ORIGINAL ARTICLE

Assessment of mental health and sleep quality among undergraduate medical students and their effects on academic performance: a cross-sectional study

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ABSTRACT

Background: Depression, poor sleep quality, and reduced academic performance are common and interrelated problems among university students. This study evaluated the mental health and sleep quality of undergraduate medical students and their association with academic performance, including the prevalence of depression and anxiety in this population.

Methods: This cross-sectional study was conducted among medical students at King Saud bin Abdulaziz University for Health and Sciences, Jeddah, Saudi Arabia. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and mental health status using the Depression, Anxiety, and Stress Scale 21 (DASS-21). Associations between sleep quality and mental health domains were assessed using Pearson chi-squared tests, and predictors of high grade point average (GPA) were identified using multivariable regression, with results expressed as beta coefficients and 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$.

Results: Among 459 students, 19.0% had mild to moderate and 15.3% had severe to extremely severe depression based on the DASS-21, and 81.9% had poor sleep quality (PSQI ≥ 5). Sleep quality was significantly associated with stress, anxiety, and depression (all $p < 0.001$). Stress was initially associated with GPA ($p = 0.003$), but this association was not confirmed in multivariable analysis after adjustment for confounders.

Conclusions: Mental health problems and poor sleep quality are prevalent among medical students and are interrelated with academic performance. Interventions targeting these factors, alongside efforts to address financial stress, may help improve the academic performance and well-being of medical students in Saudi Arabia.

Keywords: Mental health, sleep quality, academic performance.

Introduction

Mental health disorders represent a major public health concern and affect nearly half of the U.S. population at some point in life [1]. University students are particularly vulnerable to depression, with reported prevalence estimates ranging from 6% to 54% [2–4]. Depression and other mental health problems, including heightened anxiety, pessimism, difficulty concentrating, and disturbed sleep, can impair students' daily functioning and academic engagement [2–4]. Sleep quality is an important determinant of general mental health; insufficient or poor sleep has been linked to reduced alertness, impaired attention, and slower cognitive

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processing [5]. In this context, it is important to better understand how mental health and sleep quality interact and how these factors may influence academic success in medical students.

Academic success has traditionally been defined in terms of retention, progression, and graduation rates, but more recent work emphasizes its multifaceted nature and the range of individual and contextual factors that contribute to achievement [6,7]. Family background, prior academic performance, and students' ability to integrate into university life—including social relationships, teaching approaches, and learning environments—are all important determinants of success [6,7]. Interventions that address these determinants alongside mental health and sleep quality may have a meaningful impact on students' academic outcomes.

Recent research has shed light on the additional influence of sleep quality, well-being, and mental health on academic performance [8,9]. Sleep deprivation can be particularly detrimental for students, with studies demonstrating a strong correlation between sleep duration and performance in cognitive tasks, athletic activities, and subjective alertness [5]. Furthermore, research suggests a connection between sleep disturbances and the development of psychiatric disorders, particularly depression and anxiety [9].

The negative impact of mental health issues on academic performance is well documented. Studies consistently show that university students with depression and anxiety are more likely to underperform compared with their peers [10]. For instance, a study in the United States found that depression was not only associated with lower grade point average (GPAs) but also with a higher likelihood of dropping out [11]. Similar findings emerged from a regional, longitudinal cohort study in the United Arab Emirates, which revealed that higher levels of depression predicted lower GPAs [12]. Additionally, research across various regions, including South Africa, Australia, and Nigeria, further reinforces the link between poor mental health, particularly depression and anxiety, and academic failure [13,14].

In Saudi Arabia, mental health is culturally viewed as a stigma. A systematic review of 34 studies exploring the stigma associated with mental illness in Arab cultures highlighted factors such as concerns about medication use, hostility towards individuals with mental health conditions, and the perception of mental illness as a curse or punishment [15]. Owing to this stigma, students are discouraged from seeking help, hindering their academic progress and overall well-being.

While research globally highlights the prevalence of low sleep quality, depression, and anxiety among university students, data specific to Saudi Arabia remain scarce [14]. This lack of regional data creates a critical knowledge gap. To address this gap, this study aims to investigate medical students' mental health and sleep quality in Saudi Arabia and analyze the impact of these factors on academic performance. Additionally, the study will assess the prevalence of depression and anxiety among this specific student population.

Methods

Study setting and design

The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional studies.

Ethical approval for this study was obtained from the King Abdullah International Medical Research Center (KAIMRC), King Saud bin Abdulaziz University for Health and Sciences, Jeddah, Saudi Arabia (approval no. NRJ22J/331/12, dated 23 January 2023). The study was conducted in accordance with the Declaration of Helsinki and local regulations. Participation was voluntary, and electronic informed consent was obtained from all respondents before they accessed the questionnaire.

