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Impact of Sleep on Physical Activity, Stress, and Screen Time Among Medical Students

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DECLARATIONS

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ABSTRACT

Background: Medical students commonly encounter factors such as insufficient physical activity, heightened stress, and excessive screen time, all of which can adversely impact sleep quality. **Objective:** To evaluate the impact of sleep on physical activity, stress, and screen time among medical students. **Methodology:** This cross-sectional study design was conducted from January to October 2024, recruiting participants using non-probability convenience sampling. Current undergraduate medical students aged between 18 and 28 years, both male and female, were eligible. Before participation, informed consent was obtained from all students. Data was gathered using a self-administered questionnaire comprising several validated instruments: the Pittsburgh Sleep Quality Index to assess sleep patterns and habits, the International Physical Activity Questionnaire to evaluate physical activity levels, and the Perceived Stress Scale to assess perceived stress. Descriptive statistics, including frequencies and percentages, were computed to summarise the characteristics of the sample and the distribution of study variables. Ethical approval for the study was obtained from the Institutional Ethical Review Committee of United College of Physical Therapy. Throughout the research process, confidentiality of the data and anonymity of all participants were strictly maintained. **Results:** Analysis revealed that students with extended screen time demonstrated higher levels of hyperactivity, with female students reporting a slightly greater hyperactivity rate (72.2%) compared to males (69.5%). Poor sleep quality was prevalent among 71.2% of participants, while 28.8% were classified as good sleepers. Moderate stress was most common (69.2%), and 71.5% of students reported engaging in high-effort physical activity. Good sleepers were more likely to be highly physically active (75.5%) than poor sleepers (69.8%). Screen time between 1-5 hours was typical for both good (49.0%) and poor sleepers (52.0%). Poor sleepers showed a higher occurrence of moderate stress (71%) compared to good sleepers (64.7%). **Conclusion:** A substantial proportion of medical students exhibited poor sleep quality, moderate stress, and high screen time, with hyperactive students tending toward moderate stress. Good sleep was associated with higher physical activity, while screen exposure was similar across sleep quality groups.

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INTRODUCTION

Sleep is a fundamental physiological process essential for both physical restoration and mental well-being, underpinning day-to-day functioning and long-term health.[1,0] It is characterised by reduced awareness, altered brain activity, and a relaxation of muscular tension.[4,5] Recent research consistently shows that adequate, high-quality sleep, generally at least seven hours a night for adults that enables recovery, supports immune function, facilitates memory consolidation, and regulates emotions and metabolism.[2,0,0] Regular, restorative sleep not only improves cognitive performance and mood but also supports overall life satisfaction, helping to ward off conditions such as obesity, diabetes, and cardiovascular disease0

The transition to higher education, particularly in demanding fields like medicine, is associated with a notable decline in both sleep quality and duration.[0] Medical students are particularly vulnerable to poor sleep due to academic pressures, frequent examinations, clinical responsibilities, and increasingly pervasive use of electronic devices late at night.[14,15] These factors collectively contribute to difficulties in falling or staying asleep, shortened total sleep time, and increased daytime fatigue.[16,17] Such sleep disruptions can have a significant negative impact on cognitive performance, emotional regulation, psychiatric well-being, and academic achievement.[18,19,20] Multiple variables intersect to influence sleep quality in this population, including age, gender, body mass index, physical activity levels, daily stress, and screen time.[6,7]

Physical activity, broadly defined as any bodily movement requiring energy expenditure, plays a consistently positive role: both single bouts and regular engagement in moderate-intensity exercise are linked to better sleep and improved mood.[8,9] Exercise affects sleep by modulating hormonal activity, thermoregulation, and energy use, all factors critical for maintaining healthy sleep cycles.[24] Tailored home-based exercise programs are increasingly recognised as convenient, effective strategies for students needing flexibility alongside health benefits.[21] Chronic stress, prevalent among students, further complicates sleep health. Academic and personal challenges elevate stress levels, which in turn trigger emotional disturbances and impair sleep continuity.[25,26] This creates a cyclical relationship where poor sleep heightens stress susceptibility and, conversely, unmanaged stress degrades sleep quality. Alongside these factors, increased screen time, especially involving devices that emit blue light, has emerged as a major disruptor of sleep. The widespread use of smartphones, computers, and televisions into the late hours leads to delayed sleep onset, reduces total sleep time, diminishes sleep continuity, and exacerbates daytime fatigue.[11,22] Moreover, greater social media engagement, particularly at night, is linked not only to sleep disturbances but also to higher rates of anxiety and depressive symptoms[24] especially in environments where academic expectations are high and after-hours digital engagement is routine.[23,27]

In light of these interwoven factors, this study investigates how sleep quality is associated with physical activity, stress levels, and screen time among medical students, a cohort facing unique academic and clinical demands. This research addresses an important gap in the existing literature and seeks to provide evidence-based insights to inform future preventive and health-promoting strategies. Enhancing sleep health among medical students is not only vital for their immediate academic performance but also pivotal for sustaining their mental health and overall quality of life.

