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# Evaluation of Sleep Quality and Its Determinants Among Undergraduate Medical Students Across Different Phases of Medical Training

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## ABSTRACT

### Background

Adequate sleep is essential for learning, better cognitive function and mental health. This study aimed to determine the prevalence of poor sleep quality among undergraduate medical students and its association with gender, different phases of medical training, and physical activity levels measured as energy expenditure using Metabolic Equivalent Task (MET-min/week).

### Methods

A cross-sectional study was conducted among 267 undergraduate medical students using a semi-structured self-administered questionnaire. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), where a global score ≥5 indicated poor sleep quality. Data on demographics, academic phase and physical activity were collected. Appropriate statistical tests, with $p < 0.05$ considered statistically significant.

### Results

Overall, 57.7% of students had poor sleep quality. Females reported significantly more frequent sleep disturbances (92.3% vs 75.3%) and daytime dysfunction (82.1% vs 56.0%) than males ($p < 0.001$). Junior students (≤2 years) had a higher prevalence of poor sleep (64.9% vs 50.4%, $p = 0.016$), more frequent weekly sleep disturbances (94.8% vs 70.7%, $p < 0.001$), and greater daytime dysfunction (74.6% vs 60.2%, $p = 0.012$) compared with senior students. Low physical activity experienced more frequent sleep disturbances (86.3% vs 76.8%, $p = 0.046$) and greater daytime dysfunction (72.0% vs 59.6%, $p = 0.036$). Poor sleep was more prevalent among students with low physical activity (61.9% vs 50.5%).

### Conclusions

Poor sleep quality affected more than half of medical students. Females experienced more frequent sleep disturbances and daytime dysfunction. Junior students demonstrated significantly poorer sleep than seniors, and lower physical activity was associated with increased sleep disturbances and daytime dysfunction.

**Keywords:** Cognitive function; Medical students; Mental health; Physical activity; Sleep quality.

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## INTRODUCTION

Sleep is an essential biological process vital for protective physiological homeostasis and supporting mental functions like attention, memory consolidation, and learning, which are required for academic success.[1,4] Poor sleep has been linked with emotional dysregulation, increased stress reactivity, and a higher risk of anxiety and depression, negatively affecting daily functioning and academic performance.[2,3] Among students, inadequate sleep is associated with reduced concentration, lower academic achievement, and compromised well-being.[3,4] Medical students are vulnerable to sleep disturbances due to demanding academic workloads, frequent examinations, clinical responsibilities, and irregular daily routines.[5] Studies in Nepal have reported prevalence of poor sleep quality ranging from 30%- 60%.[6,8] Gender differences in sleep quality have also been reported in South Asian medical student populations.[9,10] Physical activity has been shown to improve sleep quality through circadian regulation, stress reduction, and promotion of restorative sleep stages.[11,14]. However, studies offering evidence from a Nepali context are scarce.

## METHODS

A cross-sectional study was conducted among undergraduate MBBS students using a structured self-administered questionnaire at a medical college in Nepal to assess sleep quality and its association with academic phase and physical activity. The study was carried out from 15, June 2025 to 16, September 2025. The study population consisted of 400 students, with 100 students enrolled in each academic year from first to fourth year.

The sample size was calculated using the single population proportion formula ($n = Z^2pq/L^2$) at a 95% confidence level, assuming a 50% prevalence of poor sleep to ensure maximum sample size. After applying finite population correction and accounting for a 25% non-response rate, the final sample size was 267 students. Stratified random sampling was employed, treating each academic year as a stratum. Proportional allocation resulted in 67 students selected from each of the first three years and 66 from the fourth year using simple random sampling from official class lists.

The sample size was calculated using the single population proportion formula $n = (Z^2\,p\,q) / L^2$.

Assuming a 95% confidence level ($z$=1.96), an expected prevalence of poor sleep of 50% ($p$=0.5,$q$=0.5 ), and an allowable error of 5% ($L$=0.05), the initial sample size was:

$n=(1.96)^2*0.5*0.5/(0.05)^2=384$

As the total undergraduate student population was finite ($n$=400), finite population correction was applied: $n_f$= 384/(1+383/400) ≈196

After adjusting for an anticipated 25% non-response rate, the final sample size was: N=196/0.75 ≈261

Accordingly, 267 undergraduate medical students were included in the study.