Data collection

A web survey was created using Google Forms and sent to the students' registered phone numbers via WhatsApp. Data collection began in February 2023 and ended in May 2023. As participation depended on access to and response via an online platform, this represents a convenience sample rather than a random or systematic sample of the target population.

The survey was developed by the research team after a review of the relevant literature. Content validity and clarity were assessed through expert review by a family medicine consultant and piloting with a small group of medical students to ensure that all items were comprehensible and appropriate for the target population.

The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. The PSQI is one of the most widely used questionnaires for measurement of general sleep quality over the previous month [16]. It produces a global score, facilitating comparison between different groups or individuals in both clinical and research settings. The PSQI has demonstrated good validity and reliability in adolescents and young adults [17]. The PSQI total score ranges from 0 to 21, with a higher score indicating poorer quality. A score of 5 or higher indicated poor sleep quality; for scores lower than this, sleep quality was considered good [17]. The PSQI instrument is available for non-commercial research and educational use and was used in its original, validated form without modification.

The Depression, Anxiety, and Stress Scale 21 (DASS-21) was used to assess mental health status. The DASS-21 is a reliable and valid screening tool for measuring symptoms of depression, anxiety, and stress, and has favorable psychometric properties in clinical and community samples [18,19]. It consists of 21 items rated on a four-point scale from 0 = "Did not apply to me at all" to 3 = "Applied to me very much or most of the time." The items are grouped into three subscales (stress, anxiety, and depression), comprising seven items each. Relevant scores are computed by summing the items on each subscale, yielding scores that range from 0 to 21 for each subscale. Based on the official DASS-21 scoring recommendations, each subscale score was multiplied by two so that scores ranged from 0 to 42. Categories

for each subscale (from "normal" to "extremely severe") were defined according to the thresholds provided in the DASS manual [19]. The DASS questionnaire is in the public domain, and permission is not required for its use in research.

Statistical analysis

Data analysis was conducted using R (version 4.3.0; R Foundation for Statistical Computing, Vienna, Austria) within the RStudio integrated development environment (RStudio, PBC, Boston, MA, USA). Frequencies and percentages were used to present categorical data, while numerical data were expressed as median and interquartile range (IQR). The association between sleep quality categories (poor and good) and mental health domains was assessed using Pearson's chi-squared test. In addition, group-based differences in GPA were assessed using the Wilcoxon rank-sum test for variables with two categories and the Kruskal–Wallis rank-sum test for variables with three or more categories. Variables that were significantly associated with GPA in the bivariate analysis ($p<0.05$) were entered into a multivariable generalized linear regression model to identify the independent predictors of high GPA. The results were expressed as beta coefficients and their respective 95% confidence intervals (95% CIs). Model assumptions were rigorously tested and satisfied. Multicollinearity was evaluated using Variance Inflation Factors (VIF), with all predictors demonstrating excellent stability (all VIF values <5). Homoscedasticity was maintained (Breusch–Pagan test, $p = 0.086$) and errors were independent (Durbin–Watson statistic = 1.86, $p = 0.078$). While the formal Shapiro–Wilk test indicated a violation of residual normality ($p < 0.001$), this test is oversensitive to trivial deviations in larger datasets ($n = 459$) [20]. Statistical significance was set at $p < 0.05$.

Results

Figure 1 presents a flow diagram summarizing the selection of study participants. Initially, data were collected from 514 students. However, 36 students with missing GPA values and 19 with missing or invalid responses for sleep quality were excluded, leaving 459 students for analysis (Figure 1).

All participants were Saudi nationals, and the majority were single (98.0%). More than half of the students were male (52.3%). Almost one-quarter of the students (23.5%) had financial difficulties, and 24.2% were very often or always worried about money. Almost all students were living with their families (92.6%); of these, 58.8% spent 1–3 hours per day with their families. Distributions of age, gender, marital status, current year of study, financial status, living conditions, and class attendance are provided in Table 1.

Mental health characteristics

Based on the DASS-21 (maximum score 42), the median (IQR) mental health scores were 14.0 (6.0 to 20.0) for stress, 10.0 (4.0 to 18.0) for anxiety, and 10.0 (4.0 to 18.0) for depression (Table 2).