For this research, physical activity refers to any skeletal muscle movement that increases energy expenditure; sleep is conceptualized as a restorative state recurring nightly; stress is the emotional and physiological reaction to demanding circumstances; screen time describes the total daily use of electronic screen devices; sleep quality expresses subjective satisfaction with one's sleep experience; and sleep disturbance denotes any issue that undermines sleep initiation, maintenance, or restorative effect. The purpose of the study was to evaluate the impact of sleep on physical activity, stress, and screen time among medical students. By clarifying the interconnections between these factors within a cross-sectional framework, this may contribute valuable knowledge that will guide the development of targeted interventions and policies and foster greater awareness about the importance of sleep health for the academic success and well-being of medical students.

METHODOLOGY

The present study was conducted to examine the

associations between sleep quality, physical activity, stress levels, and screen time among undergraduate medical students in Karachi, Pakistan. Data collection took place across four distinct medical colleges in the city, with the target population comprising male and female undergraduate students aged 18 to 28 years,[29,30] who were in a state of physical well-being and voluntarily agreed to participate. Employing a cross-sectional study design, the research was carried out over one year, with data specifically collected between January 2024 and October 2024, following formal approval of the research synopsis.

Using reference data from a study by Mohammad Salih et al. (2020) and the OpenEpi RAO open-source sample size calculator, a minimum sample size of 354 participants was determined at a 95% confidence interval and 5% margin of error. Participants were recruited using non-probability convenience sampling. Inclusion criteria specified that only current undergraduate medical students aged between 18 and 28 years, both male and female, in good physical health, and willing to complete the study questionnaire were eligible. Students outside the specified age range, those with any physical disability, or those unwilling to participate were excluded.

Before participation, informed consent was obtained from all students. Data was gathered using a self-administered questionnaire comprising several validated instruments: the Pittsburgh Sleep Quality Index (PSQI) to assess sleep patterns and habits, the International Physical Activity Questionnaire (IPAQ) to evaluate physical activity levels, and the Perceived Stress Scale (PSS) to assess perceived stress. Additionally, questions assessing screen time were adapted from the study "Impact of screen time on sleep quality among university students and school children."

Upon completion and collection of the questionnaires, the data were entered and statistically analysed using SPSS version 25. Descriptive statistics, including frequencies and percentages, were computed to summarise the characteristics of the sample and the distribution of study variables. Ethical approval for the study was obtained from the Institutional Ethical Review Committee of United College of Physical Therapy. Throughout the research process, confidentiality of the data and anonymity of all participants were strictly maintained.

RESULTS

A study involved 354 participants, with (95)26.8% being males and (259)73.2% being females. The age range of participants ranged from a minimum of 17 years to a maximum of 26 years. The average age of the participants was 21.38%, with a standard deviation of 1.839%. Among the participants, 0.6% were classified as inactive, 27.6% were considered minimally active, and 71.8% were categorised as highly active, with screen time levels ranging from 1 to 5. None of the participants fell into the inactive category, while 29.9% were minimally active, and 70.1% were highly active with screen time levels between 6 and 10. There were no inactive participants, 21.4% were minimally active, and 78.6% were highly active with screen time levels of 16-2.

In summary, the overall distribution was 0.3% inactive, 28.2% minimally active, and 71.5% highly active participants. All of the inactive participants, constituting 100%, reported experiencing low stress. Among minimally active participants, 14% had low stress, 71.0% had moderate stress, and 15% had high perceived stress levels. Among HEPA active participants, 16.2% had low stress, 68.8% had moderate stress, and 15.0% reported high perceived stress levels. In summary, a total of 15.8% of participants reported low stress, 69.2% reported moderate stress, and 15% reported high perceived stress.

Within the group of males, which accounted for 26.8% of the participants, none were categorised as inactive, 30.5% were minimally active, and 69.5% were classified as highly active (HEPA active). Among the 73.2% of female participants, 0.4% were inactive, 27.4% were minimally active, and 72.2% were HEPA active. In total, across all participants, 0.3% were inactive, 28.2% were minimally active, and 71.5% were highly active (HEPA active). The PSQI scale's seven components ranged from a minimum score of 0 to a maximum score of 17.

