



Technologies and Mental Health in University Students: An Unhealthy Combination

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Abstract

Introduction The exposure of medical students to a full-time schedule that includes classes, extracurricular activities, patients' lives responsibility, and great competition between classmates can interfere in emotional issues and in the sleep time.

Objective The aim of the present study was to evaluate the sleep quality, and the incidence of anxiety and depression in medical school undergraduates as well as the relationship of these parameters with the intense use of technologies.

Methods Fifty-five medical school undergraduates in their second year participated in the present study, answering questionnaires to evaluate sleep quality (Pittsburgh sleep quality index - PSQI), night-time use of technology (sleep time-related information and communication technology - STRICT), and signs of anxiety or depression (hospital anxiety and depression scale - HADS).

Results The results showed 31 students (56.4%) with poor sleep quality (PSQI > 5). Based on the STRICT questionnaire, 36 (65.4%) of the participants referred to making use of technology at night-time; and 34 (61.8%) students had compatible anxiety score, while 14 (25.4%) had a compatible score for depression on the HADS questionnaire. There has been a correlation between poor sleep quality, the abuse of technologies before sleep time, and the presence of anxiety or depression.

Conclusion The abuse of technology before sleep time reduced the sleep quality in the studied population, besides increasing the symptoms of anxiety and depression.

Keywords

- ▶ sleep
- ▶ technology
- ▶ sleep hygiene
- ▶ sleep quality
- ▶ depression
- ▶ anxiety

Introduction

Medical students have a higher chance to suffer from stress because of the university's extended workload, which is added to the fact that they are in contact with patients in weakness contexts. This workload, mental effort, and academic stress are directly related to motivation and perfor-

mance in academic activities,^{1,2} metacognitive performance, and critical thinking.² Besides that, competition and participation in extracurricular activities make them more susceptible to developing mental health disorders such as anxiety and depression.¹⁻³

Specifically in relation to anxiety, medical students show a high prevalence, with a Brazilian sample who answered the

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hospital anxiety and depression scale (HADS) reporting 19.7% of students showing this characteristic.⁴ There is an increase of pressure on students as the medical course progresses, making psychological changes more prevalent in the last years of the course. Regarding sleep quality, there is a pattern of decrease in quality over the years of medical school.⁵

Although there is a tendency for these quality of life standards to worsen during medical training, it is worth highlighting the results of two Brazilian studies, one in the state of Paraíba and the other in the state of São Paulo, which measured this variation through the quality questionnaire of Pittsburgh Sleep (PSQI). Both studies showed that the quality of sleep in the first 2 years of graduation was lower when compared to consecutive semesters 6-7.⁷

Anxiety and depression are important factors for sleep quality. A study conducted in Japan with adolescents revealed that anxiety and depression are associated with sleep deprivation.⁸ It is possible that young adults, like most medical students, will have similar symptoms. However, national studies on those variables are still scarce.

Another aggravating factor to these aspects is the intense use of technology and digital media for personal and academic matters, which is a behavior frequently displayed by university students. For example, 58.87% of medical students in India reported excessive use of technologies.⁹ The use of technologies, especially smartphones and laptops, relates to poorer sleep quality,¹⁰ and increased anxiety and depression.¹¹ Rosen et al. (2016)¹² point out, in a sample of North American university students, that anxiety has a relation with the increased use of smartphones, which lead to sleeping problems, especially middle-of-the-night awakenings. In Brazil, a country that has widespread internet access, with 82.7% of households with internet access, and 99.2% of households with at least one cell phone, this concern is even greater.¹³

Thus, aiming at a better understanding, planning, and establishment of mental health promotion strategies for medical students, the present study aimed to assess sleep quality, and the incidence of anxiety and depression in undergraduate medical students, as well as the role of technology use in those variables.

Methods

Participants

Fifty-five students participated in the current study, 37 of which were women in the 2nd-year of medicine course at a public college in the countryside of São Paulo. The mean age of the sample was 21 ± 1.74 years.