Stress was mild to moderate in 41.2% of students and severe to extremely severe in 22.9%, whereas anxiety

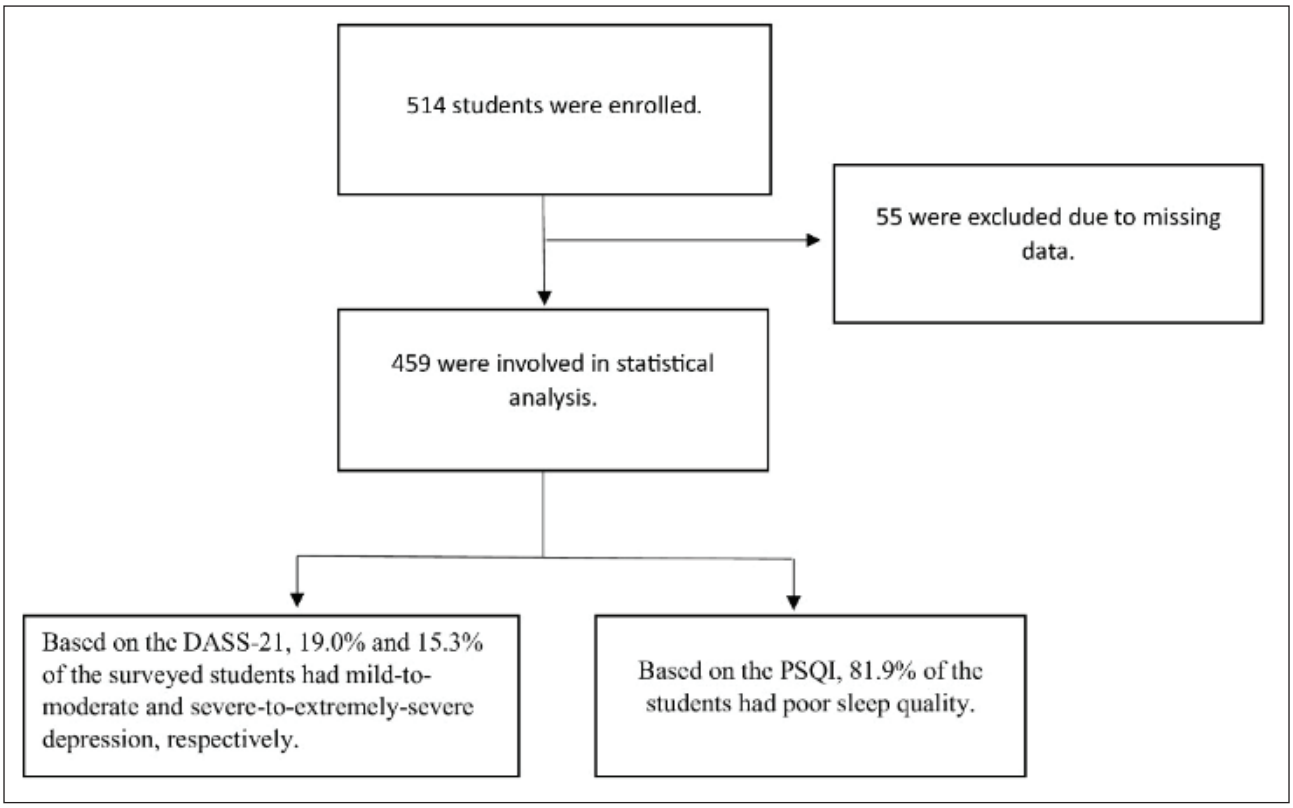


Figure 1. *Flow diagram for the characteristics of the study participants.*

Table 1. *Demographic and academic characteristics of the students.*

Parameter	Category	N (%)
Age*	18 to 20	131 (28.6%)
	21 to 23	287 (62.7%)
	24 to 26	29 (6.3%)
	Above 26	11 (2.4%)
Gender	Male	240 (52.3%)
	Female	219 (47.7%)
Marital status	Single	450 (98.0%)
	Engaged	8 (1.7%)
	Married	1 (0.2%)
Current year of study	2nd year	81 (17.6%)
	3rd year	95 (20.7%)
	4th year	93 (20.3%)
	5th year	103 (22.4%)
	6th year	87 (19.0%)
Do you face financial difficulty?	Yes	108 (23.5%)
How often do you worry about money?	Never	54 (11.8%)
	Rarely	105 (22.9%)
	Sometimes	189 (41.2%)
	Very often	83 (18.1%)
	All the time	28 (6.1%)
What is your living condition?	Live alone	30 (6.5%)
	Live with family	425 (92.6%)
	Live with roommates	4 (0.9%)
If living with roommates, do you have conflict with your roommates?	Never	1 (25.0%)
	Rarely	2 (50.0%)
	Sometimes	1 (25.0%)
	Very often	0 (0.0%)
	All the time	0 (0.0%)
If living with family, how many hours on average do you spend with your family per day?§	Less than 1 hour	59 (14.2%)
	1 to 2 hours	125 (30.1%)
	2 to 3 hours	119 (28.7%)
	3 to 4 hours	64 (15.4%)
	More than 4 hours	48 (11.6%)
Do you feel stressed around your friends?	Never	130 (28.3%)
	Rarely	150 (32.7%)
	Sometimes	134 (29.2%)
	Very often	37 (8.1%)
	All the time	8 (1.7%)
How regular is your class attendance?	Very irregular	25 (5.4%)
	Fairly irregular	69 (15.0%)
	Fairly regular	197 (42.9%)
	Very regular	168 (36.6%)
	All the time	34 (7.4%)
Do you like to work in a team for group academic activities?	Not at all	70 (15.3%)
	Sometimes	157 (34.2%)
	Usually	108 (23.5%)
	Most of the time	90 (19.6%)

