sleep while accounting for confounding variables namely caffeine intake, year level, daytime nap, duty hours, clinical rotation, sex, and age.

**Results.** A high prevalence of stress (79.71%) and poor sleep quality (59.73%) among LU III to LU VII UPCM students were found, with a statistically positive correlation (ρ=0.44) 95CI [0.33-0.55] (p-value<0.001). Both the stress scores and sleep quality indices were not statistically significantly different across LUs. Gathered data and interpreted results showed that medical students suffering from stress are more likely to have poor sleep quality, which can lead to low academic performance and high susceptibility to chronic diseases, compared to those medical students with low levels of stress. Only being an LU IV [OR=1.38 95CI (0.036-4.625)] and LU V [OR=2.13 95CI (0.296-6.936)] student had increased odds of having poor sleep quality compared to LU III students. Caffeine intake, daytime nap, duty hours, clinical rotation, sex, and age were not associated with poor sleep quality.

**Conclusion.** This study documents a statistically significant association between stress and poor sleep quality among LU III to LU VII UPCM students. A larger study covering multiple medical schools in the Philippines may be of merit for future investigations to generate nationwide data. Additional recommendations include: a) conducting a cross-sectional or a longitudinal study to detect changes in the characteristics of the population, b) observing the differences in the contributing factors at multiple points throughout the year, c) investigating the effect of dwelling set-up on sleep quality may also be investigated and d) determining if sleep quality affects the level of perceived stress of medical students.

*Keywords: sleep quality, stress scores, medical student*



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## INTRODUCTION

Medical students are highly susceptible to stress due to their exposure to a significant level of academic pressure. Stress often leads to sleep disturbance, which subsequently leads to decreased neurocognitive and psychomotor performance, as well as impaired physical and mental health.[1] In the context of physiology, exposure to stress affects the activity of the hypothalamic-pituitary-adrenal (HPA) axis and its primary hormonal product, namely cortisol, and of several biological functions such as sleep.[2] A cascade of endocrine reactions and an arousal increase are also elicited by stress which interrupts normal sleep function.[3]

There are multiple studies that have reported evidence of the association between impaired sleep quality and high-stress levels among medical students. Multiple published studies reported this association using cross-sectional surveys on all medical students.[4-11] One particular study conducted by Aloitabi and colleagues in 2020, which focused on understanding sleep quality and stress amongst preclinical medical students (1st-3rd year) in a university in Saudi Arabia, found that poor sleep quality (77.0% of participants) was significantly associated with elevated mental stress levels (63.5% of participants) and having daytime naps.[12] This conclusion is similar to another study that looked at the stress and sleep associations in medical students during their clinical training.[13] Locally, a study on medical students from the University of the Philippines College of Medicine (UPCM) previously showed different trends in impaired sleep quality across learning units (LU). The Learning Units in UPCM correspond to the year levels whereas LU I and LU II are year levels before the medicine proper and the LUs III, IV, V, VI and VII correspond to 1st, 2nd, 3rd, 4th (clerkship), and 5th (internship) year levels, respectively. The study reported a lower mean duration of sleep (hrs) observed in LU III (beginning of preclinical years) and LU VI (clinical year).[10] These studies suggest that differences in stress levels, sleep quality, and their association exist depending on the year of study in medical education.

Some of these studies also considered various possible confounding variables in determining associations between sleep quality and stress levels. The most common demographic characteristics considered were age, gender, residency, academic level, lifestyle, caffeine intake, substance abuse, marital status, and work status. Among these, academic level and caffeine intake were found to be significant factors for high-stress levels or poor sleep quality the most.[4-16] Moreover, other studies looked into the relationship between sleep quality and other mental health conditions such as anxiety and depression.[8,11] Symptoms of depression, anxiety, and high-stress levels were all found to be correlated with decreased quality of sleep among medical students.[8,11,17]

