Sleep Disorders and Their Associated Factors during the COVID-19 Pandemic: Data from Peruvian Medical Students

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Abstract: Background and objectives: Sleep disorders are a common public health problem among college students. The objective of this study was to evaluate sleep quality and its associated factors in medical students during the COVID-19 pandemic. Materials and Methods: Cross-sectional analytical study—we conducted a secondary analysis of the survey “Nomophobia in medical students in Peru” database between 2020 and 2021. Sleep disturbances were assessed using the Pittsburgh Sleep Quality Index (PSQI). To evaluate associated factors, crude and adjusted prevalence ratios (aPR) and their 95% confidence intervals (95% CI) were calculated. Results: We analyzed data from 3139 participants from 18 cities in Peru (61.1% were women, median age: 22 years). 43.4% had a quality of sleep that could require medical attention; the PSQI dimension with the highest score was daytime dysfunction. The poor sleep quality was associated with symptoms of anxiety (aPR: 1.48; 95% CI: 1.27–1.72), depression (aPR: 2.03; 1.72–2.39), or nomophobia (aPR: 1.28; 1.09–1.51). Conclusions: Sleep disorders were a common problem among Peruvian medical students and were associated with anxiety, depression, or nomophobia symptoms.

Keywords: Pittsburgh Sleep Quality Index; Peru; nomophobia; sleep quality; students; medical

1. Introduction

The COVID-19 pandemic has forced countries worldwide to implement measures to contain its spread, such as physical distancing, using masks, and, ultimately, mandatory social confinement [1]. In Peru, a state of emergency was decreed on 15 March 2020, and the beginning of compulsory social immobilization, which over time became focused on some regions during specific hours of the day and ended ultimately only on 31 January 2022 [2]. These measures, coupled with increased morbidity and mortality from COVID-19, have caused psychosocial problems such as stress, worry, fear, anxiety, depressive symptoms, and sleep disorders in public [3–6].

Sleep, like food, water, and air, is a physiological requirement for life. Common sleep disorders include insufficient sleep duration or poor daytime functioning [7]. These sleep disturbances were a public health problem long before the pandemic started [8]. Still, recent research reports that these problems could be increasing due to multiple factors caused by COVID-19, especially in specific populations such as university students, since most do not consider sleep a priority [9–11]. Among them, medical students are particularly prone to unhealthy lifestyles due to high academic load and poor time management skills, which make them more susceptible to sleep disorders and their consequences [12,13].

A systematic review that included 57 observational studies reported that the prevalence of poor sleep quality in medical students was 52.7%, with a variation between 45.3%
and 60.1%, with an increase, especially in students from Europe and America [14], but this review only included studies that had been carried out before the COVID-19 pandemic and only included seven studies carried out in Latin America. In addition, the measures to contain the pandemic and its impact on the population were very diverse in each country. Therefore, it is essential to learn more about this topic in various contexts, especially in South American countries. In this sense, the objective of the following study was to evaluate the quality of sleep in medical students in Peru and its associated factors.

2. Materials and Methods

2.1. Study Design

Cross-sectional analytical study. We performed a secondary analysis of the survey “Nomophobia and its Associated Factors in Peruvian Medical Students.” This study aimed to evaluate the factors associated with nomophobia in Peruvian medical students. The methods used and the main results have been previously described [15].

2.2. Participants and Procedures

The primary study’s population included adult medical students (over 18 years of age) who agreed to participate and declared that they were enrolled in a human medicine school in Peru. Students who did not own a cell phone in the month before the survey were excluded.

The preliminary study performed a convenience sampling and collected information through an online survey using the Google form, following the described methodology. First, they disseminated the survey through social networks with a selective focus on medical students and provide incentives for completing the study altogether. Then they invited more researchers from different medical schools in Peru, and after the training, they were asked to make personal invitations to each medical student from their respective school.

2.3. Variable Definition

The present study focused on sleep quality as the primary outcome, which was assessed using the Pittsburgh Sleep Quality Index (PSQI) [16]. The PSQI comprises 24 items, of which 19 are self-applicable (with scores from 0 to 3 for each item), and five must be answered by a roommate. This last section is not essential to evaluate the PSQI. The global rating is obtained from the sum of the components where a higher score is indicative of a lower quality of sleep.

