Sleep quality among undergraduate medical students at a South African university: A cross-sectional study

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Background. Poor sleep quality among medical students may affect their wellbeing and academic performance.
Objectives. To determine sleep quality in a cohort of undergraduate medical students at one institution during the COVID-19 pandemic in 2021.
Methods. A cross-sectional descriptive study was done using the validated Pittsburgh Sleep Quality Index at one medical school in South Africa during the second half of 2021. Demographic information (gender, age, marital status, preclinical/clinical years of study, and living arrangements) was obtained. An email with a link to an online survey was sent to all registered students in the undergraduate medical programme.
Results. Data from 164 participants were analysed (response rate 19.0%). The median age was 20.5 years, and the population was mainly female (68.5%) and included preclinical (response rate 26.9%) and clinical (13.0%) students. The overall sleep quality index was poor in 65.1% of participants, with a median sleep duration of 6 hours per night. Anxiety and stress were the most common reasons reported for sleep disturbances. No statistically significant differences in sleep quality were found between preclinical and clinical students.
Conclusion. Poor sleep quality may lead to impaired academic performance and compromised mental health in medical students. It should be addressed by including sleep education when planning interventions to improve the overall wellbeing of future healthcare professionals.
Keywords. Sleep quality, sleep problems, wellbeing, undergraduate medical students, academic performance.

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Morgan du Toit, Hanno Geldenhuys, Renemari Human, Bianca van der Vyfer and Carolyn van der Merwe graduated MB ChB in December 2024 and started their internship in 2025. Omphile Matshediso, Ruben Rodriquez and Angelo Uys are currently clinical students in the final year of the undergraduate medical programme. This research was done over a 2-year period from the first to third years of study in the University of the Free State MB ChB programme as part of an undergraduate research module. Lynette van der Merwe was the supervisor, and Cornel van Rooyen the module leader and biostatistician.

Sleep problems among medical students are a matter of concern, as they affect students' health, mental wellbeing and academic performance.[1-3] Medical studies are stressful, and the high academic workload and clinical training demands impact on sleep quality.[4] In two systematic reviews of sleep problems among medical students worldwide, the prevalence of poor sleep was reported as 57%[3] and 39.8%,[2] with similar prevalence of excessive daytime sleepiness of 33%[3] and 35.9%.[2]

Furthermore, Binjabr *et al.*[3] reported an average of 6.5 hours of sleep per night among medical students, lower than the recommended 7 - 9 hours per night for young adults,[5] while Seoane *et al.*[2] reported insufficient sleep duration in 29.1% of medical students.

Sleep deprivation affects neuronal function, especially attention and working memory.[6] El Hangouche *et al.*[7] reported a high prevalence of poor sleep quality, excessive daytime sleepiness and psychological distress among medical students, and significant associations between poor sleep quality and low academic performance. In their systematic review, the association of poor sleep quality with impaired academic performance was supported by Seoane *et al.*[2]

Limited data on the sleep quality of medical students in sub-Saharan Africa are available. No studies from this region were included in recently published systematic reviews.[2,3] A survey by Eze[8] among medical students in Abakaliki, Nigeria, described poor sleep health using the self-reported SATED questionnaire, while in a study among medical students in Rwanda, Nsengimana *et al.*[9] reported an 80% prevalence of poor sleep quality using the Pittsburgh Sleep Quality Index (PSQI).

A 2008 study among university students in all faculties at a South African (SA) institution, based on the Epworth Sleepiness Scale, reported poor sleep quality in 18% of students, with daytime sleepiness reported by 44% of this population.[10]

The COVID-19 pandemic highlighted the need to support medical students' wellbeing and mental health.[11] The aim of this study was to investigate sleep quality in undergraduate medical students as a population at risk for sleep deprivation that may affect their health and future career success.

Methods

This study followed a cross-sectional descriptive design using a validated

instrument (the PSQI[12]). All students registered in the undergraduate medical programme (MB ChB) at the University of the Free State (UFS), Bloemfontein, SA, during the second semester of 2021 were invited to participate in an online survey (*N*=863).

The MB ChB programme at the UFS is a 5-year programme spread across 10 semesters. Students in their first and second years are in the preclinical phase, while the third-, fourth- and final-year students are in the clinical phase. The final-year students included a cohort of students (*n*=63) in the Nelson Mandela Fidel Castro Medical Programme (NMFCMP) completing final clinical training following undergraduate medical training in Cuba as part of an agreement between the SA and Cuban governments.[13]

Students aged <18 years were excluded, as legal consent from guardians/parents for participation was not obtained.