*****Age category based on self-reported age in years.
§Answered only by students who reported living with family (*n* = 425).

was mild to moderate in 25.9% and severe to extremely severe in 32.0%. Furthermore, 19.0% and 15.3% of the students had mild to moderate and severe to extremely severe depression, respectively (Figure 2).

Table 2. *Descriptive statistics of mental health categories based on the DASS-21 scale.*

Mental health category	Median (IQR)	Mean ± SD	Min-Max
Stress	14.0 (6.0 to 20.0)	13.9 ± 10.1	0–42
Anxiety	10.0 (4.0 to 18.0)	11.1 ± 9.5	0–42
Depression	10.0 (4.0 to 18.0)	12.4 ± 10.8	0–42

IQR, interquartile range; **SD**, standard deviation; **DASS-21**, Depression, Anxiety and Stress Scale 21.

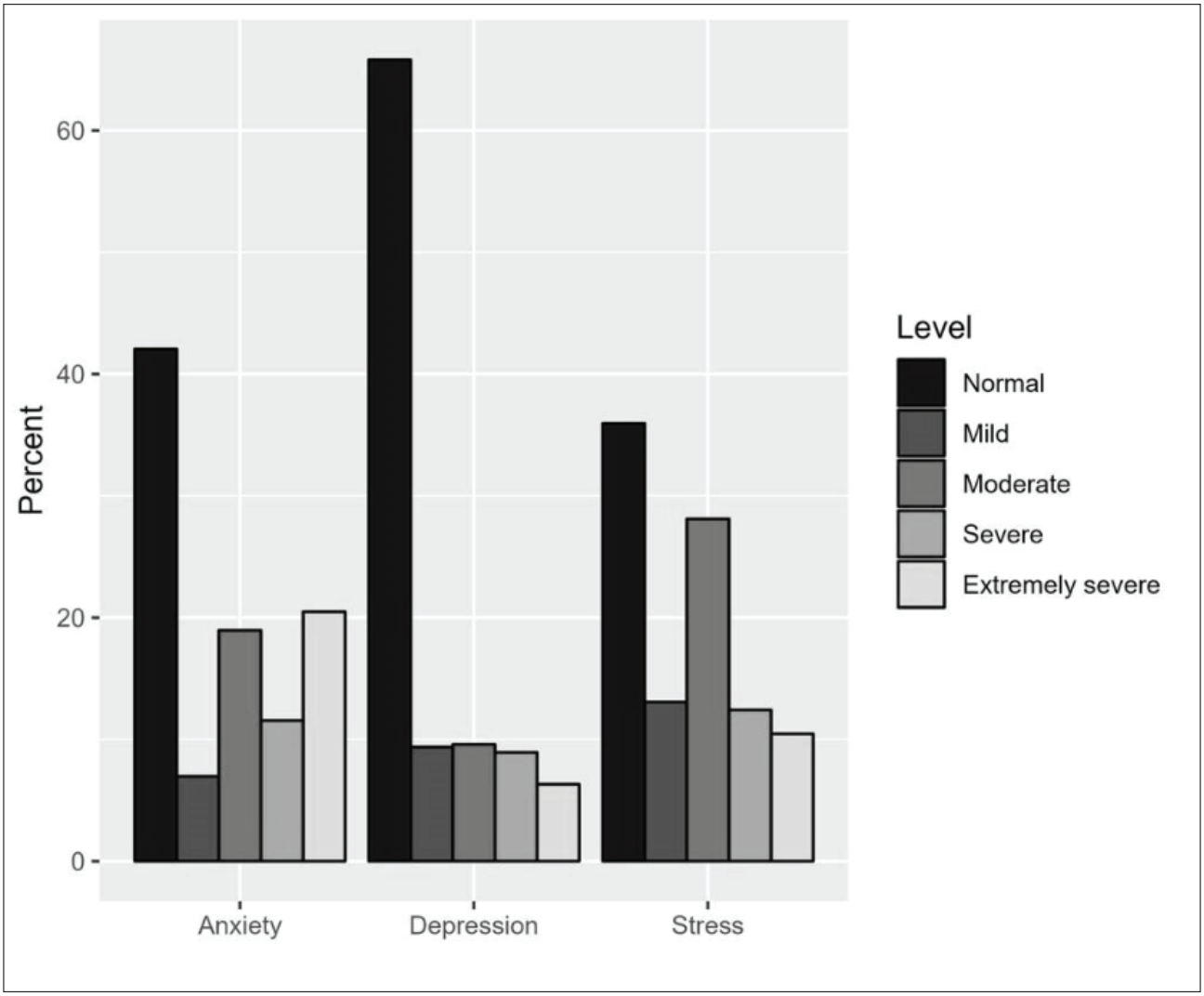


Figure 2. *The proportions of different categories of stress, anxiety, and depression among the students studied.*

Sleep quality characteristics

The median (IQR) PSQI score was 8.0 (5.0 to 10.0) out of a maximum of 21. The distribution of PSQI scores is shown in Figure 3(a). Using a cutoff score of PSQI ≥5, 376 students (81.9%) were classified as having poor sleep quality, while the remaining students had good sleep quality (Figure 3(b)).

Association between sleep quality and mental health

The inferential analysis showed that sleep quality was significantly associated with each of the three domains of mental health ($p < 0.001$). Among students with poor sleep quality, the proportions with mild to moderate and severe to extremely severe stress, anxiety, and depression were substantially higher than among those with good sleep quality (Table 3).

Factors associated with academic performance

The students' median (IQR) GPA was 4.8 (4.6 to 4.9). The GPA differed significantly based on the students' age ($p < 0.001$), gender ($p < 0.001$), current year of study ($p < 0.001$), financial difficulties ($p = 0.006$), and regularity of class attendance ($p < 0.001$) (Table 4A). Stress levels were also significantly associated with GPA in the bivariate analysis ($p = 0.003$); however, GPA was not significantly associated with the levels of anxiety ($p = 0.171$), depression ($p = 0.762$), or sleep quality ($p = 0.169$). Because only variables meeting the a priori