Stratified random sampling was employed, treating each academic year as a stratum. Proportional allocation resulted in 67 students selected from each of the first three years and 66 from the fourth year using simple random sampling from official class lists. Inclusion criteria included regular MBBS students present during data collection who provided written informed consent. Students with diagnosed sleep disorders under treatment, long-term sedative use, acute illness during data collection, or incomplete questionnaires were excluded. Data were collected using a semi-structured, self-administered questionnaire. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), a validated instrument that generates a global score ranging from 0 to 21; scores ≥5 indicate poor sleep quality.[11] Physical activity was assessed using the World Health Organization Global Physical Activity Questionnaire (GPAQ) and converted to metabolic equivalent (MET)-minutes per week. Participants were categorized as having low physical activity (<600 MET-min/week) or moderate/high physical activity (≥600 MET-min/week).[12]

Data were entered in Microsoft Excel and analysed using SPSS software. Continuous variables were summarized as mean ± standard deviation, and categorical variables as frequencies and percentages.

Independent t-tests and Chi-square tests were used to assess differences between groups. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Committee (Ref No. IRC-NMCTH 24/2025), and confidentiality and voluntary participation were maintained throughout the study.[16]

## RESULTS

A total of 267 undergraduate medical students participated in the study. Among them, 150 (56.2%) were male and 117 (43.8%) were female. With respect to academic year, the distribution of students was nearly equal across batches. First, second and third year students each comprised 67 participants (25.1%), while 66 students (24.7%) were in the fourth year. Assessment of physical activity using WHO GPAQ criteria showed that a majority of students had low physical activity levels (<600 MET-min/week), accounting for 168 participants (62.9%). Only 99 students (37.1%) met the criteria for moderate to high physical activity (≥600 MET-min/week).

Table 1 compares PSQI sleep characteristics between male (n = 150) and female (n = 117) undergraduate medical students. Mean bedtime and wake-up time were similar between genders. Males reported a slightly later bedtime (9.64 ± 1.03 hrs) than females (9.54 ± 1.01 hrs), while females woke marginally earlier (6.00 ± 1.03 hrs vs 6.12 ± 0.97 hrs in males). Average sleep duration was comparable in both groups (8.48 ± 1.09 hrs in males vs 8.45 ± 1.03 hrs in females). Sleep latency and habitual sleep efficiency also showed minimal gender differences. Most students in both groups rated their subjective sleep quality as 'very or fairly good' (76.7% males vs 76.9% females).

However, sleep disturbances and daytime dysfunction were significantly more common among females. Sleep disturbances occurring at least once per week were reported by 92.3% of females compared to 75.3% of males (p < 0.001). Similarly, daytime dysfunction at least once per week was higher among females (82.1%) than males (56.0%) (p < 0.001). Use of sleep medication was low in both groups, slightly higher among males (8.0%) than females (5.1%). Overall, poor sleep quality (PSQI ≥5) was more prevalent in males (61.3%) than females (53.0%), with an overall prevalence of 57.7% among all students (Table 1).

**Table 1. PSQI sleep parameters by gender among undergraduate medical students (n=267).**

| PSQI Parameter | Statistical Measure | Male (n = 150) | Female (n = 117) | P value |
|---|---|---|---|---|
| Bed time (hr)[1] | Mean ± SD | 9.64± 1.03 | 9.54 ± 1.01 | 0.706 |
| Sleep latency (min)[1] | Mean ± SD | 12.41 ± 2.85 | 12.91 ± 2.69 | 0.176 |
| Wake-up time (hr)[1] | Mean ± SD | 6.12 ± 0.97 | 6.00 ± 1.03 | 0.95 |
| Sleep duration (hr)[1] | Mean ± SD | 8.48 ± 1.09 | 8.45 ± 1.03 | 0.838 |
| Habitual sleep efficiency (%)[1] | Mean ± SD | 90.15 ± 10.67 | 90.64 ± 10.19 | 0.493 |
| Subjective sleep quality (%)[2] | Very and fairly good sleep | 76.70% | 76.90% | 0.961 |
| Sleep disturbances (%)[2] | At least once a week | 75.3%* | 92.3%* | P<0.001 |
| Daytime dysfunction (%)[2] | At least once a week | 56.0%* | 82.1%* | P<0.001 |
| Use of sleep medication (%)[2] | At least once a week | 8.00% | 5.10% | 0.353 |
| Poor sleep quality (%)[2] | PSQI global score ≥5 | 61.30% | 53.00% | 0.171 |

**P<0.001 highly significant, [1]t test, [2]Chi-square test*

Table 2 shows significant differences in sleep quality between students in the early years of MBBS (≤2 years) and those in later years (>2 years). A significantly greater proportion of students in ≤2 years of study had poor sleep quality (PSQI ≥5) compared with senior students (64.9% vs 50.4%), while good sleep quality was more common in students studying >2 years (49.6% vs 35.1%) (p = 0.016).

Sleep disturbances were markedly higher among junior students. Nearly all students in the ≤2-year group (94.8%) reported experiencing sleep

disturbances at least once per week, compared with 70.7% of students in the senior group. In contrast, absence of sleep disturbances in the past month was substantially higher among students in >2 years of study (29.3% vs 5.2%) (p < 0.001).