Tools

Three standardized questionnaires were used: the Pittsburgh sleep quality index (PSQI); the sleep time-related information and communication technology (STRICT), and the hospital anxiety and depression scale (HADS).

The HADS questionnaire¹⁴ consists of 14 questions with 4 possible answers, ranging from 0 to 4 points each, divided

equally between depression and anxiety. The higher the sum of the scores, the higher the chances that the student presents one or both of the disorders. The HADS proposes the division of depression and anxiety into three categories: improbable (0–7 points), questionable or doubtful (8–11 points), and probable (12–21 points). The scale has been validated for Brazilian Portuguese and shows reliability of 0.68 for anxiety and 0.77 for depression.¹⁵

The PSQI questionnaire¹⁶ contains 12 multiple-choice-questions. The result of the questionnaire consists of the final sum of 7 components graded from 0 to 3; therefore, the final grade is between 0 and 21, with values greater than 5 representing a poor sleep quality. The Brazilian adaptation performed by Bertolazi (2008)¹⁷ presents reliability of 0.82.

The questionnaire about cell phone use, STRICT,¹⁸ has 11 questions with 5 possible answers, and scores ranging from 0 to 5. The higher the score, the greater the impact of cell phone use on sleep quality. This instrument has two parts, the first one is on the use of STRICT and the second one is on sleep habits. The first part goes from questions 1 to 7, and the sum of points for each question generates the STRICT use, ranging between 0 and 35. In the second part, the students answer two questions about how many hours of sleep they have on weekdays and weekends. The score of these answers ranges from 0 to 4, and, subsequently, there is a subtraction between the score of 9 and 8, with a positive result from this account representing a greater amount of sleep on weekends than on weekdays. A negative result means the opposite, and a neutral result that the number of hours does not change between weekends and weekdays. Also, in the third part, in questions 10 and 11, the questions about bedtime on weekdays and weekends follow the same pattern.

Procedures

This research was submitted to the University's ethics review board (CAAE number 90202718.0.0000.5411). The authors invited participants to answer the instruments through the students' WhatsApp group a week before the application, explaining the research goals and the scales. There was also a reminder about the survey 1 day before the application of the questionnaires using the same technology platform. Both messages reached this group through the members of the class, at the request of the team member involved in this study.

Ninety students received the invitation, and 55 completed all scales. The authors performed the application on a single day, lasting ~ 15 minutes. The students had no difficulties in answering and the few doubts regarding the questions were promptly answered.

Statistical Analysis

After collecting the answers to the questionnaires, the results were tabulated in an Excel spreadsheet (Microsoft Corp. Redmond, WA, USA), and then submitted to inductive statistical analysis. Student's t test was used for comparative analyses, due to the result of the Shapiro-Wilk normality test. The Pearson correlation test was performed, considering $p < 0.05$.

Table 1 Frequencies, mean, and association analysis of the results of anxiety, depression, use of technologies, and sleep quality in relation to sex

| | | Total | Female | Male | P |
|--|-------------------------|-------------|-------------|-------------|--|
| Hospital anxiety and depression scale (HADS) | Anxiety | 8.93 ± 3.54 | 9.38 ± 3.6 | 8.0 ± 3.33 | 0.18 |
| | Improbable ^a | 21 (38.2%) | 13 (35.1%) | 8 (44.4%) | 0.52 ^a × ^{bc} 0.89 ^a × ^b × ^c |
| | Possible ^b | 20 (36.4%) | 13 (35.1%) | 7 (38.9%) | |
| | Probable ^c | 14 (25.4%) | 11 (29.7%) | 3 (16.7%) | |
| | Depression | 6.16 ± 3.62 | 6.14 ± 3.97 | 6,22 ± 2.88 | 0.93 |
| | Improbable ^a | 41 (74.5%) | 28 (75.7%) | 13 (72.2%) | 0.79 ^a × ^{bc} 0.34 ^a × ^b × ^c |
| | Possible ^b | 9 (16.4%) | 5 (13.5%) | 4 (22.2%) | |
| Probable ^c | 5 (9.1%) | 4 (10.8%) | 1 (5.5%) | | |
| PSQI | | 5.78 ± 3.13 | 5,97 ± 3.38 | 5.39 ± 2.57 | 0.52 |
| Technologies | | 11.5 ± 3.94 | 10,9 ± 3.69 | 12.7 ± 4.28 | 0.13 |

Abbreviation: PSQI, Pittsburgh sleep quality index;

Independent Student *t*-test for all continuous variables.