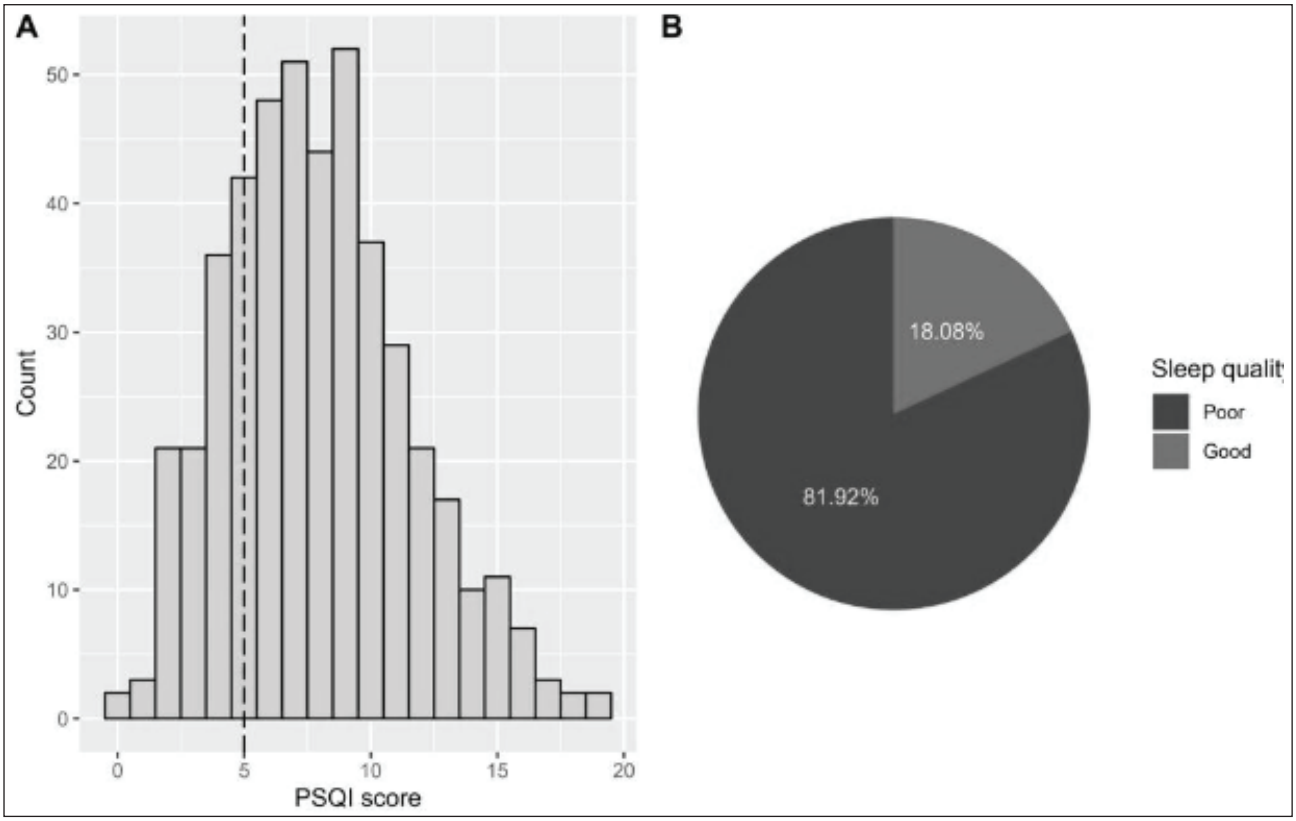


Figure 3. *Characteristics of sleep quality among students as indicated by the distribution of the PSQI score (a) and proportions of good and poor sleep quality (b). The dashed line indicates the cutoff score used to identify students with poor sleep quality (≥5).*

Table 3. *Association between sleep quality categories and the parameters of mental health.*

Parameter	Category	Poor, N = 376	Good, N = 83	p value
Stress	Normal	105 (63.6%)	60 (36.4%)	<0.001
	Mild to moderate	169 (89.4%)	20 (10.6%)	
	Severe to extremely severe	102 (97.1%)	3 (2.9%)	
Anxiety	Normal	134 (69.4%)	59 (30.6%)	<0.001
	Mild to moderate	102 (85.7%)	17 (14.3%)	
	Severe to extremely severe	140 (95.2%)	7 (4.8%)	
Depression	Normal	228 (75.5%)	74 (24.5%)	<0.001
	Mild to moderate	80 (92.0%)	7 (8.0%)	
	Severe to extremely severe	68 (97.1%)	2 (2.9%)	

significance threshold ($p < 0.05$) in the bivariate analysis were carried forward, anxiety, depression, and sleep quality were not entered into the multivariable regression model, notwithstanding their significant bivariate associations with each other reported above.

Predictors of high academic performance

Results of the regression analysis (Table 4B) showed that higher GPA scores were independently associated with being female (beta = 0.07, 95% CI 0.03 to 0.10, $p < 0.001$), studying in the fourth academic year (beta = 0.08, 95% CI 0.01 to 0.15, $p = 0.017$), and attending classes on a regular basis (beta = 0.08, 95% CI 0.01 to 0.15, $p = 0.021$). Conversely, students aged 21 to 23 years had independently lower GPA scores compared with those aged 18 to 20 years (beta = –0.30, 95%CI –0.43 to –0.17, $p < 0.001$). Group-level differences in GPA across demographic and academic characteristics are summarized in Table 4A, and the multivariable predictors of high GPA are presented in Table 4B.

Discussion

This cross-sectional study examined the mental health and sleep quality of undergraduate medical students at a Saudi university and explored their association with academic performance, measured using GPA. We observed high levels of depression and anxiety symptoms as well as a substantial burden of poor sleep quality. However, the associations between anxiety, depression, stress, and GPA were relatively modest.

