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Correlation between average sleep duration among medical students and their performance in physiology final exam

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Abstract

Sleep is a restful state of mind that plays a crucial and significant role in consolidation of memory. Several studies have reported that better and proper sleep is associated with superior cognitive functions including better learning and memory which is critical for successful academic performance. The present study was set to determine whether a correlation exists between the average sleep duration in medical students and their performance in physiology final examination score. This study was conducted in a Caribbean Medical School after approval from the Institutional Review Board. 40 medical students (23 male, 17 female) from first year of MD program were selected based on the inclusion criteria after informed written consent. The participants reported their average sleep duration in hours based on the records in their smart phones and wearable sleep/activity tracker devices. The data of their age, gender, body mass index, average sleep duration, and physiology final examination scores were tabulated in Microsoft Excel and descriptive analysis was done. The correlation of their average sleep duration in hours to physiology final examination scores in percent was determined by a Pearson correlation coefficient and regression analysis. The correlation coefficient (adjusted r^2) of our study was 0.028 and significance P was 0.154. The average sleep duration of medical students was not significantly correlated with the physiology final examination score % ($r_{(38)} = 0.229$, $p = 0.154$). The regression model predicted only 5.3% ($R^2 = 0.053$) of the physiology final examination score of medical students. Medical students with an average sleep duration of more than 6 hours performed better in their physiology final exam. Our study concludes that there is no significant correlation between the average sleep duration in medical students and their performance in physiology final exam. However, medical students with an average sleep duration of 6 hrs. or more scored better in their physiology final exam. Therefore, our study aligns with the findings of the other studies, and we conclude that the longer duration of sleep for more than 6 hours is associated with better academic performance. So, correlations of the sleep duration and quality in medical students with their performance in other subjects and examinations need to be assessed in further studies.

Keywords: Sleep; Sleep Duration; Academic Performance; Physiology Final Exam Score; Medical Students; Sleep Quality; Correlation

1. Introduction

Sleep is a restful state of mind that plays a crucial and significant role in the consolidation of memory. Better and proper sleep is associated with superior cognitive functions including better learning and memory which is critical for successful academic performance.^{1,2} Though the exact mechanisms relating the sleep, memory, and neuroplasticity have not been well described, several studies explained that active synaptic connections during awake-periods are strengthened during sleep resulting in the consolidation of memory.^{1,3,4} Sleep deprivation increases fatigue, and

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sleepiness and worsens cognitive performance.^{5,6} Poor sleep quality is also associated with lack of concentration and poor attention.^{1,7}

Several studies have linked better quality and longer duration of sleep with better academic performance.^{8,9} Medical students are more vulnerable and at increased risk for sleep disturbance because of various factors such as academic burden, crammed schedule, high parental expectations, exam stress, peer pressure, and prolonged study sessions.¹⁰⁻¹³ Sleep disturbance subjects medical students to psychiatric illness and adversely impacts their cognitive skills, emotional intelligence, and academic performance,^{11,13} which may ultimately affect their work performance as practitioners.¹⁴

Most studies have investigated the relationship of sleep quality with students' academic performance utilizing subjective measures of sleep quality in the form of self-report surveys. A very few studies have examined the relationship between average sleep duration in medical students and their academic performance in a basic medical science course utilizing objective measures. Therefore, the present study was set to determine whether a correlation exists between the average sleep duration in medical students and their performance in physiology final examination score.

2. Method

This study was a cross-sectional study and was conducted in a Caribbean Medical School after approval from the Institutional Review Board. For this study, medical students from the first year of MD program were selected based on the inclusion criteria after informed written consent. The medical students who studied two terms of medical physiology in their first year and took their physiology final examination were included in this study. The students who dropped their physiology course before taking the physiology final exam, and continued the same next term, those who did not study their two terms of medical physiology, those who were transferred from other medical schools in their second term, and those with low levels of attendance due to medical leave of absence and other extenuating circumstances were excluded from the study. Students who were using sedative medications and/or sleeping aids including melatonin were not included in the study. Students who refused to participate in the study, who did not complete the entire questionnaire, and did not record their average sleep duration were also not included in the study.