The PSQI[12] is a standardised, self-administered questionnaire with response options. Permission to use it was granted by Pittsburgh University. The PSQI consists of seven components that measure sleep quality and disturbance: (*i*) sleep duration; (*ii*) sleep disturbance; (*iii*) sleep latency and trouble sleeping; (*iv*) daytime dysfunction due to sleepiness; (*v*) habitual sleep efficiency; (*vi*) overall subjective sleep quality; and (*vii*) sleep medication use. Scoring was done using the administration instructions, references and scoring described by Buysse *et al.*[12] The PSQI global score is calculated from the scores of the seven components. Overall sleep quality is scored between 0 (minimum = better) and 21 (maximum = worse), with a total of ≤5 indicating good sleep quality.[10] Shadzi *et al.*[14] confirmed the structural validity and adequacy of the PSQI three-factor structure (sleep efficiency, perceived sleep quality and daily disturbances) among medical students.

Demographic information, including gender, age, year of study and semester in the MB ChB programme, living arrangements for the duration of the study, and marital status, was also requested from the participants.

Data collection was done using the UFS subscribed access to the Evasys electronic platform (https://evasys.de/en/). Students received an email invitation including information about the study and a link to the survey. Every participating student received a unique password generated by Evasys to prevent duplicate submissions and ensure anonymity. This password was mailed to their university email address, allowing access for completing the survey. The survey link was made available for 4 weeks, and a reminder to participate was sent out weekly to bolster the response rate.

A pilot study, as required according to the ethics review process, was conducted among students. Thirteen students participated in the pilot study. The pilot study was conducted to ensure that the questionnaire was understandable and to determine the time needed to complete the questionnaire. No changes were made to the questionnaire after the pilot study. Data collected during the pilot study were excluded from the data analysis.

Ethical approval was obtained from the Health Sciences Research Ethics Committee, Faculty of Health Sciences, UFS (ref. no. UFS-HSD 2021/0450/3108). Permission to conduct the study was obtained from the relevant authorities, including the Head of the School of Clinical Medicine and the Vice-Rector: Research at the UFS. Before starting the questionnaire, all participating students were informed via email that their information would be kept confidential and that their responses were anonymous. Consent for participation was inferred through completing the survey. No personal information was requested from the participants.

The Department of Biostatistics, Faculty of Health Sciences, UFS, analysed the data using SAS 9.4 (SAS Institute, USA). Continuous variables were summarised as medians, minimums and maximums. Categorical variables were summarised as frequencies and percentages. Differences between groups and categorical variables were evaluated using appropriate statistical tests (χ^2 test or Fisher's exact test) for unpaired data.

Results

A total of 165 out of a possible 863 students participated in the online questionnaire. One participant was excluded on the grounds of age (17 years), leaving a final study population of 164 (overall response rate 19.0%). The median age was 20.5 years (range 18 - 40 years).

Demographic information on the study population is presented in Table 1. There were 111 female (68.5%) and 51 male (31.5%) participants, and 159 (97.0%) were unmarried. The study population included 98 preclinical students out of a possible 364 (response rate 26.9%) and 65 clinical students out of a possible 499 (response rate 13.0%). There were four NMFCMP participants (2.5%) among the clinical students. About half of the participants reported living in private accommodation off campus (50.9%), while about a quarter (23.9%) lived in university accommodation.

Participants reported a median duration of 6 sleep hours per night (range 2 - 9 hours). Results from the PSQI revealed the duration of sleep per night to be 6 hours (range 3 - 8 hours). About one-third of the participants (*n*=46; 28.4%) slept <6 hours per night.

Table 2 presents sleep quality components. The total PSQI global score could be calculated for only 106 participants, as 57 participants

Table 1. Demographic information on the student participants

Variable	*n (%)*
Gender (*n*=162)	
Female	111 (68.5)
Male	51 (31.5)
Marital status (*n*=164)	
Unmarried	159 (97.0)
Married	5 (3.0)
Year of study (*n*=163)	
Preclinical	98 (60.1)
First year	59 (36.2)
Second year	39 (23.9)
Clinical	65 (39.9)
Third year	32 (19.6)
Fourth year	20 (12.3)
Fifth year, excluding NMFCMP students	9 (5.5)
Fifth year, NMFCMP students	4 (2.5)
Living arrangements (*n*=163)	
Private accommodation off campus	83 (50.9)
University accommodation	39 (23.9)
At home with family	33 (20.2)
At home without family	8 (4.9)
PSQI calculated hours of sleep per night (n=162)	
>7	49 (30.2)
6 - 7	67 (41.4)
5 - 6	28 (17.3)
<5	18 (11.1)