This way, the global classification can score between 0 and 21. The interpretation, according to the PSQI score obtained is presented as: no sleep problems (<5 points); deserves medical attention (5 to 7 points); deserves attention and treatment doctor (8 to 14 points); it is a severe sleep problem (≥15 points) [16]. For this study, we used 7 points as the cut-off point, those who had a score less than or equal to 7 were considered to have good sleep quality, and those who had a higher score were considered to have poor sleep quality. The study used the version validated in Spanish in medical students from Spain, which reported optimal internal consistency (Cronbach’s α coefficient of 0.81) [17].

To assess the degree of anxiety and depression, they used the Hopkins Symptom Checklist-25 (HSCL-25) [18]. The HSCL-25 consists of 25 items (10 to address anxiety and 15 to address depression). Responses are scored on a 4-point Likert scale, ranging from 1 (“not at all”) to 4 (“a lot”). The study used the version validated in Spanish in the adult Peruvian population, presenting adequate internal consistency (global Cronbach’s Alpha 0.90; anxiety, α = 0.81; and depression, α = 0.86) [19].

The severity of nomophobia was assessed using the Nomophobia Questionnaire (NMP-Q) [20]. The questionnaire consists of 20 items with a Likert scale score of 7 points ranging from 1 (“strongly disagree”) to 7 (“strongly agree”), and a total score between 20 and 140 points. For the study, they used the Spanish version of the NMP-Q, which was validated, reporting adequate internal consistency (Cronbach’s alpha 0.95) [21].
Other variables used for the analysis were: age (in terciles), sex, being in a relationship (yes/no), university financing (public/private), year of study (first to third year/fourth to the sixth year), failing a course in the previous semester (yes/no), number of siblings (none/one to two/more than 3), playing a sport (yes/no), level of higher technical or university education of the parents (yes/no), cell phone review time interval (5 min/20 min/1 h/3 h), cell phone usage schedule (all the time/morning/afternoon/night).

2.4. Statistical Analysis

We downloaded the database to the Microsoft Excel program and then exported it for analysis in the statistical program Stata v16. For the descriptive analysis, frequencies, percentages, measures of central tendency, and measures of dispersion were used.

To evaluate the factors associated with sleep quality, the dichotomous interpretation (good and poor sleep quality) of the PSQI was considered, as a result variable. We used Poisson regression models with robust variance and calculated the prevalence ratio (PR) with their respective 95% confidence intervals (95%CI). For this, we first performed a raw, robust variance Poisson regression with each variable, those with statistical significance ($p < 0.05$) were selected and finally entered the adjusted regression model.

2.5. Ethics

This study was conducted following the international research ethics guidelines of the Declaration of Helsinki. The research protocol was evaluated and approved by the ethics committee of the Faculty of Health Sciences of the Private University of Tacna (identification code: 099-FACSA-UI). Informed consent was not requested due to the observational and retrospective nature of the study.

3. Results

3.1. Population Characteristics

We analyzed data from 3139 medical students distributed in 18 cities in Peru. The female sex was predominant (61.1%), the median age was 22 years (IQR 20–24), and the majority reported that they did not play any sport (52.9%).

Regarding their education, 50.8% report that they study at a university with public financing, and 51.3% are between the 1st and 3rd year of studies. On the other hand, most students (86.5%) reported that they did not fail any course in the semester before the study.

Anxiety and depression symptoms were positive (score $\geq 1.75$) in 34.8% and 42.8% of the students surveyed, respectively; likewise, the median nomophobia severity score was 47 points (IQR 33–69). On the other hand, most students had a quality of sleep that required medical attention (43.4%) (Table 1).

