



The prevalence of sleep disturbance and its possible associated factors among Iranian medical students: A cross-sectional study with a national meta-analysis

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ABSTRACT

Background: The aim of this cross-sectional study was to investigate the prevalence of sleep disturbance and its possible associated factors among Iranian medical students. Additionally, a national meta-analysis was conducted to provide a comprehensive overview of sleep disturbance in this population.

Methods: A sample of medical students from Guilan University of Medical Sciences, Iran was included in the study. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep disturbance. Demographic and lifestyle factors, as well as academic performance, were collected through a self-administered questionnaire. The data collected from this study were combined with existing studies through a meta-analysis to estimate the overall prevalence of sleep disturbance among Iranian medical students using the random effects model.

Results: A total of 249 medical students participated in the study. The prevalence of sleep disturbance among Guilan University of Medical Sciences medical students was found to be 71.1%. A significant difference was observed in total PSQI means regarding medical students' residency ($p < 0.001$) and their duration of sleep in the last 24 h ($p = 0.006$). The national prevalence of sleep disturbances was 59% (95% CI: [51%–66%], $I^2 = 97\%$).

Conclusion: Sleep disturbance is highly prevalent among Iranian medical students, with various factors contributing to its occurrence. The findings of this study highlight the need for interventions and strategies to improve sleep quality and overall well-being among this population. The national meta-analysis provides valuable insights into the overall burden of sleep disturbance among Iranian medical students and can serve as a reference for future studies and public health initiatives targeting this issue.

1. Introduction

Sleep is an essential part of our daily lives and plays a crucial role in maintaining physical and mental health. Adequate sleep is critical for maintaining cognitive function, emotional well-being, and overall health [1]. However, many individuals experience sleep disturbances and sleep disorders that can affect their quality of life and health [2].

Medical education is renowned for its rigorous curriculum, long hours of study, and high-stakes examinations [3]. The intensity of these demands, combined with the responsibility of patient care during clinical rotations, places medical students in a distinct position of stress and

pressure [4]. The constant juggling of theoretical knowledge acquisition, practical skills development, and the emotional toll of dealing with illness and suffering can significantly impact their sleep patterns [5]. All these can lead to sleep disturbances and sleep disorders. Sleep deprivation has been linked to decreased cognitive function, impaired concentration, and memory deficits, all of which can affect the academic performance of medical students [6]. Sleep disturbances and sleep disorders can also have significant health consequences, including increased risk for depression, anxiety, and cardiovascular disease [7].

Studies have shown that sleep disturbances are prevalent among Iranian medical students [8–10]. A study conducted in 2020 found that

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nearly 51.3% of Iranian medical students reported poor sleep quality, with high rates of insomnia, difficulty falling asleep, and waking up during the night [9]. Another study in 2019 reported that 38.5% of medical students in Iran had sleep disorders, which positively correlated with their emotional intelligence [11].

Despite the high prevalence of sleep disturbances among Iranian medical students, limited awareness and resources are available to address this issue. Few medical schools in Iran have evaluated the sleep quality among medical students. Moreover, the stigma surrounding mental health and sleep issues in Iranian society can prevent medical students from seeking help. Therefore, this study aimed to investigate the prevalence of sleep disturbances among Iranian medical students using a sample from Guilan University of Medical Sciences and investigate the possible factors contributing to this issue.

2. Methods

2.1. Participants and sample size

In this cross-sectional investigation, individuals studying medicine at Guilan University of Medical Sciences were enlisted. The study was carried out from October 2021 to February 2022. To be eligible for participation, individuals had to be currently enrolled as medical students at the university and express their willingness to take part in the study. The exclusion criteria encompassed the failure to provide the necessary information for study participation.

To gather national data on the prevalence of sleep disorders among Iranian medical students, an extensive search strategy was devised. This strategy aimed to locate pertinent studies by utilizing various electronic databases such as Medline (PubMed), Scopus, Web of Science, MagIran, and Irandoc. The search was conducted from the inception of these databases until December 23, 2022, employing the following keywords: (“Sleep” OR “insomnia”) AND (“Medical students” OR “Medical student”) AND (Iran). Furthermore, additional studies were discovered by manually examining the reference lists of the included articles and relevant review papers.