For ordinal variables, the Mann-Whitney test was used to compare two groups and Kruskal-Wallis was used for three groups.

(*) < 0.05 statistical significance.

Results

The results will be presented in the following order: 1) descriptive results regarding HADS, technologies and sleep quality; 2) comparisons between gender (→ **Table 1**), and 3) correlations regarding these variables (→ **Table 2**). (→ **Table 1**) shows the frequencies of HADS by gender. We observed a higher occurrence of anxiety in HADS (possible or probable anxiety 61.8%) when compared with depression (possible or probable depression in 25.5%) (→ **Table 1**).

Considering the PSQI results, poor sleep quality was observed in 24 (64.9%) women and in 7 (38.9%) men. In the full sample, 31 (56.4%) participants disclosed poor sleep quality. In the STRICT questionnaire, in the question about the use of technologies before sleep, 65.4% of our sample reported this habit. → **Table 1** presents the means according to participants' sex.

The use of technology was correlated with the PSQI and HADS. The PSQI also presented a positive correlation with the HADS (→ **Table 2**).

Discussion

This study shows high frequencies of disturbance in sleep quality, high prevalence of anxiety symptoms, and abuse of technology by our students' sample. It also presents significant and positive correlations between the use of technologies, anxiety, depression, and lower sleep quality. These findings reinforce the need to create mechanisms for early intervention, during the beginning of the medical course, aiming to disseminate measures to avoid the psychological distress of university students.

There is an overall prevalence of anxiety of 26.4% in basic cycle medical students (first 2 years), 19 comparing with our study, the result is similar to that of the literature by the classification of probable anxiety (25.4%), but when comparing with the classification of possible anxiety (61.8%), our study surpasses the data in the literature. Quek's study included different questionnaires validated in the literature, not just the HADS instrument, which may explain this variation. Another factor to be considered is that question-

Table 2 Correlation between anxiety and depression with the use of technology and sleep quality

| Variables | M ± DP | 1 | 2 | 3 | 4 | 5 |
|------------------------|-------------|--------|-------|-------|-------|---|
| 1. Age | 210 ± 1.74 | | | | | |
| 2. Use of technologies | 11.5 ± 3.94 | 0.16 | | | | |
| 3. PSQI | 5.78 ± 3.13 | 0.06 | 0.34* | | | |
| 4. HADS - anxiety | 8.93 ± 3.54 | - 0.24 | 0.38* | 0.45* | | |
| 5. HADS - depression | 6.16 ± 3.62 | - 0.03 | 0.35* | 0.41* | 0.59* | |

Abbreviations: M, average; SD, standard deviation; PSQI, Pittsburgh sleep quality index, HADS, hospital anxiety and depression scale.

Statistical test: Pearson correlation.

(*) < 0.05 statistical significance.

naires applied in the same class may reflect the feelings of students in that specific week, which could have been an atypical and more stressful week than usual. Because of this factor, it is important to differentiate between students who fall into the anxiety category and those who fall into the probable anxiety category. Another factor to be considered is that questionnaires applied to the same class may reflect the students' feelings in that specific week, which could have been an atypical and more stressful week than usual. Because of this factor, it is important to differentiate between students who fit into the anxiety category and those who fall into the probable anxiety category, as these will rarely have their answers influenced by an atypical routine, while, in full-blown anxiety, this is a factor to be considered, since the HADS instrument does not ask that the symptoms being discussed have been present for a certain period.