Table 1. Characteristics of the study population ($n = 3139$).

| Characteristic               | n (%)   |
|------------------------------|---------|
| **Sex**                      |         |
| Female                       | 1919 (61.1) |
| Male                         | 1220 (38.9)  |
| **Age**                      |         |
| 18 to 20                     | 1086 (34.6)  |
| 21 to 23                     | 1162 (37.0)  |
| 24 to more                   | 891 (28.4)   |
| **Have a relationship**      |         |
| Nope                         | 2168 (69.1)  |
| Yes                          | 971 (30.9)   |
| **Financing your university**|         |
| Public                       | 1544 (49.2)  |
| Private                      | 1595 (50.8)  |
Table 1. Cont.

| Characteristic                                           | n (%)       |
|----------------------------------------------------------|-------------|
| **Year of studies**                                      |             |
| 1st to 3rd                                               | 1609 (51.3) |
| 4th to 6th                                               | 1530 (48.7) |
| **Failed a course the previous semester**                |             |
| Nope                                                     | 2714 (86.5) |
| Yes                                                      | 425 (13.5)  |
| **Number of brothers**                                   |             |
| None                                                     | 264 (8.4)   |
| 1 to 2                                                   | 2122 (67.6) |
| More than 3                                              | 753 (24.0)  |
| **Do any sports**                                        |             |
| Nope                                                     | 1660 (52.9) |
| Yes                                                      | 1479 (47.1) |
| **The level of education of the parents is higher technical or university** | | |
| Mother                                                   | 2359 (75.2) |
| Father                                                   | 2469 (78.7) |
| **How often do you check your cell phone?**              |             |
| 5 min                                                    | 360 (11.5)  |
| 20 min                                                   | 1841 (58.7) |
| 1 h                                                       | 598 (19.1)  |
| 3 h                                                       | 340 (10.8)  |
| **What part of the day do you use your cell phone?**     |             |
| All time                                                 | 411 (13.1)  |
| Mornings                                                 | 686 (21.9)  |
| Afternoon                                                 | 934 (29.8)  |
| Night                                                    | 1108 (35.3) |
| **Anxiety (HSCL-25)**                                    |             |
| Score (Range: 10 to 40 points) *                         | 15 (12–20)  |
| Average score ≥ 1.75                                     | 1091 (34.8) |
| **Depression (HSCL-25)**                                 |             |
| Score (Range: 15 to 60 points) *                         | 25 (19–32)  |
| Average score ≥ 1.75                                     | 1343 (42.8) |
| **Nomophobia (NMP-Q)**                                   |             |
| Score (Range: 20 to 140 points) *                        | 47 (33–69)  |
| Tertile 1                                                | 1047 (33.4) |
| Tertile 2                                                | 1052 (33.5) |
| Tertile 3                                                | 1040 (33.1) |
| **Sleep quality (PSQI)**                                |             |
| Score (Range: 0 to 21 points) *                          | 6 (5–8)     |
| No sleep problem (<5 points)                             | 714 (22.8)  |
| Deserves medical attention (5 to 7 points)               | 1361 (43.4) |
| Deserves medical attention and treatment (8 to 14 points)| 1042 (33.2) |
| It is a severe sleep problem (<15 points)                | 22 (0.7)    |

* Median (Interquartile Range).

3.2. Distribution of Sleep Quality Score

The dimension with the highest score (3 points) was daytime dysfunction, and within this, the highest item was “How much trouble have you had staying upbeat or enthusiastic when carrying out your tasks or activities?” (1 point) The second dimension with the highest score was sleep efficiency. On the other hand, the dimension with the lowest score was use of sleep medications, where most students report that they do not use sleep medications (Table 2 and Figure 1).
Table 2. Score on each PSQI item (n = 3139).