There have been various studies showing associations between elevated levels of stress and poor sleep quality among medical students using different populations, stress, and sleep metrics and considering different possible confounding factors and all of the studies have shown a statistically significant correlation between poor sleep quality and elevated stress levels. However, to date, the researchers found a seeming lack of such published local literature here in the Philippines warranting a similar investigation, especially in the context of the COVID-19 pandemic. The researchers, being medical students themselves, experience mental stress and sleep quality issues firsthand, and have thus decided to conduct this study for the benefit of all medical students. They have agreed that medical students must be informed about the effects of their sleep patterns on their overall function so that they may make necessary changes to improve their performance and mental health[12] and reduce their stress levels.[5] Moreover, an investigation into how the stress scores, sleep quality, and their relationship differ between the different year levels provides information that can aid students in preparing for each year level and that the college may take into consideration when making or revising curriculums and schedules.

With this, the general objective of this study was to determine the association of stress and sleep quality of LU III to VII medical students of the UPCM. Specifically, this study aims to determine the stress scores and sleep quality indices of LU III to LU VII students using the Kessler Psychological Distress Scale (K10) and Pittsburgh Sleep Quality Index (PSQI), respectively, and compare these variables. The association between stress scores and sleep indices was also investigated taking into account the confounding variables namely caffeine intake, year level, daytime nap, duty hours, clinical rotation, sex, and age. On the other hand, the differences in contributing factors between the learning units such as the curriculum design and the activity during the data collection that may affect the stress and sleep quality will not be assessed. The study will also be limited to the students of UPCM and hence, does not reflect the stress and sleep quality of the general population of medical students locally and internationally.

This study sought to enlighten the faculty regarding the situation of their students so that policy changes may be implemented and the curriculum may be adjusted to optimize students' learning and well-being. Moreover, the fulfillment of the objectives of this study would allow the incorporation of the learnings from related literature such as those performed in Saudi Arabia[11] and Pakistan[9] into the local setting. Likewise, it is expected that the target population for this study would receive similar, although more customized, benefits to that obtained from these studies previously conducted. The results of this study can also be used in developing future studies investigating the stress and sleep quality of students from different medical colleges in the Philippines and provide a general basis for curriculum and policy reforms.

# METHODS

## Study Design

This is a cross-sectional analytic study conducted between January-May 2022, with UPCM students during the second semester of the academic year 2021-2022 to determine the association between stress score determined using the K10 Psychological Distress Scale (independent variable) and sleep quality determined using the Pittsburgh Sleep Quality Index (dependent variable). The K10 scale comprises ten quantitative questions to investigate stress levels by quantifying the frequency of feelings of stress, anxiety, and depression in the past month, from 1 (none of the time) to 5 (all of the time). The severity of psychological distress is defined by specific numerical ranges: low (10-15), moderate (16-21), high (22-29), and very high (30-50). As for the PSQI, this scale includes 19 self-rated questions and additional five items to be evaluated by a room mate or bed partner if there's any. PSQI measures sleep quality by assessing the frequency and severity of seven components: day time dysfunction, habitual sleep efficiency, sleep quality, sleep latency, sleep duration, step sleep disturbances, and use of sleeping medication. The subscores of the components are tallied to yield a global score, which ranges from 0 to 21. Global scores of more than 5 are classified as poor sleepers, with higher scores indicating poorer sleep quality. Lower scores indicate a healthier sleep quality. The questionnaires are available as supplementary materials. Local studies have already been conducted to have proven the validity of these tests in the Philippine context.[18,19] In addition to these tests, specific factors that may influence sleep quality including caffeine intake, year level, daytime nap, duty hours, clinical rotation, sex, and age were also studied.

## Selection of Participants and Sample Size Calculation

This study involved students from LUs III to VII only, with the members of the investigating team excluded from the sampling population; LU III, IV, V, VI, VII correspond to 1st, 2nd, 3rd year medical proper, clerkship, and internship, respectively. A total of ten strata were generated based on year level and biological sex, and stratified random sampling was conducted to determine the participants of the study. Each strata sample was calculated based on the total population – 891 – at a 95% confidence interval, 5% margin of error, and a z-score of 1.96 to ensure sufficient representation across the different levels. Moreover, an additional 20% of the total sample population was also included to ensure an adequate response rate.