2.2. Sample size calculation

We used Cochran’s formula to calculate the required sample size for our study. With a margin error of 5, at 95% CI, and the prevalence of poor sleep quality at 50% which was taken from previous studies conducted on Iranian medical students, the required sample size was calculated [8,9,12].

2.3. Data collection

Data were gathered through the utilization of the Persian version of the PSQI questionnaire, which comprises 34 closed-ended questions. These questions have been previously validated and deemed reliable [13]. The PSQI is a self-evaluation questionnaire that evaluates seven different aspects related to sleep: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. It was designed to serve as a straightforward and dependable tool suitable for various clinical environments [14]. The 19 questions for self-assessment are divided into seven component scores, with each score ranging from 0 to 3. Higher scores indicate poorer sleep quality, and the overall global score ranges from 0 to 21. Additionally, our questionnaire also gathered demographic information, such as age, gender, and marital status.

For the national meta-analysis, two independent reviewers evaluated the titles and abstracts of the obtained articles to determine their eligibility for inclusion. Full-text articles were acquired for studies that showed potential relevance. Inclusion criteria were predetermined and encompassed studies that reported the prevalence of sleep disorders among Iranian medical students utilizing the PSQI assessment tool. Data

extraction was carried out by two reviewers independently, employing a standardized data extraction form. The extracted data included various aspects of the studies, such as author, publication year, participant characteristics, study design, details of intervention/exposure, outcome measures, and significant findings. Any discrepancies between the reviewers were resolved through discussion or by consulting a third reviewer.

2.4. Data analysis

The demographic characteristics of the study population were summarized using descriptive statistics. To determine the prevalence of sleep disturbance, the participants’ responses to the Pittsburgh Sleep Quality Index (PSQI) were analyzed. The total PSQI mean score among different groups was compared using χ^2 , independent sample test, and ANOVA. Bivariate and multivariate logistic regression were employed to calculate the crude and adjusted odds ratio for each potential factor that may influence sleep disturbance. All statistical analyses were conducted using SPSS software (version 22.0). A p-value below 0.05 was considered statistically significant.

In the national meta-analysis, the random effects model was utilized to account for variations in demographic and characteristic factors across the included studies. This model was used to combine the prevalence rates of sleep disturbances among Iranian medical students and resident physicians. The degree of heterogeneity between the studies was assessed using I2 statistics, where I2 values above 75% indicated high heterogeneity. Statistical analyses and the creation of graphics were performed using R software (version 4.1.3) and the meta package (version 5.5–0) [15].

3. Results

3.1. Characteristics of study participants

A total of 249 medical students took part in the study, with a majority being female and unmarried. The average age of the participants was 23.8 years (standard deviation [SD] = 2.5). Approximately half of the participants were medical interns. For detailed information on the demographic profile of the participants, please refer to Table 1.

3.2. Prevalence of poor sleep quality and component scores

The overall prevalence of poor sleep quality, indicated by a PSQI score greater than 5, was 71.1% (n = 177). Among those experiencing poor sleep quality, 55.9% (n = 99) reported having fairly bad or very

Table 1
Demographic characteristics of patients.

Variables		Number (percentage)/average (standard deviation)
Gender	Female	140(56.2)
	Male	109(43.8)
Marital status	Single	211(84.7)
	Married	38(15.3)
Year of Education	Basic science	36(14.5)
	Pre-clinical	47(18.9)
	Medical	57(22.9)
	Extern	
	Medical	109(43.8)
Residence	Intern	
	Dormitory	59(23.7)
	Own house	97(39)
	With parents	93(37.3)
Sleep duration in the last 24 h	<6	37(14.9)
	6–7	98(39.4)
	7–8	80(32.1)
	>8	34(13.7)
Age (years)		23.88(2.46)

bad subjective sleep quality, 53.1% (n = 94) reported using sleep medication, and 27.6% (n = 49) reported inefficiency in their sleep (see Table 2). The average PSQI score for the entire sample was 7.95 (SD = 3.76), while it was 9.66 (SD = 3.2) for those with poor sleep quality.