Students were explained about the research objectives and instructed on how to fill the questionnaire. The participants were asked to record their average sleep duration on their smartphones and wearable sleep/activity tracker devices throughout their second semester. Students were informed that their physiology final exam scores will be utilized in this study. The students' cooperation was good. At the end of the second term, the participants reported their average sleep duration in hours based on the records in their smart phones and wearable sleep/activity tracker devices. The data of their age, gender, body mass index, average sleep duration, and physiology final examination scores were tabulated in Microsoft Excel and descriptive analysis was done. The correlation of their average sleep duration in hours to physiology final examination scores in percent was determined by a Pearson correlation coefficient and regression analysis.

3. Results

A total of 40 medical students (27.5±7.2 yrs.) were included in the study of whom 23 were male (29±8.4 yrs.) and 17 were female (25.6±4.9 yrs.). The students' sleep duration was recorded as their average sleep duration in hours (7.1±1.2 hrs.) and the physiology final examination score was recorded as %.

Table 1 Summary of the Parameters Recorded

Variables	Mean ± SD
Age (yrs.)	27.5 ± 7.2
Average Sleep Duration (hrs.)	7.1 ± 1.2
Physiology final examination score (%)	84.5 ± 9.7

The correlation coefficient (adjusted r^2) of our study was 0.028 and the significance P was 0.154. The average sleep duration of medical students was not significantly correlated with the physiology final examination score % ($r_{(38)} =$

0.229, $p = 0.154$). The regression model predicted only 5.3% ($R^2 = 0.053$) of the physiology final examination score of medical students.

Table 2 Regression Statistics

Multiple R	0.229
R Square	0.053
Adjusted R Square	0.028
Standard Error	1.416
Observations	40

Table 3 Summary Output of Linear Regression Analysis

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	4.27	1.99	2.15	0.038	0.248	8.29
Score %	0.034	0.023	1.45	0.155	-0.013	0.081

Simple linear regression analysis between average sleep duration and physiology final examination score showed that the average sleep duration contributed only 9.4% (confidence interval -0.013, 0.081). The regression model showed that for each 1 hr. increase in average sleep duration, the physiology final examination score is expected to increase by 0.034% (Table 3). However, medical students with an average sleep duration of 6 hrs. or more scored better in their physiology final exam.

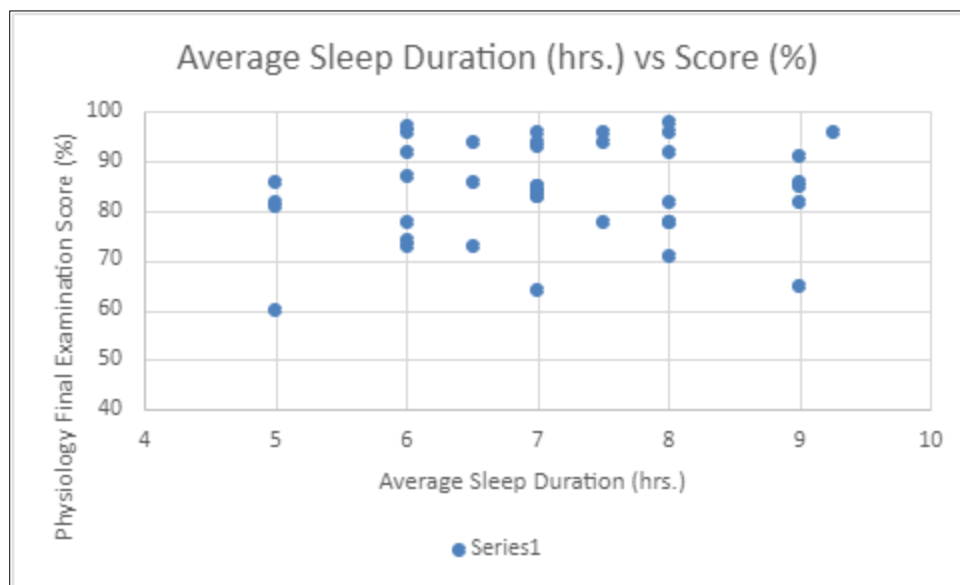


Figure 1 Average Sleep Duration (hrs.) vs Physiology Final Examination Score (%)