NMFCMP = Nelson Mandela Fidel Castro Medical Programme; PSQI = Pittsburgh Sleep Quality Index.

had responses with missing data. The sleep quality global score is only calculated if all questions of the seven components are answered, as per PSQI scoring instructions.[12] The overall PSQI could be calculated for 64.6% of participants, of whom 65.1% (preclinical and clinical students) had poor sleep quality. When comparing participants across study years, 62.1% of the preclinical students had poor sleep quality, while 70.0% of the clinical students had poor sleep quality. Preclinical and clinical students had no significant difference in sleep quality (χ^2 *p*-value 0.4094). More female (*n*=49/72; 68.1%) than male participants (*n*=19/33; 57.6%) had poor sleep quality, although this was not a significant difference based on the χ^2 test (*p*-value 0.2967).

Most participants reported 'very good' or 'fairly good' sleep quality during the past month, which was also reflected in the majority who scored 'better' with sleep latency and trouble sleeping, habitual sleep efficiency, and sleep disturbances. Similarly, most participants did not use sleep medication regularly (during the past month). The calculated daily dysfunction due to sleepiness revealed equal numbers of participants with 'better' or 'worse' daily dysfunction. Reasons stated for trouble sleeping included psychological issues, e.g. stress and anxiety (*n*=19), pain (*n*=7), environmental issues, e.g. noise (*n*=6), lifestyle factors, e.g. social media use or small children (*n*=4), struggling to fall asleep (*n*=3), and substance use, e.g. caffeine (*n*=2).

Discussion

The findings from this study contribute to the literature regarding sleep disruption among medical students in sub-Saharan Africa, supporting the urgent call to improve medical students' sleep quality, leading to enhanced academic performance and, ultimately, better-quality healthcare.[2]

Table 2. Pittsburgh Sleep Quality Index results for the study population

Sleep quality component	Overall study population, *n* (%)	Preclinical, *n* (%)	Clinical, *n* (%)	p-value*
Total PSQI global score†	*n*=106/164 (64.6)	*n*=66/98 (62.3)	*n*=40/65 (37.7)	0.4094
PSQI >5, poor sleep quality	69 (65.1)	41 (62.1)	28 (70.0)	
PSQI ≤5, good sleep quality	37 (34.9)	25 (37.9)	12 (30.0)	
Subjective sleep quality	*n*=164	*n*=98	*n*=65	0.08
Very good	14 (8.5)	11 (11.2)	2 (3.1)	
Fairly good	95 (57.9)	54 (55.1)	41 (63.1)	
Fairly bad	47 (28.7)	26 (26.5)	21 (32.3)	
Very bad	8 (4.9)	7 (7.1)	1 (1.5)	
Sleep latency and trouble sleeping	*n*=142	*n*=86	*n*=55	0.48
0 (better)	36 (25.4)	24 (27.9)	11 (20.0)	
1	51 (35.9)	27 (31.4)	24 (43.6)	
2	48 (33.8)	30 (34.9)	18 (32.7)	
3 (worse)	7 (4.9)	5 (5.8)	2 (3.6)	
Habitual sleep efficiency (%)	n=162	*n*=96	*n*=65	0.32
≥85 (better)	107 (66.1)	58 (60.4)	48 (73.9)	
75 - 84	37 (22.8)	25 (26.0)	12 (18.5)	
65 - 74	12 (7.4)	8 (8.3)	4 (6.2)	
<65 (worse)	6 (3.7)	5 (5.2)	1 (1.5)	
Sleep medication	n=164	*n*=98	*n*=65	0.71
Not during past month	126 (76.8)	78 (79.6)	47 (72.3)	
Less than once a week	14 (8.5)	7 (7.1)	7 (10.8)	
Once or twice a week	10 (6.1)	5 (5.1)	5 (7.7)	
Three times or more a week	14 (8.5)	8 (8.2)	6 (9.2)	
Daytime dysfunction	*n*=163	*n*=97	*n*=65	0.31
0 (better)	7 (4.3)	6 (6.2)	1 (1.5)	
1	78 (47.9)	46 (47.4)	31 (47.7)	
2	58 (35.6)	31 (32.0)	27 (41.5)	
3 (worse)	20 (12.3)	14 (14.4)	6 (9.2)	
Sleep disturbances	*n*=126	*n*=76	*n*=49	0.45
None	6 (4.8)	5 (6.6)	1 (2.0)	
Mild	86 (68.3)	51 (67.1)	34 (69.4)	
Moderate	33 (26.2)	20 (26.3)	13 (26.5)	
Severe	1 (0.8)	0	1 (2.0)	

PSQI = Pittsburgh Sleep Quality Index.
*A p-value <0.05 indicates significance.
†Total PSQI scores could only be calculated for 106 participants to fulfil PSQI scoring instructions requiring that all questions must be answered.