Table 4A. *Factors associated with students' GPA.*

Parameter	Category	Median (IQR)	p value
Age	18 to 20	4.90 (4.80, 4.96)	<0.001
	21 to 23	4.77 (4.55, 4.90)	
	24 to 26	4.75 (4.50, 4.89)	
	Above 26	4.50 (4.10, 4.60)	
Gender	Male	4.77 (4.50, 4.89)	<0.001
	Female	4.84 (4.64, 4.94)	
Marital status	Single	4.80 (4.60, 4.91)	0.427
	Engaged	4.72 (4.48, 4.83)	
	Married	4.73 (4.73, 4.73)	
Current year of study	2nd year	4.91 (4.84, 4.98)	<0.001
	3rd year	4.85 (4.66, 4.92)	
	4th year	4.75 (4.50, 4.90)	
	5th year	4.70 (4.50, 4.81)	
	6th year	4.79 (4.60, 4.90)	
Do you face financial difficulty?	No	4.81 (4.61, 4.92)	0.006
	Yes	4.71 (4.50, 4.90)	
How often do you worry about money?	Never	4.75 (4.53, 4.89)	0.081
	Rarely	4.82 (4.68, 4.91)	
	Sometimes	4.80 (4.60, 4.90)	
	Very often	4.80 (4.60, 4.94)	
	All the time	4.60 (4.40, 4.89)	
How regular is your class attendance?	Very irregular	4.70 (4.50, 4.80)	<0.001
	Fairly irregular	4.74 (4.49, 4.87)	
	Fairly regular	4.78 (4.58, 4.90)	
	Very regular	4.89 (4.70, 4.94)	
What is your living condition?	Live alone	4.77 (4.48, 4.89)	0.230
	Live with family	4.80 (4.60, 4.91)	
	Live with roommates	4.69 (4.45, 4.79)	
Do you feel stressed around your friends?	Never	4.81 (4.60, 4.90)	0.241
	Rarely	4.80 (4.60, 4.91)	
	Sometimes	4.79 (4.59, 4.91)	
	Very often	4.90 (4.63, 4.95)	
	All the time	4.90 (4.75, 4.94)	
Do you like to work in a team for group academic activities?	Not at all	4.80 (4.60, 4.92)	0.333
	Sometimes	4.83 (4.61, 4.92)	
	Usually	4.80 (4.57, 4.90)	
	Most of the time	4.80 (4.56, 4.90)	
	All the time	4.77 (4.43, 4.91)	
Stress	Normal	4.75 (4.50, 4.89)	0.003
	Mild to moderate	4.81 (4.61, 4.92)	
	Severe to extremely severe	4.84 (4.60, 4.93)	
Anxiety	Normal	4.80 (4.60, 4.89)	0.171
	Mild to moderate	4.82 (4.60, 4.94)	
	Severe to extremely severe	4.80 (4.58, 4.92)	
Depression	Normal	4.80 (4.60, 4.90)	0.762
	Mild to moderate	4.80 (4.60, 4.93)	
	Severe to extremely severe	4.80 (4.59, 4.90)	
Sleep quality	Poor	4.80 (4.60, 4.91)	0.169
	Good	4.79 (4.51, 4.90)	

GPA, grade point average; **IQR**, interquartile range.

In our sample, 34.3% of students reported depressive symptoms and 57.9% reported anxiety symptoms, which is broadly consistent with findings from the Healthy Minds Study and other large surveys of university populations [21]. These data underline the extent to which students are at risk of mental health difficulties

Table 4B. *Predictors of high academic performance among students.*

Parameter	Category	Beta	95% CI	p value
Age	18 to 20	Ref	Ref	
	21 to 23	–0.30	–0.43, –0.17	<0.001
	24 to 26	–0.10	–0.21, 0.00	0.057
	Above 26	0.01	–0.10, 0.07	0.760
Gender	Male	Ref	Ref	
	Female	0.07	0.03, 0.10	<0.001
Current year of study	2nd year	Ref	Ref	
	3rd year	–0.05	–0.14, 0.04	0.267
	4th year	0.08	0.01, 0.15	0.017
	5th year	0.04	–0.02, 0.09	0.199
	6th year	0.02	–0.07, 0.04	0.549
How regular is your class attendance?	Very irregular	Ref	Ref	
	Fairly irregular	0.00	–0.08, 0.08	0.981
	Fairly regular	0.08	0.01, 0.15	0.021
	Very regular	0.01	–0.07, 0.04	0.652
Stress	Normal	Ref	Ref	
	Mild to moderate	0.02	–0.03, 0.07	0.403
	Severe to extremely severe	0.01	–0.05, 0.03	0.556

GPA, grade point average; **CI**, confidence interval; **Ref**, reference category.

and highlight the value of ongoing surveillance to identify groups who may benefit from early support. The Healthy Minds Study, for example, reported record-high levels of depression and anxiety among U.S. college students, with 44% reporting depressive symptoms and 37% reporting anxiety symptoms [22]. Local work from Saudi Arabia has suggested that depressive symptoms may increase during the early years of medical school and decline in the final year, and other reports indicate that many college students are reluctant to seek help despite experiencing substantial distress [10,24].

Previous studies have found that approximately 60% of university students experience poor sleep quality [23]. In the present study, the proportion was even higher, with 81.9% of students reporting sleep problems. These disturbances may reflect a combination of unhealthy sleep habits, daytime napping, and short nocturnal sleep duration [24].