3.3. Factors associated with sleep quality

Upon conducting factor analysis and comparing total PSQI means among different groups, no significant differences were observed in the scores between male and female medical students (p = 0.44), the age of medical students (Pearson correlation r = 0.07, p = 0.22), their marital status (p = 0.12), and the year of education (p = 0.05). However, a significant difference was found in total PSQI means with respect to medical students' residency (p < 0.001) and the duration of sleep they had in the last 24 h (p = 0.006) (refer to Fig. 1). Additionally, our multivariate logistic regression analysis indicated a significant correlation between sleep quality and the duration of sleep in the last 24 h for medical students (see Table 3).

3.4. National meta-analysis for assessing the prevalence of sleep disorder among iranian medical students

The initial database search yielded a total of 453 articles. After removing duplicates, 321 unique records remained. Through screening the titles and abstracts, 29 articles were deemed potentially relevant and underwent full-text assessment. Finally, 16 studies met the inclusion criteria and were included in the national meta-analysis [8–12,16–26]. The characteristic of the included is presented in Table 4.

The pooled prevalence rates of sleep disturbances among Iranian medical students were estimated using the random effects model. The prevalence of sleep disturbances was 59% (95% CI: [51%–66%], I2 =

97%). Forest plots illustrating the prevalence rates and their corresponding CIs for each outcome are presented in Fig. 2.

4. Discussion

Based on the findings of the study, it is clear that sleep disturbances and poor sleep quality are widespread among Iranian medical students. The study revealed a high prevalence rate of 71.1% for poor sleep quality, indicating a significant public health concern within this population. Interestingly, when examining various factors such as gender, marital status, age, and educational year, no significant effects on the mean PSQI score were found. These results were further confirmed through multivariate analysis. Although the mean PSQI score varied significantly across different residency groups, the multivariate analysis did not establish any significant association between residency and sleep quality, whether it was good or poor. Surprisingly, the only factor found to be predictive of sleep quality was the student's sleep duration in the past 24 h.

The results of our meta-analysis, which is the first national report, showed a pooled prevalence of 59% for sleep disturbances among Iranian medical students. Previous meta-analysis by Rao et al. reported the worldwide prevalence of sleep disorder among medical students using PSQI assessment tool to be 52.7% by including 57 articles [27]. European medical students found to be the most common students experiencing sleep issues with 65% of sleep disorder prevalence. Their moderator analysis found that study site, publication year, sample size, response rate, and quality score are significant predictors of poor sleep quality [27]. Another meta-analyses conducted among Brazilian and Chinese medical students showed a pooled prevalence of 51.5% and 27.38%, respectively [28,29].

Few studies have evaluated the sleep quality among Iranian medical students. One of the first studies was conducted by Ghoreishi et al. among medical students in Zanjan University of Medical Sciences [8]. Among 224 medical students, 91 participants suffered from low sleep quality. The prevalence is significantly lower than what we have find in our study, showing increasing burden of sleep disorder through the time. In contrast to our findings, Ghoreishi et al. reported year of education, residency, marital status, and economic status are significant predictors of sleep disorders. Depression and anxiety did not have a significant effect on overall sleep quality in their study. This finding was in contrast with recent investigations which showed psychological symptoms such as depression, and anxiety are significantly associated with sleep disorders among Iranian medical students [9,10]. One interesting finding of this study is that there were no significant differences in PSQI scores between male and female medical students and the age of medical students, which is consistent with recent investigations [9]. This finding suggests that sleep disturbances and poor sleep quality may affect both male and female medical students equally, and highlights the need for interventions that target all medical students regardless of their gender and age.