Considering the complaints related to depression, from the possible and probable classifications, there was an occurrence of 25.5%, which is similar to the results of a meta-analysis carried out with the population of medical students, which observed the occurrence of 27.2% of depression, also resulting from questionnaires.²⁰ It is interesting to highlight the difference between medical students and the Brazilian population, which would have a prevalence of 4.1% in the estimate by Munhoz et al. (2016).²¹ Future research should characterize in detail the context of medical education, correlating it with mental health problems, for better planning of health promotion actions.²⁰ It is interesting to highlight the difference between medical students and the Brazilian population, which would have a prevalence of 4.1% in an estimate made by Munhoz et al. (2016).²¹ Future research should investigate whether medical students have a higher baseline for this depressive symptomatology or whether the events and context of medical training are the primary culprits for this prevalence of mental health issues.

It is possible that because of the transience of some anxiety or depressive symptoms related to contextual factors, some participants do not actually have the disorders. However, the prevalent symptomatology of depression in this population is a global phenomenon according to a meta-analysis on the topic.²² However, treatments are rare or non-existent in most cases. Universities and medical courses must make an effort to guarantee access to care for students during their training.

In the present study, it was possible to observe that more than half of the sample presented changes in the quality of sleep (56.4%), as well as a high use of technology at bedtime, 65.4% of the population. These findings are similar to those observed in the literature. A study investigating medical and pharmacy students from Morocco indicated the use of cell phones in the presleep routine as associated with poor sleep quality,²³ which was also found in a study conducted in the United States.¹²

The present study suggested an important association between poor sleep quality, anxiety or depression, and the excessive use of technologies at bedtime, which also has been reported previously in the literature.²⁴ This shows that the routine of these students induces them to maintain negative

habits, such as poor sleep and the use of devices with screens that compromise sleep hygiene. These aspects, combined with a brief opportunity for help and health monitoring of students around the world²² show the urgent need for changes that will produce greater acceptance and possibilities for interventions with this group of students.

As a limitation of this study, we can mention the small sample size, all from the same medicine course with similar experiences throughout the basic cycle, which makes the results more homogeneous and, therefore, less susceptible to major routine differences that would be observed, for example, in boarding school students. Another limitation is that the questionnaires were applied at a single moment, with possible exacerbation of symptoms for an atypical week, as pointed out in the discussion.

Despite its limitations, the importance of this study lies in showing the high prevalence of psychological disorders, besides changes in sleep quality and poor sleep hygiene, which show the need for this population to be identified early and to be monitored by the educational institution.

Conclusion

The present study showed that most students' quality of sleep was poor, in addition to a high anxiety and depression symptoms prevalence. We point out that both the quality of sleep and the presence of psychological disorders are related to the abuse of technology before bedtime.

Conflict of Interests

The authors have no conflict of interests to declare.

References

- Atalay KD, Can GF, Erdem SR, Muderrisoglu IH. Assessment of mental workload and academic motivation in medical students. *J Pak Med Assoc* 2016;66(05):574–578
- Trigueros R, Padilla A, Aguilar-Parra JM, Mercader I, López-Liria R, Rocamora P. The influence of transformational teacher leadership on academic motivation and resilience, burnout and academic performance. *Int J Environ Res Public Health* 2020;17(20):7687
- Trigueros R, Padilla A, Aguilar-Parra JM, et al. The influence of teachers on motivation and academic stress and their effect on the learning strategies of university students. *Int J Environ Res Public Health* 2020;17(23):9089
- Vasconcelos TC, Dias BRT, Andrade LR, Melo GF, Barbosa L, Souza E. Prevalência de sintomas de ansiedade e depressão em estudantes de medicina. *Rev Bras Educ Med* 2015;39(01):135–142
- Alves JGB, Tenório M, dos Anjos AG, Figueroa JM. Qualidade de vida em estudantes de Medicina no início e final do curso: avaliação pelo Whoqol-bref. *Rev Bras Educ Med* 2010;34(01):91–96
- Segundo LVG, Neto BFC, Paz DA, Holanda MMA. Aspectos relacionados à qualidade do sono em estudantes de Medicina. *Revista Brasileira de Neurologia e Psiquiatria* 2017;1414–0365
- Corrêa CC, Oliveira FK, Pizzamiglio DS, Ortolan EVP, Weber SAT. Sleep quality in medical students: a comparison across the various phases of the medical course. *J Bras Pneumol* 2017;43(04):285–289
- Ojio Y, Nishida A, Shimodera S, Togo F, Sasaki T. Sleep duration associated with the lowest risk of depression/anxiety in adolescents. *Sleep (Basel)* 2016;39(08):1555–1562