| Statements                                                                 | Score (Median ± Interquartile Range) |
|---------------------------------------------------------------------------|--------------------------------------|
| **Dimension 1: Subjective sleep quality**                                |                                      |
| How would you rate the quality of your sleep during the last four weeks? | 1 (1–2)                              |
| **Dimension 2: Sleep latency**                                            |                                      |
| In the last four weeks, how long did it usually take to fall asleep (fall asleep) at night? (In minutes) | 20 (10–30)                           |
| In the last four weeks, how long did it usually take to fall asleep (fall asleep) at night? (In hours) | 1 (0–2)                              |
| **Dimension 3: Duration of sleep**                                        |                                      |
| In the last four weeks, how many effective hours have you slept per night? (In hours) | 6 (5–7)                              |
| **Dimension 4: Sleep Efficiency**                                         |                                      |
| In the past four weeks, write the usual time you went to bed              | 24 (1–23)                            |
| In the last four weeks, what time did you usually get out of bed in the morning and have not gone back to sleep? | 6 (6–8)                              |
| **Dimension 5: Sleep disturbances**                                       |                                      |
| In the last four weeks, how many times have you had trouble sleeping because of waking up at night or early in the morning? | 1 (0–2)                              |
| How many times have you had trouble sleeping for other reasons in the last four weeks? | 0 (0–1)                              |
| **Dimension 6: Use of sleep medications**                                 |                                      |
| During the past four weeks, how often have you taken sleeping medicine (prescribed by the doctor or on your own)? | 0 (0–0)                              |
| **Dimension 7: Diurnal dysfunction**                                      |                                      |
| During the last four weeks, how often have you felt drowsy (or very sleepy) when driving, eating, working, studying, or doing some other activity? | 1 (0–2)                              |
| Over the past few weeks, how much trouble have you had staying upbeat or excited about doing your tasks or activities? | 1 (1–2)                              |

Figure 1. Distribution of the score of each dimension of the PSQI (n = 3139).

3.3. Factors Associated with Sleep Quality

In the adjusted Poisson regression model, we identified that the factors associated with poor sleep quality were anxiety symptoms (PRa: 1.48; 95% CI: 1.27–1.72), depression (PRa: 2.03; 95% CI: 1.72–2.39), or nomophobia (PRa: 1.28; 95% CI: 1.09–1.51). On the other hand, the factor associated with better sleep quality was found in those who reported using cell phones predominantly in the afternoons (PRa: 0.81; 95% CI: 0.68–0.97) (Table 3).
Table 3. Poisson regression to determine the factors associated with poor sleep quality in the study population.