Using the PSQI, we found that 65.1% of undergraduate medical students at the UFS had poor sleep quality. This is higher than the poor sleep quality prevalence of 39.8% reported in a systematic review and meta-analysis by Seoane *et al.*[2] conducted in the Americas, Asia and Oceania, the Middle East region and Europe, representing 20 countries overall, but somewhat similar to the 57% prevalence reported in a systematic review by Binjabr *et al.*[3] that included 59 427 participants representing 31 countries.

The COVID-19 pandemic during the time of the study may have had an impact on quality of sleep among medical students, as seen in other studies.[2,3] Furthermore, our findings are similar to the prevalence reported in studies in Rwanda[9] and Nigeria,[8] also during the COVID-19 pandemic. As in these studies,[8,9] we also found that clinical students (70.0%) had poorer sleep quality than preclinical students (62.1%), which could be attributed to the workload and irregular hours associated with clinical training and rotations. These differences, however, were not statistically significant (p=0.4094).

Findings from the present study confirm that most undergraduate medical students have poor sleep quality and sleep less than the recommended 7 hours per night.[15] Interestingly, most students scored 'better' on sleep quality components (subjective sleep quality, habitual sleep efficiency, sleep latency and trouble sleeping), very few students used sleep medication, and most reported 'better' daytime functioning.

Sleep deprivation may adversely affect academic performance and lead to poorer cognitive functioning and overall health and mental wellbeing.[16] In a study among Saudi medical students before the COVID-19 pandemic, Almojali *et al.*[17] found a significant association between poor sleep quality, using the PSQI, and stress, as determined by the Kessler Psychological Distress Scale. COVID-19 pandemic-related restrictions were in place in SA during our study.[18] This context may have added to the stress that undergraduate medical students experienced through exposure to the increased demands on healthcare services and adjusted educational approaches, including social distancing and online learning. Students in our cohort mentioned mostly psychological factors, including stress and anxiety, as contributing to poor sleep, with very few reporting pain or environmental or lifestyle factors. This corresponds with the findings of Fichardt *et al.*,[19] who described psychological stressors, wellbeing and coping strategies during COVID-19 at the same institution. Binjabr *et al.*[3] also emphasised the impact of COVID-19 on students' sleep quality and wellbeing.

Study limitations

The small study population and low response rate in this study limit the generalisability of the findings. However, use of the validated PSQI allows for comparison with studies done in similar populations globally.

Bias may have been introduced if only participants who perceived themselves as having poor sleep quality chose to complete the questionnaire. COVID-19 pandemic-related restrictions at the time of data collection may have inhibited participation further. The self-reported nature of the study may have contributed to incomplete questionnaires.

Conclusion and recommendations

In this study, the PSQI showed that sleep quality among undergraduate medical students is poor, and worse among clinical students and females. Most students sleep less than the recommended average of 7 hours per night,[5] placing them at risk for the adverse effects of sleep deprivation on academic performance and mental wellbeing. Stress and anxiety were reported as the most common factors contributing to poor sleep, underscoring the importance of including sleep education for medical students when planning interventions to improve their holistic wellbeing. Students should be informed about the adverse effects of shorter sleep duration on their physical and psychological health and their academic performance, and should be encouraged to adopt healthy sleep patterns (early bedtime, wake times, napping) and avoid sacrificing sleep duration. Students can be informed about proper sleep hygiene through a structured approach to educating them about the impact of sleep on their wellbeing and academic performance. This process could involve conducting educational workshops at the university, launching awareness campaigns in the institution, and integrating sleep hygiene education into the curriculum through health or psychology classes. These structural approaches could help raise awareness and provide practical guidance for students to improve their sleep habits, ultimately benefiting their overall wellbeing and academic success.

Declaration. The research for this study was done as a requirement in the MSSM module (special study module) that is completed over 2 years as part of the MB ChB programme at the UFS. MdT, HG, RH, OM, RR, BvdV, CvdM and AU were all undergraduate students in the MB ChB programme during the 2-year period over which this study was done. LJvdM and CvR are academic staff members in the Faculty of Health Sciences, UFS. The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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Author contributions. MdT, BvdV, OM, AU, CvdM, HG, RH and RR wrote the protocol, conducted the research and wrote the initial draft of the manuscript. FCvR (module leader and biostatistician for the project) provided methodological input, performed statistical analysis and contributed to the manuscript. LJvdM (study supervisor) provided the research topic, guided the student researchers through the research process from planning to write-up, and finalised the manuscript for submission.