One particularly noteworthy finding of this study was the significant impact of sleep duration in the past 24 h on the sleep quality of the subjects. This finding holds important implications not only for the understanding of sleep disturbances among medical students but also for the broader field of sleep disorder research. The results suggest that sleep duration in the immediate timeframe can have a considerable influence on an individual's overall sleep quality, highlighting the need to consider and control for this variable in future studies. When comparing these findings with the existing literature, it becomes evident that the role of sleep duration in assessing sleep quality has garnered limited attention [30]. Previous studies have often focused on broader aspects such as overall sleep patterns, sleep hygiene practices, or long-term sleep duration, neglecting the immediate effects of recent sleep duration on sleep quality [17–19,23]. This study's emphasis on the significance of sleep duration in the past 24 h provides a fresh perspective and raises important questions about the potential biases that may have influenced

Table 2
Sleep quality and its component score among Iranian medical students studying at Guilan University of Medical Sciences during 2021–2022 (N = 249).

Component	Frequency	Percent
Sleep latency		
0	48	19.3
1	104	41.8
2	45	18.1
3	52	20.9
Sleep duration		
>7	20	8.0
6-7	117	47.0
5-6	55	22.1
<5	57	22.9
Sleep efficiency (%)		
>85	188	75.5
75-84	43	17.3
65-74	8	3.2
<65	10	4.0
Day time dysfunction		
0	32	12.9
1	101	40.6
2	61	24.5
3	55	22.1
Sleep disturbance		
0	152	61.0
1	62	24.9
2	23	9.2
3	12	4.8
Subjective sleep quality		
Very good	34	13.7
Fairly good	108	43.4
Fairly bad	73	29.3
Very bad	34	13.7
Use of sleep medication		
Not during the past month	152	61.0
Less than once a week	62	24.9
Once or twice a week	23	9.2
Three or more times a week	12	4.8

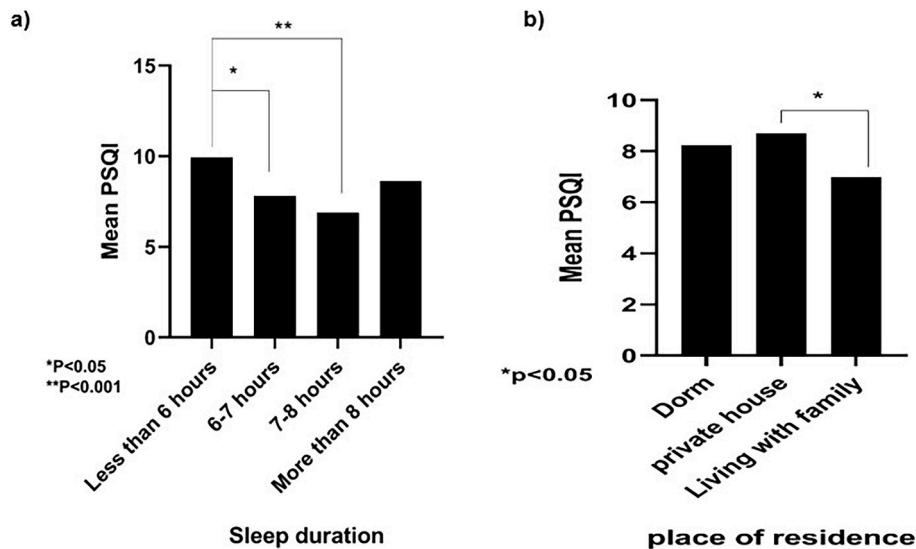


Fig. 1. Total PSQI means a) medical students' residency, and b) their duration of sleep in the last 24 h.

Table-3
Bivariate and multivariate logistic regression showing the association between possible factors and sleep quality.