Among the participants, 24.6% did not experience any daytime dysfunction, while 26.2% reported experiencing 1-2 days of daytime dysfunction, 26% reported 3-4 days, and 23.4% reported 5-6 days of daytime dysfunction. During the past month, the majority of participants, specifically 82.2%, did not utilise any sleep medication. A small percentage, 7.3%, used sleep medication less frequently than once a week. Additionally, 5.9% of participants

Figure 1: Gender of participants and sleep quality

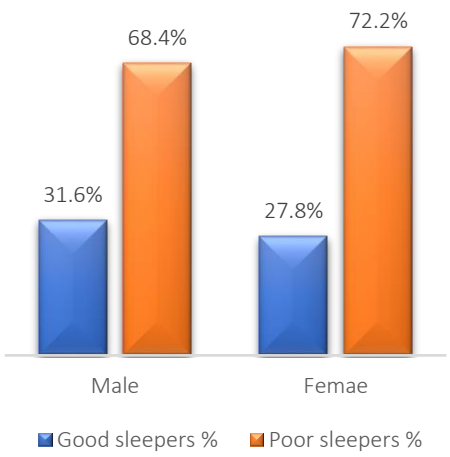
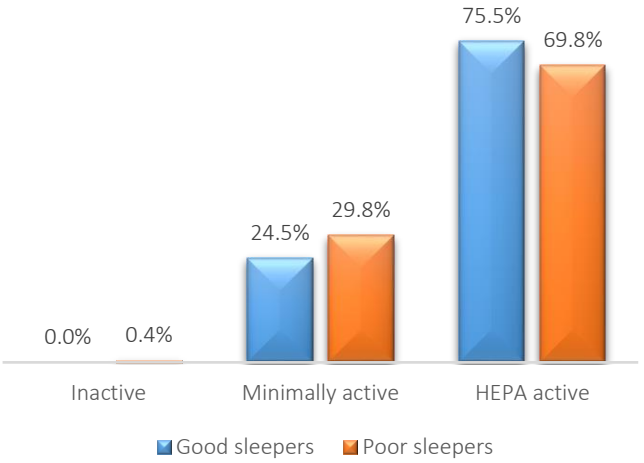


Figure 2: Sleep quality and physical activity



used sleep medication once or twice a week, and 4.5% of participants relied on sleep medication three times a week or more. A breakdown of participants' sleep latency reveals that 18.6% experienced no sleep latency, 32.8% had a sleep latency of 1-2, 31.4% had a sleep latency of 3-4, and 17.2% exhibited a sleep latency of 5-6.

Among the participants, 6.8% experienced no sleep disturbance, while the majority, which is 63.8%, encountered sleep disturbances ranging from 1 to 9 occurrences. Additionally, 28.2% of participants reported experiencing sleep disturbances occurring between 10 and 18 times, and a small fraction of 1.1% had sleep disturbances between 19 and 27 times. Among the participants, 38.1% had a sleep duration exceeding seven hours, while 40.4% reported a sleep duration of 6 to 7 hours. Additionally, 11.9% of participants slept for 5-6 hours, and 9.6% had a sleep duration of less than five hours.

Among the participants, 30.5% reported experiencing very good sleep, while 50.0% indicated fairly good sleep. Moreover, 15.8% described their sleep as fairly bad, and a small portion of 3.7% reported having a very poor sleep quality. The majority of participants, specifically 86.7%, exhibited a sleep efficiency exceeding 85%. A portion of 11% had a sleep efficiency ranging from 75% to 84%, while 1.4% of participants had a sleep efficiency in the range of 65% to 74%. A smaller percentage, 8%, had a sleep efficiency of less than 65%.

Here are the statistics for various sleep-related factors: The mean daytime dysfunction was 1.48%, with a median of 1% and a standard deviation of 1.102%. Sleep medication had a mean of 0.33%, a median of 0, and a standard deviation of 0.782%.

Sleep latency had a mean of 1.47%, a median of 1%, and a standard deviation of 0.985%. Participants experiencing sleep disturbances had a mean of 1.24%, a median of 1%, and a standard deviation of 0.583%. The mean sleep duration was 0.93%, with a median of 1% and a standard deviation of 0.939%. Sleep quality had a mean, median, and standard deviation of 0.92%, 1%, and 0.77%, respectively.