## Data Collection: Ethics and Assessment Tools

Prior to the commencement of data collection, ethical approval from the University of the Philippines Manila Research Ethics Board was acquired for the study. Participants were informed of the objectives of the study and informed written consent was included in the first section of the electronic questionnaire. Moreover, the participants were free to withdraw from the study at any stage and their information was kept confidential, pursuant to Chapter VI, Section 16 of the Data Privacy Act of 2012, and used for research purposes only.

An electronic self-administered questionnaire was distributed to the participants through electronic mail and was kept open for 30 days. Once consent from the participants was acquired, the second section focused on the demographics and lifestyle of the respondents, followed by the K10 scale and the PSQI. Moreover, to address non-response among the participants, two follow-up electronic emails were sent to the participants, one given a week after the initial distribution of the questionnaires, and the second one sent a week thereafter.

## Data Management and Statistical Analysis

The questionnaires were automatically linked to a protected Google Spreadsheet file to minimize any possible data leak. De-identification of the raw data was then conducted by a separate data processing unit in the investigative team to avoid linkage of responses to the respondents. Participants with incomplete or incorrect data were excluded from the analysis given that the missing data from such participants fell under MCAR (missing completely at random) or MAR (missing at random). Furthermore, only those who were clinically diagnosed with sleep disorders were considered as having sleep disorders during the analysis of the confounding variables.

Data analysis was performed by three members of the analysis team using Google Spreadsheet, Excel, and R (version 4.1.2) separately and triangulation of the final results was done to ensure the validity of quantitative results. The correlation between stress scores and sleep quality indices was calculated using Spearman's Rho and the effect size was categorized based on Cohen's criteria.[20] Meanwhile, the Kruskal-Wallis test was used to determine if there are statistically significant differences between the K10 scores and the PSQI scores of the different LUs. Lastly, in order to understand further the effect of stress on sleep while accounting for other possible confounding factors, binary logistic regression was performed. A p-value <0.05 was considered significant for all statistical tests.

# RESULTS

## Population and Demographics

There were a total of 273 participants who responded and the breakdown of respondents per strata can be found in Table 1. Two respondents were excluded due to missing/inappropriate responses. The final sample used in this study was n = 271, 30.4% of the whole population. The response rate overall was RR = 37.6% with the highest response rate among LU III students (63.4%) and the lowest response rate among LU VI students (26.9%). Given the overall

**Table 1.** Distribution of Population, Recruited Population per Strata and Response Rate

| Strata | LU III | | LU VI | | LU V | | LU VI | | LU VII | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | M | F | M | F | M | F | M | F | M | |
| *Total (N)* | 84 | 84 | 98 | 77 | 94 | 89 | 93 | 89 | 93 | 90 | 891 |
| *Recruited (n + 20%)* | 71 | 71 | 71 | 74 | 70 | 73 | 72 | 73 | 72 | 73 | 721 |
| *Number of respondents (RR%)* | 41 (48.8%) | 47 (56%) | 30 (39.0%) | 19 (19.4%) | 24 (25.5%) | 23 (25.8%) | 17 (18.3%) | 22 (24.7%) | 24 (26.7%) | 24 (25.8%) | 271 (37.6%) |

*N: total population per strata; n: ideal sample calculation; Recruited population size: n + 20% of each strata; RR (response rate): % of responses / recruited population. *Excluded 2 due to incomplete / inappropriate data*

**Table 2.** Summary of K-10 Stress Scores and PSQI Scores per Learning Unit (LU)

| Variable | Mean K-10 Stress Score (± SD) | Confidence Interval at 95% (±) | Mean PSQI scores (± SD) | Confidence Interval at 95% (±) |
|---|---|---|---|---|
| *LU III* | 24.24 ± 7.95 | 1.66 | 5.96 ± 2.52 | 0.53 |
| *LU IV* | 22.35 ± 8.25 | 2.31 | 6.39 ± 2.91 | 0.84 |
| *LU V* | 21.98 ± 7.51 | 2.15 | 6.64 ± 3.10 | 0.91 |
| *LU VI* | 21.00 ± 6.10 | 1.92 | 6.85 ± 2.97 | 0.96 |
| *LU VII* | 22.23 ± 7.48 | 2.12 | 6.73 ± 2.49 | 0.72 |
| *Overall* | 22.68 | 0.91 | 6.42 | 0.33 |
| *p-values* | 0.2458 | | 0.3892 | |