| Characteristic                                    | Participants with Good Sleep Quality (%) | Participants with Poor Sleep Quality (%) | Crude PR (95% CI) | PR Adjusted (95% CI) |
|---------------------------------------------------|------------------------------------------|------------------------------------------|-------------------|-----------------------|
| Sex                                               |                                          |                                          |                   |                       |
| Male                                              | 861 (70.6)                               | 359 (29.4)                               | Ref.              | Ref.                  |
| Female                                            | 1214 (63.3)                              | 705 (36.7)                               | 1.24 (1.09–1.40)  | 1.07 (0.94–1.22)      |
| Age                                               |                                          |                                          |                   |                       |
| 18 to 20                                          | 695 (64.0)                               | 391 (36.0)                               | Ref.              | Ref.                  |
| 21 to 23                                          | 757 (65.2)                               | 405 (34.9)                               | 0.98 (0.85–1.13)  | 1.05 (0.89–1.24)      |
| 24 or more                                        | 623 (69.9)                               | 268 (30.1)                               | 0.85 (0.73–1.00)  | 1.06 (0.88–1.28)      |
| Have a relationship                               |                                          |                                          |                   |                       |
| No                                                | 1415 (65.3)                              | 753 (34.7)                               | Ref.              | -                     |
| Yes                                               | 660 (68.0)                               | 311 (32.0)                               | 0.92 (0.81–1.05)  | -                     |
| Financing your university                         |                                          |                                          |                   |                       |
| Public                                            | 1058 (68.5)                              | 486 (31.5)                               | Ref.              | -                     |
| Private                                           | 1017 (63.8)                              | 578 (36.2)                               | 1.16 (0.99–1.35)  | -                     |
| Year of studies                                   |                                          |                                          |                   |                       |
| 1st to 3rd                                        | 1025 (63.7)                              | 584 (36.3)                               | Ref.              | Ref.                  |
| 4th to 6th                                        | 1050 (68.6)                              | 480 (31.4)                               | 0.87 (0.77–0.98)  | 0.96 (0.83–1.12)      |
| Failed a course the previous semester             |                                          |                                          |                   |                       |
| No                                                | 1825 (67.2)                              | 889 (32.8)                               | Ref.              | Ref.                  |
| Yes                                               | 250 (58.8)                               | 175 (41.2)                               | 1.26 (1.07–1.48)  | 1.16 (0.98–1.37)      |
| Number of brothers                                |                                          |                                          |                   |                       |
| None                                              | 161 (61.0)                               | 103 (39.0)                               | Ref.              | -                     |
| 1 to 2                                            | 1405 (66.2)                              | 717 (33.8)                               | 0.87 (0.71–1.07)  | -                     |
| More than 3                                       | 509 (67.6)                               | 244 (32.4)                               | 0.84 (0.66–1.06)  | -                     |
| Do any sports                                     |                                          |                                          |                   |                       |
| No                                                | 1032 (62.2)                              | 628 (37.8)                               | Ref.              | Ref.                  |
| Yes                                               | 1043 (70.5)                              | 436 (29.5)                               | 0.77 (0.69–0.88)  | 0.94 (0.82–1.06)      |
| His mother’s educational background is higher technical or university | | | | |
| No                                                | 552 (70.8)                               | 228 (29.2)                               | Ref.              | -                     |
| Yes                                               | 1523 (64.6)                              | 836 (35.4)                               | 1.19 (1.03–1.39)  | -                     |
| His father’s educational background is higher technical or university | | | | |
| No                                                | 458 (68.4)                               | 212 (31.6)                               | Ref.              | -                     |
| Yes                                               | 1617 (65.5)                              | 852 (34.5)                               | 1.07 (0.92–1.25)  | -                     |
| How often do you check your cell phone?           |                                          |                                          |                   |                       |
| 5 min                                             | 200 (55.6)                               | 160 (44.4)                               | Ref.              | -                     |
| 20 min                                            | 1213 (65.9)                              | 628 (34.1)                               | 0.77 (0.65–0.92)  | -                     |
| 1 h                                               | 419 (70.1)                               | 179 (29.9)                               | 0.68 (0.55–0.85)  | -                     |
| 3 h                                               | 243 (71.5)                               | 97 (28.5)                                | 0.65 (0.51–0.84)  | -                     |
| What part of the day do you use your cell phone?  |                                          |                                          |                   |                       |
| All time                                          | 545 (58.4)                               | 389 (41.7)                               | Ref.              | Ref.                  |
| Morning                                           | 275 (66.9)                               | 136 (33.1)                               | 0.79 (0.65–0.96)  | 0.91 (0.75–1.11)      |
| Afternoon                                         | 486 (70.9)                               | 200 (29.2)                               | 0.70 (0.59–0.83)  | 0.81 (0.68–0.97)      |
| Night                                            | 769 (69.4)                               | 339 (30.6)                               | 0.74 (0.64–0.86)  | 0.87 (0.75–1.01)      |
| Anxiety (HSCL-25)                                 |                                          |                                          |                   |                       |
| Average score < 1.75                              | 1589 (77.6)                              | 459 (22.4)                               | Ref.              | Ref.                  |
| Average score ≥ 1.75                              | 486 (44.6)                               | 605 (55.5)                               | 2.47 (2.19–2.79)  | 1.48 (1.27–1.72)      |
| Depression (HSCL-25)                              |                                          |                                          |                   |                       |
| Average score < 1.75                              | 1454 (81.0)                              | 342 (19.0)                               | Ref.              | Ref.                  |
| Average score ≥ 1.75                              | 621 (46.2)                               | 722 (53.8)                               | 2.82 (2.48–3.21)  | 2.03 (1.72–2.39)      |
| Nomophobia (NMP-Q)                                |                                          |                                          |                   |                       |
| Tertile 1                                         | 801 (76.5)                               | 246 (23.5)                               | Ref.              | Ref.                  |
| Tertile 2                                         | 694 (66.0)                               | 358 (34.0)                               | 1.45 (1.23–1.70)  | 1.14 (0.97–1.35)      |
| Tertile 3                                         | 580 (55.8)                               | 460 (44.2)                               | 1.87 (1.60–2.19)  | 1.28 (1.09–1.51)      |

4. Discussion

4.1. Sleep Quality

About 77.3% of the medical students evaluated reported poor sleep quality, and about half obtained a score for which they possibly required medical attention to treat...
this problem. A study in 2013 conducted at a medical school in Lambayeque-Peru among medical students from 1st to 6th years, which also used the Pittsburgh sleep quality questionnaire and used 5 points as a cut-off point for poor sleep quality, reported that they presented a prevalence of poor sleep quality in 79.9% of the students evaluated [22], another study in the same year and city, similar to the previous one, evaluated 247 health sciences students, and reported that the 85% of the respondents had a prevalence of poor sleep quality [23].

