

Original article

Sleep quality and sleep hygiene in preclinical medical students of tertiary care center amidst COVID-19 pandemic: a cross-sectional observational study

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Abstract

Objectives: Due to the long-lasting pandemic measures, such as lockdown and stay-at-home orders, the COVID-19 pandemic has had a negative impact on higher education. In this study, we aimed to determine sleep quality, excessive daytime sleepiness, and sleep hygiene, and their association with anxiety, and their correlation in preclinical medical students during the COVID-19 pandemic.

Materials and Methods: We included 101 medical students, aged between 17–20 years of both sex from a tertiary care medical institute. Standard questionnaires were used to assess sleep quality, sleep hygiene, daytime sleepiness, and anxiety among medical students.

Results: Fifty-one percent of the medical students had good sleep quality, but 35% had borderline poor sleep quality, and 13% had poor sleep quality during the lockdown. Six percent of medical students had alarmingly high daytime sleepiness. The total Adolescent Sleep Hygiene Scale (ASHS) score was grouped into poor sleep hygiene (ASHS score ≤ 3.8) and good sleep hygiene (ASHS score ≥ 4.9). Overall, sleep hygiene of medical students was poor due to behavioral arousal and bedtime routine factors, and the scores for anxiety and sleep hygiene were significantly negatively correlated, whereas daytime sleepiness showed a significant positive correlation.

Conclusion: Our study revealed a high prevalence of poor sleep quality among medical students during the lockdown. Poor sleep hygiene is an eye-opener for the mostly ignored aspect of altered sleep patterns.

Key words: COVID-19 pandemic, lockdown, medical students, sleep quality, sleep hygiene

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Introduction

Due to the long-lasting pandemic situation and onerous measures, such as lockdown and stay-at-home orders, the COVID-19 pandemic has had a negative impact on higher education. Preclinical medical students are in a critical period of acquiring the necessary knowledge and experience

that would be useful for the rest of their education and careers. Compared to students of the same age in other disciplines, medical students bear higher occupational stress in adapting to their new lifestyle and are often exposed to large amounts of stress¹.

Studies from various countries have documented a high prevalence of sleep disturbances among medical students, including sleep deprivation, poor sleep quality, and excessive daytime sleepiness (EDS)^{2–4}.

Sleep hygiene is a set of behaviors believed to have a positive effect on both sleep quality and quantity. Alcohol use, consumption of caffeine, energy drinks, and stimulants, and frequent use of technology such as phones or computers before sleep are among common behaviors that are incompatible with sleep hygiene^{5–11}. Environmental conditions have been associated with poor sleep quality, while psychological problems such as depression, anxiety, and stress have been

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associated with sleep disorders such as insomnia^{12, 13}.

There is sparse evidence on the psychological effects of the current pandemic on medical students, who are known to be a vulnerable population¹⁴. Scrutiny of factors and assimilation of possible solutions proposed to preclinical students will help in outlining a plan to bridge the gap in students' academic experience in the future.

In this study, we intended to determine sleep quality, EDS, and sleep hygiene, and their association with anxiety during the COVID-19 pandemic.

Hence, the aims and objectives of this study were to assess sleep quality, sleep hygiene, anxiety scores, and their correlation in preclinical medical students during the COVID-19 pandemic.

Material and Methods

This cross-sectional observational study was conducted on first professional year medical students in the academic year 2019–2020. We included 101 medical students, aged between 17–20 years of both sex from a tertiary care medical institute in the study. We excluded medical students with a current history of medical illness or psychiatric disorders and those who were not willing to participate in the study. We also obtained informed written consent after explaining the study protocol and procedures to all participants. The medical students did not receive any incentives or financial compensation to participate in the study. Participants were free to withdraw from the study at any time. The institutional ethics committee approved the study (Reference No. AIIMS/IEC/21/15 Dated 09/01/2021).

The participants in the study were introduced to the survey procedure through telephonic communication and were informed that the survey was anonymous, voluntary, and was performed for a research project. The participants received a set of previously validated online questionnaires in the English language. On average, the survey took approximately 40 minutes to complete. After collecting the data and eliminating defective questionnaires, properly completed questionnaires were qualified for further analysis. The collected material was encoded in Excel, and the results were analyzed collectively. The time for the distribution of the self-administrated questionnaires was chosen carefully, paying attention to the exam schedule of the students, such that they had no exam over two weeks before and after filling out the questionnaires.

