Sleep Science and Practice

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Evaluation of psychometric properties of sleep quality questionnaire among medical students of Guilan University of Medical Sciences

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Abstract

Background Since evaluating sleep quality among students is of great importance and is one of the challenges facing the health field regarding this group, we were determined to conduct this study to evaluate the psychometric properties of the Sleep Quality Questionnaire (SQQ) among the medical students at the Guilan University of Medical Sciences.

Methods This research was conducted as a cross-sectional study. In the procedure, a random group of medical students at Guilan University of Medical Sciences were provided with questionnaires and the study's pre-prepared checklist and were asked to answer them accurately. The questionnaires used in this study include the Sleep Quality Questionnaire (SQQ), and the Pittsburgh Sleep Quality Index (PSQI). After collecting the entries, all the data were subjected to a statistical analysis using the SPSS software.

Results In this study, 249 medical students with an average age of 23.88 ± 2.46 were evaluated, of which 140 (56.2%) were female and the rest were male. According to the results, the average sleep quality for SQQ was 19.31 ± 8.06, and the Pittsburgh Sleep Quality Index (PSQI) was 7.95 ± 3.76. Based on the results obtained from the exploratory analysis, it was determined that no high overlap exists between the two evaluated factors in the sleep quality questionnaires, confirming their divergent validity. In evaluating the convergent validity, the correlation between the SQQ and PSQI questionnaires was reported as 0.642, which was significant ($p < 0.001$). Cronbach's alpha for the SQQ questionnaire was equivalent to 0.882, which is verified since the minimum value is 0.70. Also, utilizing the test-retest method, the reliability was found to be 0.74, which is acceptable according to the minimum value of 0.70. SQQ scores had a direct and meaningful relationship with age ($r = 0.185$, $p = 0.003$). Based on the pairwise comparison, there was a significant difference in SQQ scores between the students in different stages and the duration of sleep.

Conclusion The current study's findings indicate that the SQQ questionnaire possesses adequate validity and reliability, which could be utilized to evaluate sleep quality in domestic studies.

Keywords Psychometric properties, Sleep quality questionnaire, Medical students

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Introduction

Sleep is characterized by a lack of voluntary control over the physical environment and a decrease or loss of consciousness level, during which bodily and mental activities change, and vivid hallucinations replace clear real images. Sleep is one of the essential elements of the body's circadian physiological cycle and is important for the health and restoration of the human nervous system, immune system, and musculoskeletal system (Ghoreishi and Aghajani 2008; Mah et al. 2018). This active, repetitive, and reversible behavior contributes to several important functions in the body, including growth and repair, learning, and memory consolidation (Curcio et al. 2006). In fact, human health is related to the quantity and quality of sleep (Ahrberg et al. 2012). According to international statistics, 60% of the total population suffers from sleep-related disorders (Golabi et al. 2008) .

Students are a segment of the population that can be particularly affected by sleep disorders. Numerous studies indicate an increasing prevalence of sleep disorders and mental illnesses among medical students (Seoane et al. 2020). Some studies have identified factors such as age, gender, socioeconomic status, lifestyle habits, and psychological factors as influential factors in sleep quality (Veldi et al. 2005). In 2014, Kato et al. conducted a study to evaluate the validity and reliability of a 10-item form (the Sleep Quality Questionnaire (SQQ) of the Pittsburgh Sleep Quality Index (PSQI). This questionnaire assessed sleep disorders and duration and was initially designed and validated in Japan (Kato 2014). In this study, the convergent validity of the questionnaire has been evaluated using the Medical Outcomes Study (MOS) and Epworth Sleepiness Scale (ESS) questionnaires. The scores of the SQQ exhibited significant correlations with MOS and ESS, affirming the validity of the SQQ questionnaire.