Explanatory variables	Sleep Quality		Crude Odds ratio (95% ci)	Adjusted Odds ratio (95% ci)
	Poor (n = 177)	Good (n = 72)		
Gender				
Male	75	34	Ref	Ref
Female	102	38	1.217 (0.702–2.110)	1.514 (0.825–2.778)
Year of Education				
Basic science	23	13	Ref	Ref
Pre-clinical	34	13	1.478 (0.581–3.759)	1.774 (0.634–4.964)
Medical	37	20	1.046 (0.438–2.498)	1.397 (0.472–4.138)
Extern			1.804 (0.802–4.057)	2.552 (0.678–9.596)
Medical Intern	83	26		
Residence				
Dormitory	41	18	Ref	Ref
Own house	71	26	1.199 (0.587–2.447)	1.263 (0.566–2.819)
With parents	65	28	1.019 (0.501–2.072)	0.996 (0.462–2.144)
Marital status				
Single	149	62	Ref	Ref
Married	28	10	1.165 (0.534–2.543)	0.752 (0.310–1.825)
Sleep duration in the last 24 h				
<6	30	7	Ref	Ref
6-7	75	23	0.761 (0.295–1.960)	0.794 (0.299–2.106)
7-8	43	37	0.271 (0.107–0.689)	0.275 (0.104–0.728)
>8	29	5	1.353 (0.385–4.752)	1.426 (0.392–5.178)
Age (years)				
			1.041 (0.932–1.164)	0.924 (0.759–1.125)

previous research findings. By recognizing the impact of recent sleep duration, researchers and clinicians can better comprehend and interpret the complexities of sleep disorders.

The factors contributing to sleep disturbances among Iranian medical students are complex and multifaceted. Academic demands, long hours of studying and clinical rotations, and competition for residency positions are some of the factors that contribute to sleep disturbances among Iranian medical students. Additionally, lifestyle factors such as

excessive use of technology, lack of physical activity, and poor dietary habits can also affect sleep quality.

Our study has several strengths and limitations. First, this is the first national report regarding the prevalence of poor sleep quality among Iranian medical students, by pooling the results of 17 original studies from Iran. Second, not only we included original articles in our meta-analysis, but also the conference abstracts and the results of thesis were included. It is important to note that the present study has some limitations. For instance, the study was conducted using psychological symptoms and other possible factors that could affect sleep quality were not investigated in our multivariable logistic analysis. Additionally, we recognize the importance of larger sample sizes for generalizability. Therefore, by conducting a national meta-analysis we did our best to address this issue. Finally, PSQI is a limited assessment tool in capturing a comprehensive range of sleep disturbances. Future studies should use clinical assessment to assess sleep disturbances.

In conclusion, this study sheds light on the prevalent sleep disturbances and poor sleep quality experienced by Iranian medical students. The high prevalence rate emphasizes the need for targeted interventions to address this significant public health issue. Furthermore, while factors like gender, marital status, age, and educational year did not show a direct impact on sleep quality, the duration of sleep in the last 24 h emerged as a crucial predictor.

Financial Support

Not applicable.

Ethics approval

The research adhered to the Helsinki Declaration on Human Experimentation, 1964, as well as its subsequent revisions, with the latest one being in Seoul in October 2008. The study received ethical approval from the Ethics and Protocol Review Committee of Guilan University of Medical Sciences, identified by the protocol ID number IR. GUMS. REC.1401.167. Furthermore, each participant provided written consent voluntarily and with full awareness of the study's purpose and procedures after receiving a detailed explanation.

5. Data availability statement

Available through a reasonable request.

Table 4
Characteristics of the included studies in the meta-analysis.