Although these studies were conducted only in one medical school and with a small number of students, the prevalence of poor sleep quality is similar to what we report, suggesting that medical students in Peru possibly already suffered from poor quality sleep, even before the pandemic. This poor quality of sleep could generate alterations in cognitive processes, memory, and learning [14,25], which would lead to poor academic performance [14,26]. In addition, it has been reported that it can lead to an increased risk of psychological morbidity [27], lowering mood, and finally being related to various mental health problems, cardiovascular diseases, obesity, diabetes, and increased mortality [28].

There is controversy about the impact of the COVID-19 pandemic on sleep quality; some authors report that poor sleep quality increased [3,10], probably due to the stress generated by social isolation and changes in habitual behavior. On the other hand, other studies report an improvement in sleep quality [11,29] due to an increase in sleep time due to the fact that classes became online, clinical rotations were not carried out, and the time spent going and coming from the university and hospitals were reduced to zero.

4.2. Nomophobia Associated with Poor Sleep Quality

Nomophobia is considered a disorder of contemporary digital and virtual society, and it refers to a pathological fear of being left without a mobile phone. In our research, students with poor sleep quality were associated with higher nomophobia scores. This result is like a study conducted between 2016 and 2017 on 610 medical students from Saudi Arabia [30]. Other investigations on medical students whose instruments differed from ours also associated poor sleep quality with mobile devices [31–33]. The similarity of these findings could be because excessive use of mobile devices is a factor in developing sleep disorders [34] due to several mechanisms, such as the bright light emitted by the device [30] and more time looking the cellphone [35]. This may delay the circadian cycle when it occurs at night, which could interfere with sleep quality [32]. It should be noted that these facts may have been amplified in the context of the pandemic.

On the other hand, there is electrophysiological, neuroimmunological, neuroendocrine, and autonomic evidence of arousal and anxiety in people with sleep disorders [36–38]. This suggests that anxiety may be a common factor underlying the two conditions (i.e., nomophobia and insomnia). This is consistent with the hyperarousal model of insomnia, and anxiety would also play a prominent role in nomophobia [15]. Therefore, future research should learn more about the mechanisms involved in nomophobia and its possible consequences; this could be developed with multicentric and prospective studies that evaluate not only the characteristics of people with nomophobia but also possible interventions to reduce this health problem.

4.3. Anxiety and Depression Associated with Poor Sleep Quality

Students who suffered from symptoms of anxiety or depression had a lower quality of sleep; this result is similar to that of other studies [14,39–41]. This association could be because poor sleep quality acts as a symptom, comorbidity, or cause of mental disorders (anxiety or depression) [42] since sleep disturbances can be an early marker of depression or anxiety [43,44].

On the other hand, increased stress related to the COVID-19 pandemic has been associated with longer sleep latency, more fragmented sleep, and nightmares [45–47]. These findings are similar to the effects of being in the face of natural disasters or traumas [48]; this could probably be because the COVID-19 pandemic increased stress levels, and this,
in turn, caused sleep disorders; moreover, we can’t tell if anxiety directly affected sleep quality or vice versa since we cannot extract a one-way causality with our data.

4.4. Limitations

This study has certain limitations that must be considered when interpreting the results. First, the data analyzed belong to a cross-sectional study, which makes it impossible to assess the direction of the temporality of the associations. Second, all variables of interest were self-reported, with the inherent social desirability bias. However, it was explained to the participants that the survey would be anonymous, which could reduce this risk. Finally, it should be considered that the participants were approached through Facebook and WhatsApp, so the users of these applications are likely overrepresented.

5. Conclusions

A high frequency of medical students in Peru had poor sleep quality during the COVID 19 pandemic. In addition, it was shown that there was a significant association between symptoms of anxiety and depression and suffering from Nomophobia. These problems may have been amplified during the pandemic years compared to years before the pandemic. For this reason, it is recommended to carry out educational programs on the importance of sleep and carry out more research on the factors associated with poor sleep quality.

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