Based on the aforementioned explanations, researchers need suitable tools to measure sleep disorders and their subcategories in different populations. These tools should be reliable in the studied communities and accurately represent the details of sleep disorders in those communities (Lund et al. 2010). For the first time in Iran, Farahani Moghaddam and colleagues designed and presented the Persian version of the standardized Pittsburgh Sleep Questionnaire in 2012 at the Kerman University of Medical Sciences (Farrahi Moghaddam et al. 2012). Other tools for assessing sleep status and quality include the Medical Outcomes Study Sleep Scale and the Epworth Sleepiness Scale (Johns 1991; Stewart et al. 1992). Additionally, several different methods have been designed to measure sleep quality, among which questionnaires are prioritized due to their affordability and easy accessibility. SQQ can assess sleep quality in two different domains (insomnia problems and daytime sleepiness) (Kato 2014). Since so far, no concise criteria have been designed to evaluate both of these areas together, there is a need for a questionnaire to assess these two domains. Also there was a need to assess the validity of the *Persian* version of SQQ questionnaire. Furthermore, unlike this study, the majority of research employing the SQQ questionnaire has been conducted on the general population rather than the *clinical population* examined in this study. Considering the high importance of evaluating the quality of sleep among students and one of the challenges in the field of mental health related to this population, we aim to evaluate the psychometric properties of the SQQ questionnaire through a study conducted on the population of medical students at Guilan University of Medical Sciences. We also intend to investigate the possible relationship between sleep quality and demographic factors like age, sex and level of education.

Materials and methods

Participants

This cross-sectional study involved a random group of medical students enrolled at Guilan University of Medical Sciences. The participants were selected through a random sampling technique to ensure a representative sample of the medical student population. The inclusion criteria were twofold: firstly, enrollment at Gulan University of Medical Sciences, and secondly, expressed willingness to participate in the study. Those with incomplete completion of information required to participate in the study were excluded from the study. The total number of participants included in the study was determined based on a power analysis, aiming for a sufficient sample size to detect significant differences. For this, a formula based on the average estimate of a community was used. Considering the standard deviation of 5.01 (related to the sleep quality variable) of previous studies (Kato 2014), the power of 95%, the error level of 0.05, and d = 5.1, the minimum sample size of 246 was obtained.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2 .\sigma^2}{d^2} = \frac{(1.96 + 1.64)^2 \times 5.01^2}{(1.15)^2} = 245.97 \cong 246$$

Ethical approval for the study was obtained from the institutional review board of Guilan University of Medical Sciences (Registration No: 2589). Informed consent was obtained from all participants prior to their involvement in the study.

Instrumentation

The participants were provided with two questionnaires to assess sleep quality: the Sleep Quality Questionnaire (SQQ) and the Pittsburgh Sleep Quality Index (PSQI).

The Sleep Quality Scoring Index (SQQ) is a research tool utilized to assess the sleep quality of patients. It was developed in 2014 by Kato et al. (2014). The questionnaire consists of 10 items that employ a 5-factor Likert scale, ranging from "completely agree" (score 4) to "completely disagree" (score 0). The total score on this questionnaire falls between 0 and 40, with higher scores indicating poorer sleep quality. Confirmatory factor analysis was employed in a study involving 1400 Japanese students to validate the questionnaire. The analysis confirmed two subscales: (1) Daytime Sleepiness (comprising questions 3, 5, 6, 7, 8, and 10) and (2) Sleep Difficulty (consisting of questions 1, 2, 4, and 9). Furthermore, the results of the study demonstrated a positive correlation between the aforementioned subscales, namely Daytime Sleepiness and Sleep Difficulty, with the participants' mental health scores based on the 12-question general health questionnaire (GHQ-12) ($r=0.612$; $r=0.449$). This suggests that higher scores on the subscales are associated with a greater degree of daily stress and mental health issues. The retest reliability of the SQQ questionnaire was assessed after an 8-week interval, yielding a reliability coefficient of 0.75 for daily pollution and 0.79 for difficulty in sleeping. These findings indicate that the questionnaire provides consistent and reliable results over time when measuring daily pollution and sleep difficulty.

The Pittsburgh Sleep Quality Questionnaire (PSQI) is a widely used tool for assessing individuals' sleep quality. Developed in 1989 by Dr. Boyce and his colleagues at the Pittsburgh Institute of Psychiatry (Buysse et al. 1989), the questionnaire consists of 19 items. Each item is rated on a four-point Likert scale, ranging from 0 to 3, with higher scores indicating poorer sleep quality.

The PSQI encompasses seven scales that capture different aspects of sleep quality:

1) Subjective Sleep Quality: This scale assesses the individual's overall perception of their sleep quality during the past month.
2) Sleep Latency: It measures the time taken by the individual to fall asleep once they have initiated their sleep period.
3) Sleep Duration: This scale quantifies the total amount of sleep obtained by the individual, considering both nighttime sleep and daytime napping.
4) Sleep Efficiency: It reflects the percentage of time spent actually asleep in relation to the total time spent in bed.
5) Sleep Disturbances: This scale evaluates the frequency and severity of various sleep disturbances, such as waking up during the night or having trouble breathing.
6) Use of Sleep Medication: It assesses the frequency of sleep-inducing medication usage during the past month.
7) Daytime Dysfunction: This scale examines the individual's level of functional impairment during waking hours due to sleepiness or sleep-related problems.