Author	Year	Type of publication	Study design	Medical School	Total Patients (Total/Those who respond)	Age (mean ± SD)	Male (%)
Farhadi-nasab et al. [26]	2007	Peer-reviewed journal	Cross-sectional	Hamedan University of Medical Sciences	150	21.73 ± 3.5 range = 18-32	52%
Ardani et al. [24]	2011	Peer-reviewed journal	Cross-sectional	Mashhad University of Medical Sciences	310/231	22.7 ± 2.6 range = 18-40	28%
Fath et al. [25]	2017	Thesis	Cross-sectional	Qom Islamic Azad University of Medical Sciences	303	NA	NA
Abdali et al. [11]	2019	Peer-reviewed journal	Cross-sectional	Semnan University of Medical Sciences	259	NA	NA
Ghoreishi et al. [8]	2008	Peer-reviewed journal	Cross-sectional	Zanjan University of Medical Sciences	280/234	23 ± 2.815 range = 18-31	0.388
Janatmakan Amiri, A [9].	2020	Peer-reviewed journal	Cross-sectional	Mashhad University of Medical Sciences	(310/300)	21.94 ± 2:28	165 (55%)
Keyvanfar, A [10].	2022	Peer-reviewed journal	Cross-sectional	Shahid Beheshti University of Medical Sciences	(320/320)	22.95 ± 2.59	45.30%
Maghsoudi, S [16].	2022	Peer-reviewed journal	Cross-sectional	Isfahan university of medical sciences	(106/100)	23.2 (±4.8 SD years)	32%
Mohammadbeigi, A [17].	2016	Peer-reviewed journal	Cross-sectional	Qom University of Medical Sciences	(380/363)	21.8 ± 3.2	30.9
Moudi et al. [18]	2014	Peer-reviewed journal	Cross-sectional	Babol University of Medical Sciences	153	20–35	50.30%
Pournik et al. [19]	2020	Peer-reviewed journal	Cross-sectional	Tehran University of Medical Sciences	250/154	19.1 (±0.99)	44.20%
Rezaei et al. [20]	2018	Peer-reviewed journal	Cross-sectional	Tehran University of Medical Sciences	616/553	21.69 ± 1.11 range = 19-27	48.50%
Sahraian [21]	2010	Peer-reviewed journal	Cross-sectional	Shiraz University of Medical Sciences	159	21.5(2.67)	49.70%
Shadzi et al. [12]	2020	Peer-reviewed journal	Cross-sectional	Shiraz University of Medical Sciences	487/402	22.4 (±2.18)	0.497
Teimouri et al. [22]	2021	Peer-reviewed journal	Cross-sectional	Isfahan University of Medical Sciences	NR/290	NR	116 (40%)
Yazdi, Z [23].	2016	Peer-reviewed journal	Cross-sectional	Qazvin University of Medical Sciences	(325/285)	22.8 ± 1.74	47.4

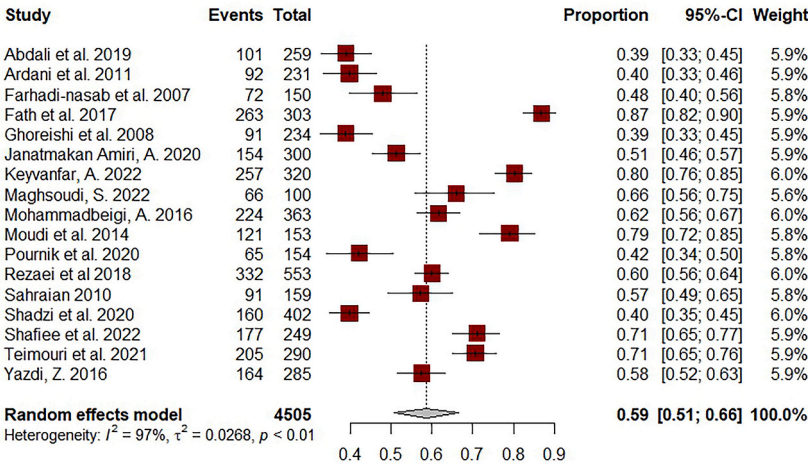


Fig. 2. The results of national meta-analysis for the prevalence of poor sleep quality among Iranian medical students.

CRedit authorship contribution statement

Arman Shafiee: Conceptualization, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Jafar Fili:** Investigation, Project administration, Writing – review & editing. **Samane Ghafari:** Investigation, Methodology, Resources. **Mohammad Amin Sattari:** Supervision. **Nahid Borna:** Supervision, Writing – original draft. **Ali Pourramzani:** Conceptualization, Investigation, Project administration, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no conflicts of interest to this work.

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