proportion (poor sleep quality, 57.93%) shown in the Sleep Scores of LU III to LU VII students section, a total population of N=891, a sample size of n=271, and a 95% CI, the computed margin of error was ±4.906 (±5).

## Stress Scores of LU III to LU VII students

Table 2 shows the summary of mean stress scores and the PSQI scores per LU. The average stress scores fall under moderate to high psychological distress levels. Overall, the mean K10 stress score was 22.68±0.91. LU III students reported the highest average stress score (24.24±1.66) while LU VI had the least average stress score (21.00±1.92). It can be seen that there is a reduction in K10 stress scores as the year level advances except for the last year. According to the result of the Kruskal-Wallis test, however, the differences in the K10 stress scores among the different LUs are not statistically significant (p-value = 0.2458). There is no sufficient evidence to support that the stress scores of the LUs are statistically different (i.e., lower or higher) when compared to the stress scores of the other LUs.

The stress scores of LU III to LU VII students using the K10 questionnaire were determined and categorized as low (10-15), moderate (16-21), high (22-29), and very high (30-50).[21-23] The percentage frequency distribution in each learning unit is illustrated in Figure 1.

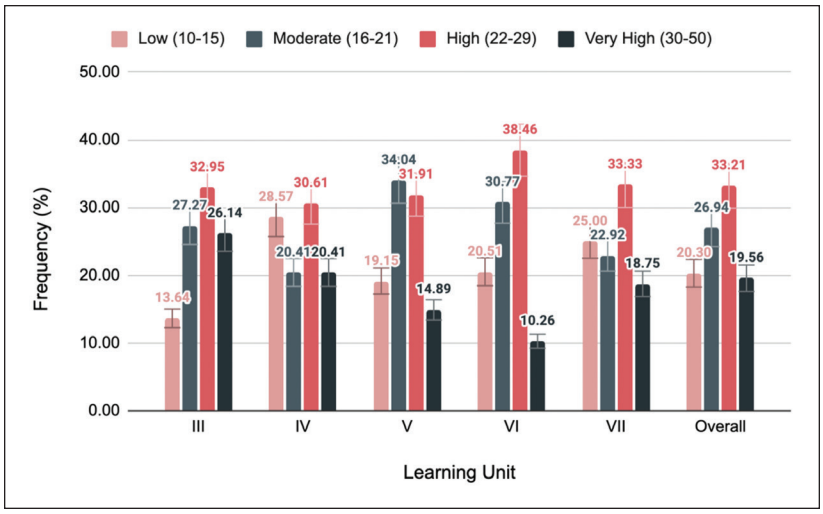


**Figure 1.** Frequency distribution (in terms of %) of medical students according to their psychological distress level (low, moderate, high, and very high) stratified by Learning Unit.


**Figure 2.** Frequency distribution (in terms of %) of medical students with good vs. poor sleep quality stratified by Learning Unit.

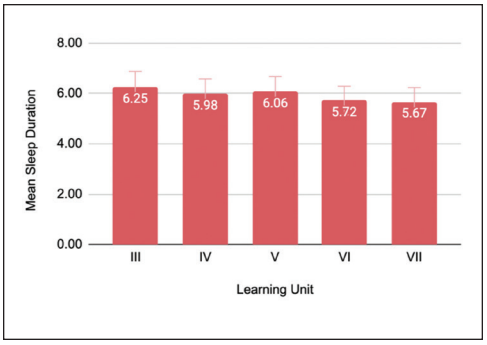


**Figure 3.** Average sleep duration per Learning Unit.

## Sleep Scores of LU III to LU VII students

As seen in Table 2, the mean global PSQI score was 6.42±0.33. LU VI had the highest mean PSQI score of 6.85, and LU III had the lowest, with a mean score of 5.96. Moreover, the mean PSQI scores between the different LUs were not statistically significant (p = 0.3892) from the Kruskal-Wallis Test.