Evidence from both clinical and community samples indicates that sleep problems are not only a symptom of mental illness but may also contribute to the onset or worsening of psychiatric disorders [9,23,24]. A bidirectional relationship between sleep and mental health has been described, whereby poor sleep can exacerbate anxiety and depressive symptoms, and these symptoms can in turn further disrupt sleep [23,24]. Our findings are consistent with this pattern, as stress, anxiety, and depression were all significantly associated with sleep quality, with the most pronounced differences observed for anxiety and depression.

Despite these associations, we did not observe an independent relationship between stress and GPA in multivariable analyses. This is in line with previous work suggesting that, although high levels of stress may correspond to lower academic performance, some degree of stress can be motivating and may not be directly reflected in GPA [25]. Stress may have important consequences for students' mental and physical health that are not captured by academic results alone. It is also plausible that students with higher GPAs experience greater stress related to the pressure to maintain their performance, which may further complicate the stress-achievement relationship.

Our interpretation is supported by studies indicating that stress can play a dual role, being beneficial at mild levels and detrimental when severe [26,27]. In contrast to stress, previous research has more consistently linked depressive symptoms and poor sleep quality to lower academic productivity and GPA [27,28]. In our study, however, neither depression nor sleep quality showed an independent association with GPA. This may reflect the relatively high overall GPA in the sample, the cross-sectional design, or the influence of unmeasured confounders.

Gender and age also emerged as relevant factors. Consistent with previous work, female students in our study had higher GPAs than male students [29]. Some studies have suggested that older students tend to have better academic outcomes, possibly because of greater life experience, coping skills, and maturity [30]. In our cohort, however, younger students reported higher GPAs, which may be related to the cumulative GPA calculation system and cohort-specific factors. Financial difficulties were another important consideration: students who reported concerns about their financial status had lower GPAs, echoing findings that financial stress can lead students to seek part-time employment at the expense of study time and academic performance [30,31].

This study has several limitations. The cross-sectional design precludes causal inference and does not allow us to determine the directionality of the relationships between mental health, sleep quality, and academic performance. Data were collected using a convenience sample recruited via a self-administered Google Form distributed through WhatsApp, which may limit the representativeness of the sample and introduce selection bias, as students with particular levels of distress or academic performance may have been more or less likely to participate. Both the PSQI and DASS-21 are self-report instruments, and their use may have introduced self-report bias as well as social desirability bias, particularly given that mental health remains a stigmatized topic in this cultural context. In addition, the study was conducted at a single institution in Saudi Arabia, which may limit the generalizability of the findings to other settings. Longitudinal studies that follow medical students over time and incorporate objective sleep measures could provide a more detailed understanding of how mental health and sleep trajectories influence academic outcomes.

Conclusion

In summary, this study assessed mental health, sleep quality, and academic performance among undergraduate medical students. We observed a high prevalence of depressive and anxiety symptoms and a substantial proportion of students with poor sleep quality. Sleep quality was closely linked to stress, anxiety, and depression, but neither stress nor sleep quality showed an independent association with GPA after adjustment for confounding factors. Female gender and regular class attendance were associated with higher GPA, whereas financial difficulties were associated with lower GPA.

These findings underscore the importance of integrating mental health and sleep support into medical education environments and of identifying students at risk at an early stage. Targeted interventions to improve mental health and sleep hygiene, alongside efforts to address financial stress, may help to promote students' academic performance and overall well-being. Creating a supportive academic climate that normalizes help-seeking and encourages healthy sleep practices could contribute to better educational and health outcomes for medical students.

Declarations

Ethics approval and consent to participate

This study was approved by the KAIMRC, King Saud bin Abdulaziz University for Health and Sciences, Jeddah, Saudi Arabia (approval no. NRJ22J/331/12, dated 23 January 2023). Participation was voluntary, and electronic informed consent was obtained from all participants before completing the questionnaire.

Consent for publication

Not applicable, as no individually identifiable data are presented in this manuscript.

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available because they contain potentially identifiable information, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Dr Ahmad Sabban and Dr Sultan Magliah conceived the study, designed the methodology, and supervised the project. Dr Maryam Jabli, Dr Razan Alsolamy, and Dr Lujain Bahakeem coordinated data collection and data curation. Dr Ahmed Alqerafi and Dr Adil Khalid performed the statistical analysis. Dr Abdulaziz Allhybi and Dr Waleed Malibari drafted the manuscript. All authors critically revised the manuscript, approved the final version, and agree to be accountable for all aspects of the work.

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Supplementary content (if any) is available online.

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