Sleep efficiency had a mean of 0.16%, a median of 0, and a standard deviation of 0.466%. In summary, these statistics provide insights into various aspects of sleep-related measurements. The outcomes obtained from the data gathered show that students with a prolonged duration of screen time are hyperactive than others. Also, the stress levels are within the range of a moderate stress level. Female students tend to be more hyperactive, i.e., 72.2% than the male students with 69.5% of hyper-activeness. The sleep scale results indicated that there was a higher prevalence of poor sleepers at 71.2% compared to good sleepers, who constituted 28.8% in total. The findings regarding screen time among medical students indicated that 51.1% of students spent 1-5 hours on screens, while 37.9% had a screen time of 6-10 hours. Additionally, 7.1% dedicated 11-15 hours to screen activities, and only 4% of students had a screen time falling within the range of 16-20 hours.

Among the students, 15.8% experienced low stress, while 69.2% disclosed having moderate stress. The remaining 15% exhibited high perceived stress in aggregate. The results of the physical activity scale showed that a mere 0.3% of students were classified as inactive, 28.2% as minimally active, and the majority, 71.5%, were classified as HEPA active. In terms of gender, a higher percentage of females (72.2%) experienced

poor sleep compared to males (68.4%). Additionally, 31.6% of males were classified as good sleepers, while only 27.8% of females fell into the category of good sleepers.

When examining the relationship between sleep and stress, among those categorised as good sleepers, 49.0% of students reported having 1-5 hours of screen time, while 34.3% had 6-10 hours, 11.8% had 11-15 hours, and 4.9% had 16-20 hours. In contrast, among poor sleepers, 52% had 1-5 hours of screen time, 39.3% had 6-10 hours, 5.2% had 11-15 hours, and 3.6% had 16-20 hours. The overall observation regarding sleep and screen time revealed that 51.1% of students had 1-5 hours of screen time, 37.9% had 6-10 hours, 7.1% had 11-15 hours, and only 4.0% had 16-20 hours. Notably, poor sleepers (52.0%) and good sleepers (49.0%) both exhibited a screen time of 1-5 hours.

The connection between physical activity and sleep demonstrated that in the group of students identified as good sleepers, none were inactive, 24.5% were minimally active, and 75.5% were HEPA active. In contrast, among those classified as poor sleepers, only 0.4% were inactive, 29.8% were minimally active, and 69.8% were HEPA active. The overall results showed 0.3% inactive students, 28.2% minimally active, and 71.5% active. To summarise, historically, Students identified as good sleepers (75.5%) exhibited higher levels of HEPA activity compared to those classified as poor sleepers (69.8%). The correlation between sleep and stress indicated that among students characterised as good sleepers, 29.4% had low stress, 64.7% experienced moderate stress, and only 5.9% reported high perceived stress. In the category of poor sleepers, 10.3% had low stress, 71% dealt with moderate stress, and 18.7% experienced high perceived stress. The overall findings revealed that 15.8% of students had low stress, 69.2% experienced moderate stress, and 15% had high perceived stress. Notably, students identified as poor sleepers (71%) had a higher incidence of moderate stress compared to those classified as good sleepers (64.7%).

DISCUSSION

Sleep quality among medical students remains a topic of considerable significance, given its multifaceted impact on health, well-being, and academic functioning. Consistent with prior research, our findings highlight a high prevalence of poor sleep, with 71.2% of the studied medical students classified as poor sleepers, and a particularly notable gender disparity where 72.2% of female students reported poor sleep compared to 68.4% of males. This corroborates earlier studies such as those by Hangouche et al. (2018)[0] which documented that female medical students tend to experience higher rates of sleep disturbances, potentially impinging on their academic performance and overall quality of life.

Unlike El Hangouche et al.'s (2018) study, which established a direct link between poor sleep and academic underperformance, our research deliberately pivoted away from academic achievement to focus on the broader behavioural and psychosocial correlates of sleep, particularly physical activity, stress, and screen time. By decoupling academic outcomes, our study offers a clearer view into lifestyle and psychological factors that interact with sleep in this unique population. Physical activity emerged as a salient feature; over 70% of medical students in our study were