The distribution of those with good or poor sleep quality among the different LUs is illustrated in Figure 2. Most of the medical students were considered to have poor sleep quality across the different LUs. Overall, 57.93% of the 271 respondents have poor sleep quality or a global PSQI score of less than 5.

During the month preceding the survey, the average total hours of sleep was 5.99 ± +1.17 per night. Figure 3 shows the self-reported hours of sleep across the different LUs. Statistical analysis shows that there is a statistically significant difference (p = 0.003) between the hours of sleep of LU III and VII students. The rest of the sleep durations did not differ significantly (p >0.05) between the different year levels.

Of the seven components, sleep duration, sleep latency, daytime dysfunction, and subjective sleep quality had means above 1, associating them with the highest contributors to the global PSQI score. Sleep disturbance, sleep efficiency, and the use of sleep medications had mean scores below 1.

The frequencies of the component scores of sleep quality are shown in Table 3. It was noted that only 25.83% reported sleeping for at least 7 hours in a day. Sleep efficiency of less than or equal to 74% was reported by 13.65%. Self-reported sleep quality was estimated to be fairly bad or very bad for 23.25% while 76.75% rated their sleep quality as fairly good or very good. Moreover, the use of medication in the last month was reported by 7.75%.

## Correlation between Sleep and Stress

The stress and sleep scores are rank ordinal data of range [1-50] and [1-21], respectively and all participants had individual stress and sleep scores, satisfying the assumptions for Spearman Rho correlation analysis. There is also a monotonic increasing relationship between stress and sleep scores. Table 3 shows the results of the overall correlation analysis and the sub-cohort (by LU) analysis.

There is a statistically significant positive correlation, ρ = 0.44 95CI [0.33-0.55] (p-value <0.001) between stress scores and sleep scores among medical students. The correlation remained significant when the analysis was done on sub-cohorts categorized by LU as shown in Table 4, except for LU VI. Among LU VI students, the correlation between stress and sleep scores was ρ = 0.26 95CI [-0.09-0.60] (p-value =0.11) which was not statistically significant. Note, however, that the statistical power for this subgroup's analysis was only 36% which suggests that the subgroup may be under-sampled to detect any significant correlation. The correlation coefficients obtained (ρ) for the entire sample population and for each sub-cohort by LU were classified as moderate-high correlation according to Cohen's criteria.

## Analysis of factors affecting poor sleep quality among medical students

As shown in Figure 4, among the confounding variables, academic level particularly being in LU IV (p-value= 0.0441) and LU V (p-value=0.0130) significantly affected the sleep quality indices given α = 0.05. The logistic regression analysis showed that given all other variables are the same, a student being in LU IV has a 1.38x 95CI (0.036-4.625), and being in LU V has a 2.13x 95CI (0.296-6.936) increased odds of having poor sleep quality compared to LU III students. Being an LU VI or LU VII did not have a significant difference in odds of having poor sleep quality compared to LU III.

**Table 3.** Characteristics of the Pittsburgh Sleep Quality Index (PSQI) including Frequency and Percentage (%) distribution of Medical Students with Corresponding Scores for each PSQI Sleep Component