- 9 Chaudhari B, Menon P, Saldanha D, Tewari A, Bhattacharya L. Internet addiction and its determinants among medical students. *Ind Psychiatry J* 2015;24(02):158–162
- 10 Dowdell EB, Clayton BQ. Interrupted sleep: College students sleeping with technology. *J Am Coll Health* 2019;67(07):640–646. Doi: 10.1080/07448481.2018.1499655
- 11 Zeeni N, Doumit R, Abi Kharma J, Sanchez-Ruiz MJ. Media, technology use, and attitudes: associations with physical and mental well-being in youth with implications for evidence-based practice. *Worldviews Evid Based Nurs* 2018;15(04):304–312
- 12 Rosen L, Carrier LM, Miller A, Rokkum J, Ruiz A. Sleeping with technology: cognitive, affective, and technology usage predictors of sleep problems among college students. *Sleep Health* 2016;2(01):49–56. Doi: 10.1016/j.sleh.2015.11.003
- 13 Instituto Brasileiro de Geografia e Estatística (IBGE) Pesquisa Nacional por Amostra de Domicílios – PNAD. Available in: <https://www.ibge.gov.br/estatisticas/sociais/populacao/9127-pesquisa-nacional-por-amostra-de-domicilios.html>
- 14 Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67(06):361–370
- 15 Botega NJ, Bio MR, Zomignani MA, Garcia C Jr, Pereira WAB. Transtornos do humor em enfermagem de clínica médica e validação de escala de medida (HAD) de ansiedade e depressão. *Rev Saude Publica* 1995;29:359–363
- 16 Buysse DJ, Reynolds CF III, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28(02):193–213
- 17 Bertolazi AN, Fagundes SC, Hoff LS, Pedro VD, Menna Barreto SS, Johns MW. Portuguese-language version of the Epworth sleepiness scale: validation for use in Brazil. *J Bras Pneumol* 2009;35(09):877–883. Doi: 10.1590/s1806-37132009000900009
- 18 Polos PG, Bhat S, Gupta D, et al. The impact of Sleep Time-Related Information and Communication Technology (STRICT) on sleep patterns and daytime functioning in American adolescents. *J Adolesc* 2015;44:232–244
- 19 Quek TT, Tam WW, Tran BX, et al. The Global Prevalence of Anxiety Among Medical Students: A Meta-Analysis. *Int J Environ Res Public Health* 2019;16(15):2735
- 20 Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. *JAMA* 2016;316(21):2214–2236
- 21 Munhoz TN, Nunes BP, Wehrmeister FC, Santos IS, Matijasevich A. A nationwide population-based study of depression in Brazil. *J Affect Disord* 2016;192:226–233. Doi: 10.1016/j.jad.2015.12.038
- 22 Puthran R, Zhang MW, Tam WW, Ho RC. Prevalence of depression amongst medical students: a meta-analysis. *Med Educ* 2016;50(04):456–468. Doi: 10.1111/medu.12962
- 23 Jniene A, Errguig L, El Hangouche AJ, et al. Perception of sleep disturbances due to bedtime use of blue light-emitting devices and its impact on habits and sleep quality among young medical students. *BioMed Res Int* 2019;2019(02):7012350
- 24 Demirci K, Akgönül M, Akpınar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. *J Behav Addict* 2015;4(02):85–92