Daytime dysfunction also differed significantly by academic duration. Weekly daytime dysfunction was reported by 74.6% of students in ≤2 years, compared with 60.2% among those in >2 years. Conversely, no daytime dysfunction in the past month was more common among senior students (39.8% vs 25.4%) (p = 0.012).

**Table 2. Comparison of PSQI Sleep Characteristics by Duration of MBBS Study (n=267).**

| PSQI Parameters | ≤ 2 Years MBBS (n = 134) | > 2 Years MBBS (n = 133) | P value |
|---|---|---|---|
| **PSQI Global Score** | | | |
| Good sleep (<5) | 47 (35.1%) | 66 (49.6%) | 0.016* |
| Poor sleep (≥5) | 87 (64.9%) | 67(50.4%%) | - |
| **Sleep Disturbance** | | | |
| Not in past 1 month | 7 (5.2%) | 39 (29.3%) | <0.001** |
| At least once a week | 127 (94.8%) | 94 (70.7%) | - |
| **Daytime Dysfunction** | | | |
| Not in past 1 month | 34 (25.4%) | 53 (39.8%) | - |
| At least once a week | 100 (74.6%) | 80 (60.2%) | 0.012* |

**p<0.05, **p<0.001*

Sleep characteristics were compared between students with low physical activity (<600 MET-min/week) and those with moderate physical activity (≥600 MET-min/week) Table 3. Subjective sleep quality did not differ significantly between the two groups. The proportion reporting 'very or fairly bad' sleep was similar among students with low and moderate activity (23.8% vs 22.2%), while most students in both groups reported 'very or fairly good' sleep (76.2% vs 77.8%) (p = 0.767).

However, sleep disturbances were significantly more common in students with low physical activity. Disturbances occurring at least once a week were reported by 86.3% of the low-activity group compared to 76.8% of the moderate-activity group. Conversely, absence of disturbances in the past month was higher among more active students (23.2% vs 13.7%) (p = 0.046).

Although a greater proportion of low-activity students had poor sleep quality (PSQI ≥5) compared to their more active peers (61.9% vs 50.5%), this difference did not reach statistical significance (p = 0.069). Use of sleep medication was slightly more frequent among students with low physical activity (8.9% vs 3.0%), but the difference was not statistically significant (p = 0.063). Daytime dysfunction was significantly associated with physical activity level. Weekly daytime dysfunction was reported by 72.0% of students with low activity compared to 59.6% of those with moderate activity, while absence of daytime dysfunction was more common in the moderate-activity group (40.4% vs 28.0%) (p = 0.036). Overall, lower physical activity was associated with more frequent sleep disturbances and greater daytime dysfunction.

**p<0.05*

**Table 3. Association between physical activity (METS) and PSQI sleep parameters among undergraduate medical students (n=267).**

| PSQI Parameter | Low physical activity (<600 MET-min/week, n = 168) | Moderate physical activity (≥600 MET-min/ week, n = 99) | P value |
|---|---|---|---|
| **Subjective sleep quality** | | | |
| Very and fairly bad sleep | 40 (23.8%) | 22 (22.2%) | - |
| Very and fairly good sleep | 128 (76.2%) | 77 (77.8%) | 0.767 |
| **Sleep disturbance** | | | |
| Not disturbed in past 1 month | 23 (13.7%) | 23 (23.2%) | 0.046* |
| Disturbed at least once a week | 145 (86.3%) | 76 (76.8%) | - |
| **PSQI Global score** | | | |
| Good sleep (<5) | 64 (38.1%) | 49 (49.5%) | 0.069 |

| | | | |
|---|---|---|---|
| Poor sleep (≥5) | 104 (61.9%) | 50 (50.5%) | - |
| **Sleep medication use** | | | |
| Not used in past month | 153 (91.1%) | 96 (97.0%) | - |
| Used at least once a week | 15 (8.9%) | 3 (3.0%) | 0.063 |
| **Daytime dysfunction** | | | |
| Not in past month | 47 (28.0%) | 40 (40.4%) | - |
| Once in a week | 121 (72.0%) | 59 (59.6%) | 0.036* |

## DISCUSSION

This study revealed that more than half (57.7%) of undergraduate medical students had poor sleep quality, indicating a substantial burden. Adequate sleep is essential for cognitive processing, emotional stability, and learning efficiency, and sleep deprivation adversely affects attention, memory, and executive function.[1,4] Medical students are particularly susceptible due to academic stress, long study hours, and irregular schedules.[5] This study adds to the growing body of evidence showing that poor sleep quality is highly prevalent among undergraduate medical students and is closely linked to diminished academic performance. Across different phases of medical training, students frequently report inadequate sleep duration, prolonged sleep latency, night-time awakenings, and daytime dysfunction, all of which contribute to higher global PSQI scores. Similar findings have been reported in medical schools in Nepal, the Middle East, and other regions, where a substantial proportion of students were classified as poor sleepers.[8,1]