| PSQI Component | Component Score | Interpretation | Frequency | Percentage (%) |
|---|---|---|---|---|
| ***Sleep Duration*** | 0 | ≥7 h | 70 | 25.83 |
| | 1 | 6-7 h | 116 | 42.80 |
| | 2 | 5-6 h | 60 | 22.14 |
| | 3 | <5 h | 25 | 9.23 |
| ***Sleep Disturbance*** | 0 | - | 39 | 14.39 |
| | 1 | - | 210 | 77.49 |
| | 2 | - | 20 | 7.38 |
| | 3 | - | 2 | 0.74 |
| ***Sleep Latency*** | 0 | - | 68 | 25.09 |
| | 1 | - | 111 | 40.96 |
| | 2 | - | 58 | 21.40 |
| | 3 | - | 34 | 12.55 |
| ***Day Dysfunction due to Sleepiness*** | 0 | - | 22 | 8.12 |
| | 1 | - | 170 | 62.73 |
| | 2 | - | 66 | 24.35 |
| | 3 | - | 13 | 4.80 |
| ***Sleep Efficiency (%)*** | 0 | ≥85% | 191 | 70.48 |
| | 1 | 75-85% | 43 | 15.87 |
| | 2 | 65-75% | 18 | 6.64 |
| | 3 | <65% | 19 | 7.01 |
| ***Overall Sleep Quality*** | 0 | Very good | 12 | 4.43 |
| | 1 | Fairly good | 196 | 72.32 |
| | 2 | Fairly bad | 60 | 22.14 |
| | 3 | Very bad | 3 | 1.11 |
| ***Need Meds to Sleep*** | 0 | Not during the past month | 250 | 92.25 |
| | 1 | Less than once a week | 6 | 2.21 |
| | 2 | Once or twice a week | 9 | 3.32 |
| | 3 | Three or more times a week | 6 | 2.21 |

**Table 4.** Spearman Correlation Analysis on Stress Scores vs. Sleep Scores for the Sub-cohorts Grouped according to LU and the Entire Sample

| Year Level | n | P-value (α = 0.05) | 95% CI | Statistical power (%) | Correlation Coefficient (ρ) | Effect size classification |
|---|---|---|---|---|---|---|
| ***LU III*** | 88 | <0.001 | 0.41 - 0.75 | 99 | 0.59 | high |
| ***LU IV*** | 49 | <0.001 | 0.22 - 0.75 | 95 | 0.48 | moderate-high |
| ***LU V*** | 47 | <0.001 | 0.24 - 0.75 | 96 | 0.50 | high |
| ***LU VI*** | 39 | 0.11 | -0.09 - 0.60 | 36 | 0.26 | moderate |
| ***LU VII*** | 48 | 0.01 | 0.08 - 0.64 | 72 | 0.36 | moderate |
| ***All*** | 271 | <0.001 | 0.33 - 0.55 | 99 | 0.44 | moderate-high |

The analysis in Figure 4 also showed that poor sleep quality indices are significantly affected by all higher levels of psychological distress (moderate, high, very high) given a much lower confidence level α = 0.0001. The full tabulated results are available as supplementary materials. This means that given all other confounding variables are the same, having moderate stress levels significantly increases the odds of having poor sleep quality by 4.29x 95CI (1.269 - 11.094) compared to those with low-stress levels. Meanwhile having high-stress levels increases the odds of having poor sleep quality by 7.21x 95CI (2.696 - 18.464) and having very high-stress levels increases the odds by 22.50x 95CI (7.584 - 71.049) compared to those with low-stress levels. Hence, the higher the stress levels, the more likely it is to have poor sleep quality. This finding is congruent with the positive correlation between stress scores and sleep quality indices noted in Spearman Correlation Analysis.

## DISCUSSION

A total of n=271 (30.4%) eligible UPCM students were successfully recruited and included in the study. The