The physical sleep quality index (PSQI)¹⁵ is a self-report questionnaire that assesses sleep quality over a 1-month time interval. Developed by researchers at the University of Pittsburgh, it takes 5–10 minutes to complete. The PSQI consists of 19 items and measures several aspects of sleep, offering seven component scores and one composite score. The component scores consisted of subjective sleep qual-

ity, sleep latency (i.e., how long it took to fall asleep), sleep duration, habitual sleep efficiency (i.e., the percentage of time in bed that one was asleep), sleep disturbances, use of sleeping medication, and daytime dysfunction. Each item is weighted on a 0–3 scale. The global PSQI score was then calculated by totaling the seven component scores, providing an overall score ranging from 0–21, with lower scores indicating healthier sleep quality.

The Epworth Sleepiness Scale (ESS)¹⁶ is a self-administered questionnaire with eight questions. Respondents were asked to rate on a 4-point scale (0–3) their usual chances of dozing off or falling asleep while engaged in eight different activities. Most people engage in these activities occasionally, although not necessarily every day. The total ESS score can range from 0–24. The higher the ESS score, the higher the person's average sleep propensity (ASP) in daily life or daytime sleepiness.

The Adolescent Sleep Hygiene Scale (ASHS)¹⁷ is a self-report questionnaire specifically designed to assess theoretically based sleep hygiene domains thought to influence the sleep quality and quantity of youth aged ≥ 12 years. It assesses the following factors: physiological (e.g., evening caffeine consumption); cognitive (e.g., thinking about things that need to be done at bedtime); emotional (e.g., going to bed feeling upset); sleep environment (e.g., falling asleep with the lights on); sleep stability (e.g., different bedtime/wake time patterns on weekdays and weekends); substance use (e.g., evening alcohol use); daytime sleep (e.g., napping); and having a bedtime routine.

The State-Trait Anxiety Inventory (STAI-Y) version¹⁸ contains 20 items to measure state anxiety and another 20 items to measure trait anxiety. Both state and trait subscales are assessed using a four-point scale, from "not at all" to "very much so" for the trait anxiety factor, and from "almost never" to "almost always" for the state anxiety factor. The scores ranged between 20 and 80. The higher the score, the greater the anxiety.

We displayed all data as raw numbers with percentages and estimated the mean and standard deviation values. A content analysis was performed for open-ended questions to identify and quantify common categories. Frequencies were determined using standard measures and unpaired student t-tests for sleep hygiene variables. The value of the correlation coefficient (I) was determined for the correlation between the STAI-Y, ASHS, and ESS. All analyses were performed using SPSS version 25 software for Windows (SPSS Inc., Chicago, IL, USA). Statistical significance was set at $P < 0.05$.

Results

A total of 101 medical students were recruited from the first professional year. The mean age of participants was

20.18 ± 7.19 years; among them 29% were females and 71% were males.

All medical students completed an online survey on their self-assessed perceptions about sleep changes observed during the COVID-19 lockdown. Approximately 65% of the medical students had altered sleep-wake time and sleep duration during the COVID-19 pandemic lockdown. Eighty-six percent agreed that altered sleep patterns were specifically observed during lockdown stay at home; 42% could sleep and wake up at regular times at home; 92% of the students had altered sleep; and 29% had no improvement despite homestay. Approximately 22% of students had altered sleep-wake time specific to the COVID-19 pandemic, whereas 58% was the result of homestay during the lockdown, and 20% owing to hostel stay. Sleep-wake time improved in 35% percent of students during the declining trend of COVID-19 positive cases during the lockdown, whereas approximately 43% of students had improvements in sleep duration (Table 1).

Fifty-one medical students had good sleep quality, 35 had borderline poor sleep quality, and 13% had poor sleep quality during the lockdown period (Table 2). Six percent of medical students had alarmingly high sleepiness dur-

ing daytime, and 34% had borderline high sleepiness during daytime (Table 3). The total ASHS score was grouped into poor sleep hygiene (ASHS score ≤ 3.8) and good sleep hygiene (ASHS score ≥ 4.9)¹⁷⁾. The sleep hygiene of medical students was poor due to behavioral arousal factors and bedtime routine factors; however, poor sleep hygiene was observed due to a combination of emotional, sleep stability, and daytime sleep factors (Table 4). The STAI score of anxiety showed that almost equal number of medical students reported state anxiety and trait anxiety (Table 5). The score of anxiety and sleep hygiene was significantly negatively correlated, whereas anxiety and daytime sleepiness showed a significant positive correlation (Table 6).