4. Discussion

The result of this study reports an average sleep duration of 7.1 hrs. among medical students. This result of our study is in line with the systematic review, meta-analysis, and meta-regression of 109 studies involving 59427 participants done by Binjabr et al who found that the average sleep duration of only 6.5 hrs. per night among medical students and concluded that at least 30% of them get less sleep than the recommended 7–9 hrs. per night.¹⁵ Several other studies also reported that the majority of medical students have poor sleep quality and duration less than the recommended 7-9 hours.^{16,17} Sleep disturbances are common among medical students and more prevalent than in non-medical students

and the general population.¹⁸ In a cross-sectional survey study, Yassin et al found that sleep disorders are common among undergraduate medical students and concluded that several sleep disorders such as insomnia, affective disorder, sleep state misperception, narcolepsy, and circadian rhythm disorder are associated with poor academic performance.¹⁹

Our study showed that there is no significant correlation between the average sleep duration among medical students and their physiology final examination score. This finding of our study is well in line with a systematic review and meta-analysis study done by Seoane et al which reported that the academic grades correlated significantly with sleep quality scores and diurnal sleepiness, but not with the sleep duration.²⁰ Highest academic achievers and those with the highest levels of psychological well-being are not the best sleepers in terms of overall sleep quality.²¹

In our study, we found that medical students with an average sleep duration of 6 hrs. or more scored better in their physiology final exam. This finding is consistent with the findings of several other studies where they have reported that the sleep duration and quality contribute to overall academic performance.¹⁶ Academic performance in medical students is negatively correlated with the decreased nocturnal sleep time, late bedtimes during weekdays and weekends, and increased daytime sleepiness.²² However, we didn't record bedtimes and daytime sleepiness and didn't analyze their correlation with the academic performance. Also, a study done by Falloon et al concluded that the short sleep duration and poorer sleep quality the night before an observed clinical assessment were associated with lower scores in the assessment.¹⁷

Not only the sleep duration, but also the sleep consistency and falling asleep early after going to bed have greater impacts on Grade Point Averages (GPAs). Hershner found a strong correlation of greater sleep consistency to the better academic performance and concluded that the greater sleep consistency may have a greater impact on GPA than sleep duration.²³ Leak et al, in their study, found that the pharmacy students who took less than 15 min to fall asleep on the bed had higher professional-phase GPAs than those who took more than an hour or more.²⁴

There are several factors contributing to sleep disturbance in medical students including, but not limited to academic burden, crammed schedule, high parental expectations, exam stress, peer pressure, and prolonged study sessions.¹⁰⁻¹³ Besides sleep disturbances, several other factors that are significantly correlated with the academic performance of medical students such as class attendance,²⁵ academic ability, insight into medicine, extracurricular activities, and interest, linguistic and communication skills,²⁶ study habits such as effective time management, disruption of daily work by phone, family, and friends, study hours, use of resources and technologies, and peer teaching,²⁷ learning approaches,²⁸ and student well such as substance use, mental health and burn out.²⁹ Therefore, though the present study reports better academic performance among the medical students whose average sleep duration is 6 hrs. or more, the other factors contributing to sleep disturbances in medical students and their academic performance need to be considered in future studies.

5. Conclusion

Our study concludes that there is no significant correlation between the average sleep duration in medical students and their performance in physiology final exam. However, medical students with an average sleep duration of 6 hrs. or more scored better in their physiology final exam. Therefore, we recommend that the medical students should be encouraged to sleep more than six hours, if possible, for the recommended 7-9 hrs. to achieve better academic performance in medical school.

Limitation

The present study has a small sample size and was conducted in a single academic institution. In addition, our study did not include sleep quality, and analyzed the correlation of sleep duration with academic performance in only one course. Therefore, further studies considering the other factors that contribute to sleep disturbances and academic performance in medical students are recommended in the future.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No potential conflict of interest relevant to this article was reported.

Authors' contributions

Conceptualization: RP, KRP. Data curation: RP, KRP. Formal analysis: RP, KRP. Methodology: RP, KRP. Project administration: RP, KRP. Visualization: RP, KRP. Writing–original draft: RP. Writing–review & editing: RP, KRP.

Statement of ethical approval

This study was conducted after ethical approval from the Institutional Review Board (IRB).

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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