Figure 3: Sleep quality and screen time levels

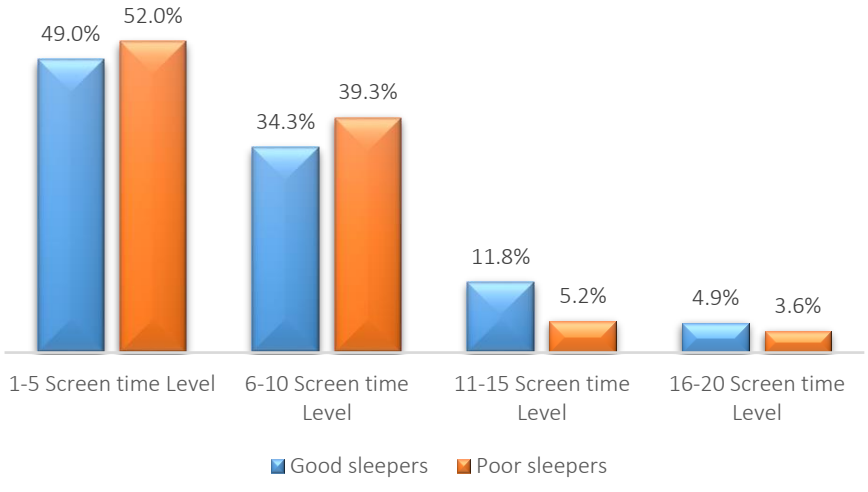
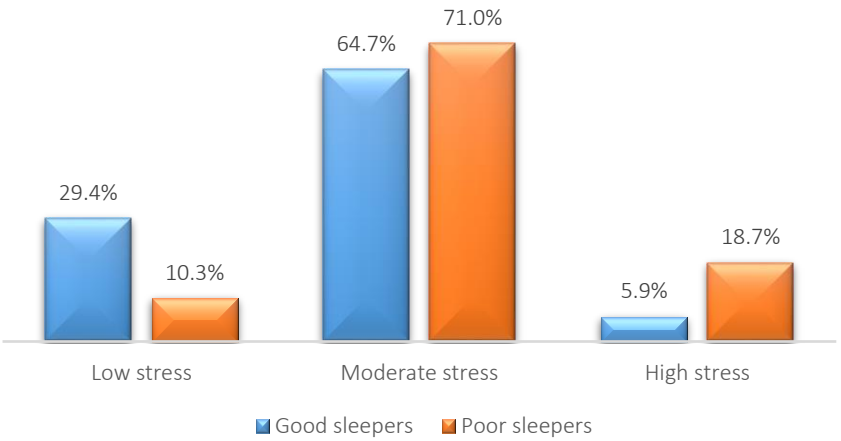


Figure 4: Sleep and stress levels



classified as highly active (HEPA). Interestingly, this contrasts with previous findings such as those by Sadeh et al. (2019)0, where male students exhibited greater physical activity than females, yet paradoxically poorer sleep. In our study, females not only reported higher physical activity but also experienced more sleep problems. This divergence may indicate shifting cultural norms or differing pressures and roles between genders in the current generation of medical students, emphasising the need to contextualise findings within social and institutional frameworks.0 Screen time emerged as another important variable. Prior studies, such as those by Yan et al. (2017)36, warn of the detrimental impacts of excessive screen time on mental health, physical inactivity, obesity, and sleep disruption. Our findings, however, offer a nuanced perspective.

The majority of students reported 1-5 hours of daily screen time, and somewhat paradoxically, those with the highest screen exposure (16-20 hours) showed a tendency towards greater physical hyperactivity, a trend that runs counter to the widely held belief that sedentary screen behaviours necessarily diminish physical activity.[0] This suggests that, among medical students, screen time may often include activities that do not preclude physical movement or may be offset by mandatory schedules, such as clinical rotations or structured fitness routines. However, even at moderate levels, screen time was associated with poor sleep quality, affirming the need for balanced digital habits. Our study broadly aligns with Semplonius et al. (2018), demonstrating the reciprocal link between physical activity and sleep quality: highly active students tended to report somewhat better sleep quality, although, notably, hyperactivity did not universally equate to high sleep quality in our cohort. This may reflect the high overall workload and potentially maladaptive coping behaviours characteristic of medical training.[0] These nuanced and sometimes paradoxical results, such as hyperactivity co-occurring with poor sleep, or females reporting both higher activity and more sleep difficulties, underscore the complexity of human behaviour and the web of factors influencing student well-being. The findings invite further exploration into the mediators and moderators of these relationships, including psychosocial dynamics, academic structures, and cultural expectations.[33,34,35]

The relatively low proportion of male students may limit the generalizability of gender-specific findings. The use of a cross-sectional design precludes causal inference. Additionally, data were collected from a single city and only included medical students, possibly limiting broader applicability. Future research should include larger, more gender-balanced samples across multiple disciplines (e.g., law, engineering) and utilise longitudinal designs to explore causality.

CONCLUSION

This study reinforces the interconnectedness of sleep, stress, physical activity, and screen time among medical students, with a significant majority suffering from poor sleep quality. Poor sleepers tended to experience higher stress, while good sleepers were more likely to be physically active and maintain lower screen exposure. Female students were disproportionately affected by poor sleep, highlighting a need for gender-sensitive approaches to sleep health in medical education.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of Data and Materials: Data will be made available upon request. The corresponding author will submit all dataset files.

Competing interests: None

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Authors' contributions: All authors had read and approved the final manuscript.

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