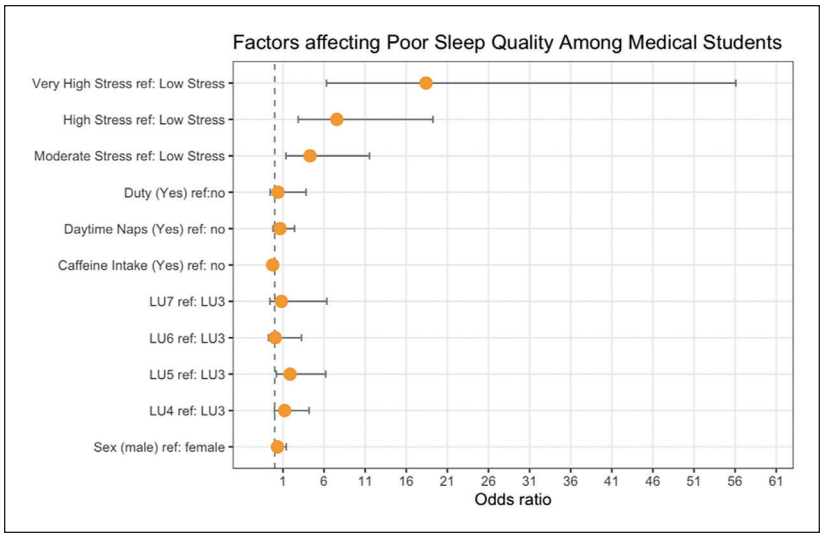


**Figure 4.** Adjusted odds-ratio with corresponding 95% CI for factors affecting poor sleep quality.

response rate is lower in this study compared to a previous sleep quality-related study conducted last 2016 to 2017 by Jorge et al.[10], which had 426 (59%) participants. The possible reasons for the lower response rate include the limitation brought by the online set-up, the administration of the questionnaire near the end of the semester, around April and May, when students may be preoccupied with finishing requirements, and the possible preoccupation that came with the national elections.

In general, it is known that medical students are subjected to various stressors. The descriptive statistics of K10 questionnaire in terms of agreement level (%) per LU is available as supplementary materials. Interestingly, "being tired out for no good reason" was the top source of stress among UPCM medical students according to the K10 results. The number of students who answered "some of the time to all of the time" to the question of being nervous was also high (58-65% per LU). According to the study of Zhan et al., the difficulties in schoolwork—combined with adjustments due to the pandemic, such as reduced social interaction, stay-at-home restrictions, and substantial changes to their daily routine—may all have contributed to students to experiencing moderate-very high stress.[24]

Results show that LU III and LU VI have the highest and lowest average stress score, respectively. Possibly, the adjustments that come with entering the first year of medicine proper are a significant stressor. It can also be noted that the average stress scores decrease with increasing year levels except for the last year (LU VII - clinical internship). This finding is similar to the observation in the study of Safhi et al.[6] However, the stress scores across LUs were found to not be statistically significantly different using the Kruskal-Wallis test. This may suggest that each academic year level has its own source of stress (i.e., academic curriculum, learning set-up) and varying coping mechanisms. Yet, in general, all medical students experience an elevated level of stress ranging from moderate to very high stress.

In the study, 57.93% of the participants had poor sleep quality. This is similar when compared to medical students in other countries such as the United States (50.9%)[25] and Ethiopia (55.8%).[16] However, this result appears to be lower than in countries like Saudi Arabia (77%).[11] Furthermore, it was shown that the medical students sleep for 5.99 ± 1.17 hours a day, which is less than the recommended duration of 8 to 10 hours. This result is still consistent with a prior local study, which reported an average duration of 6.43 hours per night.[10] The data show that sleep duration generally decreases with increasing year level, except for LU V. The LU VII students had the shortest sleep duration, and this had a statistically significant difference when compared to LU III. This trend can be accounted for by differences in particular curriculum components, such as clinical rotations, which may contribute to the shorter sleep duration of those in LU VII.[25]

A statistically significant association was found between stress scores and sleep indices of medical students overall with Spearman Rho's correlation coefficient of $\rho = 0.44$ 95CI [0.33-0.55] (p-value <0.001). The correlation was significant in a sub-cohort analysis done per LU level except for LU VI which had a p-value= 0.11 and statistical power = 36% suggesting that the sub-cohort may be under-sampled (n=39) to detect a significant correlation. All correlation coefficients per LU and overall were classified as moderate-high effect size based on Cohen's criteria. The results of the overall correlation analysis are congruent with eight other published literature[4-11] which reported a significant association between stress and sleep among medical students using a similar cross-sectional study design. Safhi et al.[5] who used the same study design and metrics (K10 and PSQI Questionnaire)

reported a correlation of 0.371 (moderate correlation) which falls within the 95% CI of this study's estimates which further strengthens the evidence for the association between the two variables.[5] Furthermore, the logistic regression analysis revealed that increased stress levels are associated with increasing levels of impaired sleep quality even while accounting for multiple other confounding variables.