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Data availability statement. The datasets generated and analysed during the current study are available from the corresponding author (LJvdM) upon reasonable request.

Conflicts of interest. None.

1. Jahrami H, Dewald-Kaufmann J, Faris MA, et al. Prevalence of sleep problems among medical students: A systematic review and meta-analysis. J Public Health (Berl) 2020;28;605-622. https://doi.org/10.1007/s10389-019-01064-6
2. Scoane HA, Moschetto L, Orliacq F, et al. Sleep disruption in medicine students and its relationship with impaired academic performance: A systematic review and meta-analysis. Sleep Med Rev 2020;53:101333. https://doi.org/10.1016/j.smrv.2020.101333
3. Binjabr MA, Alalawi IS, Alzahrani RA, et al. The worldwide prevalence of sleep problems among medical students by problem, country, and COVID-19 status: A systematic review, meta-analysis, and meta-regression of 109 studies involving 59427 participants. Curr Sleep Med Rep 2023;9:161-179. https://doi.org/10.1007/s40675-023-00258-5

4. Waqas A, Khan S, Sharif W, Khalid U, Ali A. Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: A cross sectional survey. Peer J 2015;3:e840. https://doi.org/10.7717/peerj.840
5. Hirshkowitz M, Whiton K, Albert SA, et al. National Sleep Foundation's updated sleep duration recommendations: Final report. Sleep Health 2015;1(4):233-243. https://doi.org/10.1016/j.sleh.2015.10.004
6. Krause AJ, Simon EB, Mander BA, et al. The sleep-deprived human brain. Nat Rev Neurosci 2017;18(7):404-418. https://doi.org/10.1038/nrn.2017.55
7. El Hangouche AJ, Jniene A, Aboudrar S, et al. Relationship between poor quality sleep, excessive daytime sleepiness and low academic performance in medical students. Adv Med Educ Pract 2018;9:631-638. https://doi.org/10.2147/AMEP.S162350
8. Eze C. Sleep health among medical students in Abakaliki Nigeria: A descriptive study. Sleep Med X 2024;7:100103. https://doi.org/10.1016/j.sleepx.2024.100103
9. Nsengimana A, Mugabo E, Niyonsenga J, et al. Sleep quality among undergraduate medical students in Rwanda: A comparative study. Sci Rep 2023;13(1):265. https://doi.org/10.1038/s41598-023-27573-9
10. Reid A, Baker FC. Perceived sleep quality and sleepiness in South African university students. S Afr J Psychol 2008;38(2):287-303. https://doi.org/10.1177/008124630803800203
11. Wald HS. Optimizing resilience and wellbeing for healthcare professions trainees and healthcare professionals during public health crises – practical tips for an 'integrative resilience' approach. Med Teach 2020;42(7):744-755. https://doi.org/10.1080/0142159X.2020.1768230
12. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193-213. https://doi.org/10.1016/0165-1781(89)90047-4
13. Donda BM, Hift RJ, Singaram VS. Assimilating South African medical students trained in Cuba into the South African medical education system: Reflections from an identity perspective. BMC Med Educ 2016;16(1):281. https://doi.org/10.1186/s12909-016-0800-4
14. Shadzi MR, Rahmanian M, Heydari A, Salehi A. Structural validity of the Pittsburgh Sleep Quality Index among medical students in Iran. Sci Rep 2024;14(1):1538. https://doi.org/10.1038/s41598-024-51379-y
15. Watson NF, Badr MS, Belenky G, et al. Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. Sleep 2015;38(6):843-844. https://doi.org/10.5665/sleep.4716
16. Ahmed N, Sadat M, Cukor D. Sleep knowledge and behaviors in medical students: Results of a single center survey. Acad Psychiatry 2017;41(5):674-678. https://doi.org/10.1007/s40596-016-0655-3
17. Almojali AI, Almalki SA, Alothman AS, Masuadi EM, Alaqeel MK. The prevalence and association of stress with sleep quality among medical students. J Epidemiol Glob Health 2017;7(3):169-174. https://doi.org/10.1016/j.jegh.2017.04.005
18. SA Corona Virus Online Portal. Summary of Level 2 Regulations (as of 13th September 2021). Gazette 45156 of 12 September 2021. https://sacoronavirus.co.za/2021/09/12/summary-of-level-2-regulations-as-of-13th-september-2021/(accessed 7 February 2024).
19. Fichardt AE, Janse van Vuuren C, van der Merwe L. Psychological well-being, stressors, coping strategies and support of undergraduate healthcare students amid COVID-19. Health SA 2023;28:2340. https://doi.org/10.4102/hsag.v28i0.2340

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