Literatures has also found association between impaired sleep quality and lower academic outcomes is biologically and cognitively plausible. Sleep plays a central role in memory consolidation, learning efficiency, executive functioning, and sustained attention. Disturbed or insufficient sleep negatively affects these neurocognitive processes, leading to reduced concentration during lectures, impaired retention of new information, and poorer examination performance. Previous studies have demonstrated that students with higher PSQI scores tend to report lower grade point averages or increased risk of academic difficulty compared to those with healthier sleep patterns.[8,17,18]

The prevalence observed in this study is higher than that reported in earlier Nepalese studies. Paudel et al. reported poor sleep quality in 38.2% of medical students,[6] while Shrestha and Ansari found a prevalence of 30.3% during the COVID-19 period.[7] Differences may reflect variations in academic intensity, lifestyle habits, screen exposure, and stress levels. Nevertheless, all studies consistently demonstrate that sleep disturbances are common in medical students.

Sah et al. further confirmed that poor sleep quality negatively impacts academic performance among Nepalese medical students.[8]

Gender differences were notable. Although males had slightly higher overall poor sleep prevalence, female students reported significantly more frequent sleep disturbances and daytime dysfunction. Similar gender patterns have been reported in South Asian student populations [9] and among Nepali medical trainees.[10] Hormonal influences, higher perceived stress, and psychosocial factors may explain these differences, highlighting the need for gender-sensitive wellness strategies.

Academic phase significantly influenced sleep. Early-year students experienced poorer sleep and more daytime dysfunction than senior students. Adjustment to academic demands, examination stress, and irregular schedules may disrupt sleep in junior years. Similar findings have been reported among Nepalese medical students, where junior students showed worse PSQI scores than seniors.[6,10] Senior students may gradually adapt and develop better coping and time-management skills. Psychological factors also appear to mediate the relationship between sleep and academic outcomes. Elevated stress levels, anxiety related to examinations, and symptoms of depression are commonly reported among medical students and are

known to disrupt normal sleep architecture. These mental health challenges may create a bidirectional cycle in which poor sleep worsens psychological distress, which then further degrades sleep quality and academic performance. However, literatures suggest that this interaction may be particularly pronounced during transition periods, such as entry into clinical training, when workload and emotional demands increase.[19,20]

Physical activity also played an important role. Students with low physical activity levels reported more frequent sleep disturbances and greater daytime dysfunction. Exercise is known to improve sleep quality through circadian regulation, stress reduction, and enhancement of deep sleep stages [13,14]. Although overall PSQI scores did not differ significantly, the association with disturbance frequency and daytime function suggests that physical activity may partially mitigate the negative effects of academic stress on sleep.

International evidence similarly shows that poor sleep among medical students is associated with mental distress, academic difficulties, and impaired daily functioning.[5,15] Chronic sleep deprivation during training may increase the risk of burnout and long-term health problems.

Poor sleep quality has serious academic and health implications. Daytime dysfunction can impair learning efficiency, concentration, and clinical reasoning. Over time, chronic sleep restriction may predispose students to mood disorders, metabolic problems, and reduced well-being.[2,15]

## CONCLUSIONS

This study found a high prevalence of poor sleep quality among undergraduate medical students. Females experienced more sleep disturbances and daytime dysfunction, while males showed a slightly higher overall prevalence of poor sleep. Junior students had poorer sleep than seniors, and lower physical activity was associated with more frequent disturbances and daytime dysfunction.

## Limitations

The cross-sectional design limits the ability to establish causal relationships between sleep quality, gender, academic phase, and physical activity levels. Data were collected using self-administered questionnaires, which may be subject to recall bias. The study was conducted in a single medical institution, which may limit the generalizability of the findings to other medical schools or student populations.

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## Authors' contributions

**Conceptualization:** Alok Acharya, Surya Raj Niraula.

**Data curation:** Alok Acharya, Surya Raj Niraula.

**Formal analysis:** Alok Acharya, Surya Raj Niraula.

**Investigation:** Alok Acharya, Binod Kumar Yadav, Amar Kumar Yadav.

**Methodology:** Alok Acharya, Binod Kumar Yadav, Amar Kumar Yadav.

**Supervision:** Alok Acharya, Amar Kumar Yadav.

**Writing – original draft:** Alok Acharya.

**Writing – review & editing:** Alok Acharya.

## Abbreviations

GPAQ - Global Physical Activity Questionnaire
METs - Metabolic Equivalents (of Task).
PSQI – Pittsburgh Sleep Quality Index.
WHO – World Health Organization.

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