The negative effect of stress on sleep quality is evident in different studies. In the study by Ramamoorthy et al.,[26] stress was associated with a decrease in sleep quality among adolescents who are academically overloaded. High-stress levels also lead to higher fatigue severity and the manifestation of depressive symptoms.[27] Further, sleep disruption leads to short-term consequences which may include emotional distress, reduced quality of life, mental health and behavior problems, and cognition, memory, and performance deficits. In addition to that, in the context of medical students, poor sleep hygiene is also reported to negatively affect their academic performance[28]; elevated levels of stress result in poor sleep quality for medical students.[5]

It was also found that the academic level (LU) was a statistically significant predictor of poor sleep quality. That is, the adjusted odds of an LU IV student having poor quality of sleep is 1.38 times higher than an LU III student. LU V students are also more likely to have a poor quality of sleep than LU III students by a factor of 2.16. While LU VI and LU VII students were reported to not have a significant difference in odds of having impaired sleep quality compared to LU III students. Waqas et al. and Al-Khani et al.,'s respective studies also showed that the year of study or level of medical education and academic-related stressors was significant factor for poor sleep quality.[9,11] Lemma et al.[16] also reported that female students, particularly those in second (LU IV in UPCM) and third-year (LU V in UPCM) have higher adjusted odds of having poor sleep quality.[16] The results of their study closely resemble the observations in this study except that no significant difference was observed in terms of sex. The absence of a significant association between sex and sleep quality is also consistent with the result of other studies.[4,5]

Lastly, other possible confounding factors such as daytime naps[12] were found to be significantly associated with poor sleep quality and high-stress levels in other studies but this was not statistically significant in this study. Caffeine intake was not significant, unlike the other studies where caffeine intake was a significant factor for high-stress levels or poor sleep quality.[4-11,15,16] The length and frequency of daytime naps, amount of caffeine intake, and type of coffee were not taken into account.

## CONCLUSION

This study has shown that the majority of UPCM students experience moderate-very high levels of stress and at the same time more than half experience poor sleep quality. The evidence for the association between stress and sleep quality was extensively elicited as well as the differences across different year levels. These trends and correlations may be attributed to several factors including the differences in the curricular components of the LUs, the number of hours doing clinical rotations and duties, or the mode of teaching (i.e., online vs face-to-face classes) among many others.

Most medical students are exposed to academic, mental, and emotional stressors which have been shown to be associated with the deterioration of their sleep quality and may consequently affect their academic performance. This also makes these students susceptible to chronic illnesses or diseases which may reflect the health care they will provide to their future patients. As a part of the primary health care system, it is beneficial to identify the risk factors that impair the quality of sleep and to determine socioeconomic stressors to alleviate their effects and avoid their aforementioned consequences.

Hence, there is a need for medical academic institutions like UPCM to constantly address and tackle this issue by reducing the effects of stressors through student counseling; providing financial support and lodging; adjusting and modifying academic policies with respect to the changing times; and motivating their students to get involved in socio-cultural programs like volunteering in medical missions and extracurricular activities such as exercising, meditating, and listening to music.

### Recommendations

The study only intended to determine and compare the stress scores and the sleep quality indices among LU III to LU VII students of the UPCM. Hence, it is recommended for future studies to involve a larger sample size that will cover multiple medical schools in the Philippines. Cross-sectional and longitudinal studies could also be conducted to detect changes in the characteristics of the population especially with changing modes of learning experienced by medical students (face-to-face vs. blended vs. purely online learning). The effect of dwelling set-up (e.g., having a bed partner or roommate, living at home with a family or apartment) on sleep quality may also be investigated. A prospective study assessing the differences in the contributing factors in stress scores and sleep qualities at multiple points throughout the year is also recommended. It is also encouraged to determine if sleep quality directly affects the level of perceived stress.

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## Data availability

All supplementary materials can be made available upon request. Please email the corresponding author.

## Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

## Author Disclosure

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