Discussion

Preclinical students go through an intensive course before entering clinical wards and have contact with patients. Thus, it is useful to observe the well-being of students before they proceed to the subsequent stage. Limited research investigated the sleep habits of this subgroup, which could have both health and academic implications. Our study aimed to evaluate sleep quality and its related factors among

Table 1 Perceptions of sleep changes during COVID-19 pandemic lockdown among medical students (n=101)

| Sr.No. | Perception of sleep changes during COVID-19 | No (%) | Sometimes (%) | Yes (%) |
|--------|--|-----------------------|---------------|-----------------|
| 1 | Have you noticed any difference in your sleeping and waking time due to COVID-19 pandemic? | 21.8 | 10.9 | 67.3 |
| 2 | Have you noticed any difference in your sleep duration throughout during COVID-19 pandemic? | 21.8 | 14.9 | 63.4 |
| 3 | Do you think your irregular sleeping and waking time is influenced while staying at home in comparison to a hostel stay? | 13.9 | - | 86.1 |
| 4 | If Yes, is it better at home? | 13.9 | 27.7 | 58.4 |
| 5 | Do you think your sleep duration is influenced while staying at home in comparison to a hostel stay? | 9.9 | - | 90.1 |
| 6 | If yes, is it better in home? | 9.9 | 18.8 | 71.3 |
| | | COVID 19 Pandemic (%) | Home stay (%) | Hostel stay (%) |
| 7 | What according to you has influenced your sleep duration? | 23.8 | 57.4 | 18.8 |
| 8 | What according to you has influenced your sleeping and waking time? | 21.8 | 58.4 | 19.8 |
| | | No (%) | Sometimes (%) | Yes (%) |
| 9 | Since the influence of COVID-19 pandemic is declining has there been any improvement in your sleeping and waking time? | 65.3 | - | 34.7 |
| 10 | Since the influence of the COVID-19 pandemic is declining has there been any improvement in your sleep duration. | 57.4 | - | 42.6 |
| | | 33.00% | 66.00% | 99.00% |
| 11 | If yes, to what percent? | 25.7 | 14.9 | 2 |
| | | No (%) | Sometimes (%) | Yes (%) |
| 12 | If yes, did you do anything for overcoming sleep-related challenges or difficulties? | 81.2 | - | 18.8 |

Table 2 Total score of Pittsburgh Sleep Quality Index (PSQI) during COVID-19 pandemic lockdown among medical students (n=101)

| Grades | PSQI total score | Frequency (n=101) | Medical students (%) |
|--------------------|------------------|-------------------|----------------------|
| Good sleep quality | <5 | 52 | 51.5 |
| Borderline poor | 5–8 | 36 | 35.5 |
| Poor sleep quality | >8 | 13 | 13 |

Table 3 Total score of daytime sleep during COVID-19 pandemic lockdown among medical students (n=101)

| Grades of sleepiness | Range | Medical students (%) |
|------------------------------|-------|----------------------|
| Normal sleepiness | 0–7 | 45.5 |
| Moderate daytime sleepiness | 8–9 | 14.9 |
| Excessive daytime sleepiness | 10–15 | 33.7 |
| Dangerously sleepy | 16–24 | 5.9 |

Table 4 Total score of sleep hygiene during COVID-19 pandemic lockdown among medical students (n=101)

| Sleep hygiene scale | Mean ± SD |
|--|-------------|
| Physiological factors | 4.98 ± 1.34 |
| Behavioural arousal factor | 3.80 ± 1.70 |
| Cognitive/Emotional factor | 4.36 ± 1.44 |
| Sleep environment factor | 5.31 ± 1.08 |
| Sleep stability factor | 4.03 ± 1.59 |
| Daytime sleep factor | 4.58 ± 1.53 |
| Substance factor | 5.85 ± 0.56 |
| Bedtime routine factor | 2.68 ± 2 |
| Total ASHS SCORE (mean of all 8 subscales) | 4.45 ± 0.43 |

Table 5 Total score of anxiety during COVID-19 pandemic lockdown among medical students (n=101)

| Anxiety score | Mean ± SD |
|---------------|---------------|
| State anxiety | 44.91 ± 11.51 |
| Trait anxiety | 45.30 ± 6.64 |

Table 6 Correlation between sleep hygiene with anxiety and daytime sleepiness during COVID-19 pandemic lockdown among medical students (n=101)

| Scales | (r) |
|-----------------------------------|--------|
| STAI and ASHS | −0.037 |
| STAI and Epworth sleepiness scale | 0.22 |

STAI: State Trait Anxiety Inventory; ASHS: Adolescence Sleep Hygiene Scale; r: correlation co-efficient.

medical students during the lockdown period.

The PSQI is a 19-item self-report measure of sleep quality from the previous month. It consists of seven component scores, with higher scores indicating greater difficulty of quality of sleep. *Subjective sleep quality* is measured with one item and assesses how one rates one's overall sleep quality. *Sleep latency* consists of two items and is the average length of time it takes one to fall asleep. *Sleep duration* is measured with one item and is the average number of hours of sleep that one engages in each night. *Habitual sleep efficiency* is calculated from three items and represents the number of hours slept, given the number of hours spent in bed. *Sleep disturbance* measures the frequency with which various situations have troubled one's sleep and consists of nine items representing different situations (e.g., bad dreams, pain, and inability to breathe well). *The use of sleep medications* consists of one item inquiring how frequently one has taken medicine to aid sleep. The seventh component is *daytime dysfunction*, which consists of two items and measures daily problems related to sleep such as having trouble staying awake or having enough enthusiasm

to get things done. These seven component scores can be summed to form a single global score, which ranges from 0 to 21, with higher scores reflecting greater overall sleep disturbances. A global PSQI score ≥ 5 is indicative of poor sleep quality among younger adults²⁰ though others suggest a cut-off of 8^{19, 20}.

The ASHS measures sleep hygiene and may be described as practicing behaviors that facilitates sleep and avoids behaviors that interfere with sleep. Inadequate sleep hygiene is defined in the International Classification of Sleep Disorders (American Sleep Disorders Association, 1990) as a "sleep disorder due to the performance of daily living activities that are inconsistent with the maintenance of good quality sleep and full daytime alertness"^{21, 22}.

Our research demonstrates that the lockdown in India has a major impact on sleep quality and hygiene, with im-

portant implications for medical students' psycho-emotional well-being. During the COVID-19 lockdown, we noticed low sleep quality and poor sleep hygiene among medical students, as observed in other studies conducted in the general population. Owing to homestay during the lockdown, there was a worsening of sleep quality (as measured by the PSQI) and symptoms linked to poor sleep efficiency (as measured by the ASHS). Poor sleep hygiene, however, was linked to a considerable increase in anxiety^{23, 24}, which is consistent with our study findings.

Few studies have been published on the effect of social isolation caused by COVID-19 on chronotypes. Leone *et al.* discovered a delay in sleep-wake time, implying that individuals' sleep timing was aligned with their internal time²⁵.

Altena *et al.* indicated in a task force study for the European Academy for cognitive behavioural therapy for insomnia (CBT-I) that during the lockdown, sleep habits changed owing to social limitations and a change in social rhythms, such as working and daily activity schedules²⁶. In our study, home confinement had a greater impact on sleep habits among medical students.

Similar results have been reported in the literature regarding COVID-19 and psycho-emotional distress. In all of these studies and our sample, psycho-emotional distress had a greater impact on medical students. Cellini *et al.* found that 24.2% of their study participants reported depressive symptoms from moderate to severe, and 32.6% reported anxiety symptoms from moderate to severe^{27–35}.

The effect of social isolation on feelings of loneliness, vulnerability, and emergency worry may have led medical students to feel less efficient in overcoming problems, provoking an increase in anxiety and depressive symptoms. Anxiety and fear, in addition to provoking worsening sleep quality, increases cortisol levels, reduces melatonin synthesis, and causes changes in biological rhythms^{36, 37}. Dysregulation of the hypothalamic-pituitary-adrenal axis may also play a role in the link between poor sleep and feelings of

loneliness and dread²⁴.

However, this study had several limitations. First, the nature of this study is one of the major limitations. Future longitudinal studies are needed to evaluate the residual effects of social isolation after health emergencies. Second, we used a web-based survey, which may have introduced selection bias. This survey was composed of only self-reported questionnaires that were not deepened by clinical and instrumental examinations. The results of our study may provide support for the implementation of interventions for well-being during pandemics. It is important to offer psychological support and psycho-educational interventions to the most vulnerable categories (medical students) on sleep and circadian rhythms to maintain a normal sleep-wake schedule and daily routine during periods of isolation.

Conclusion

Our study revealed a high prevalence of poor sleep quality among medical students during the lockdown. Poor sleep hygiene is a revelation for the mostly ignored aspect of altered sleep patterns. This study showed that sleep quality has significantly improved during the decreasing trend of COVID-19 cases among medical students. However, these are challenging times. The COVID-19 pandemic may be an opportunity to reconsider the effectiveness of current undergraduate medical education and welcome innovative methods of delivering education while ensuring the psychological health of medical students.

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