By analyzing responses across these scales, the PSQI provides a comprehensive evaluation of an individual's sleep quality and helps identify specific areas of concern. It has proven to be a valuable tool in both research and clinical settings for understanding and addressing sleep-related issues.

Additionally, a pre-prepared checklist was utilized to gather demographic information from the participants. The checklist included items such as age, gender, marital status, place of birth, educational level, place of residence, and self-reported normal sleep duration in 24 h.

Procedure

The participants were provided with the questionnaires and the study's pre-prepared checklist. They were instructed to answer the questionnaires accurately and provide the requested demographic information. The questionnaires and checklist were distributed in a paper-and-pencil format during a designated time slot. Clear instructions were given, and participants were encouraged to seek clarification if needed.

Questionnaire validation process

Translation

In the first stage of this study, the original English version of the questionnaire was translated into Persian using the standard forward-backward translation method. Two professional translators independently translated the questionnaire from English to Farsi. The translated versions were then discussed and combined to reach a consensus on a single agreed-upon version. This version was back-translated into English by an independent translator who had no access to the original questionnaire. The back-translated English version was compared to the original English version during discussion sessions. Through this iterative process, the Persian version of the questionnaire was finalized.

Formal validity and content

To assess content validity quantitatively, two measures were used: Content Validity Ratio (CVR) and Content Validity Index (CVI). Ten professors and specialists in the field examined each question and rated them as necessary, useful but not necessary, or not necessary. CVR was calculated by dividing the number of experts who rated a question as necessary by 10. CVI was obtained

by averaging the CVR coefficients for each question. According to Hirobio et al., a CVI value of 0.8 or higher is considered acceptable (Rubio et al. 2003).

Factor structure analysis

Confirmatory factor analysis (CFA) was performed to assess the fit of the factor structure of the original questionnaire to the data obtained from the Iranian sample. Goodness-of-fit indices used included the Comparative Fit Index (CFI) (Bentler 1990), where values higher than 0.9 indicate good fit and values higher than 0.95 indicate excellent fit. The Tucker-Lewis Index (TLI) was also used, with values higher than 0.9 indicating good fit and higher than 0.95 indicating excellent fit. Additionally, the Root Mean Square Error of Approximation (RMSEA) was considered, with values less than 0.08 indicating good fit and values less than 0.05 indicating excellent fit (Kline and St 2022).

Exploratory factor analysis (EFA) was conducted to explore the factors. Principal component analysis with varimax rotation was used, and the two-by-two method was employed to replace missing values. Items with a factor loading above 0.4, following Steven's suggestion, were selected for retention (Stevens 2012).

Internal consistency of the factors was assessed using Cronbach's alpha, with values above 0.6 indicating acceptable internal homogeneity. For factors with fewer than six items, average inter-item correlation was used, as suggested by Briggs et al. (Briggs and Cheek 1986).

Test-retest reliability was evaluated by selecting a subset of 20 participants who completed the questionnaire at two different time points, with a two-week interval. The Spearman-Brown correlation coefficient was calculated, and correlations higher than 0.3 indicated moderate reliability, while correlations higher than 0.5 indicated good reliability, following Cohen's suggestion (Cohen 1992).

Data analysis

For qualitative data, frequency and percentage distributions were used to describe the variables, while mean and standard deviation were utilized for quantitative data. Descriptive tables and graphs were employed to present the findings for both measurement scales. The normality of the data was assessed using the Kolmogorov-Smirnov test, and the homogeneity of variances was examined using Levene's test. These tests helped determine if the data met the necessary assumptions for subsequent analyses. To establish the validity of the measures, the content validity ratio (CVR) and the content validity index (CVI) were calculated. Convergent validity was also assessed to ensure the measures were capturing the intended constructs. Reliability analysis involved calculating Cronbach's alpha to evaluate internal consistency and employing test-retest reliability to assess the stability of the measures over time. Exploratory and confirmatory factor analyses were conducted to evaluate the fit of the factor structure in relation to the original version of the SQQ questionnaire. These analyses helped determine if the questionnaire items were appropriately measuring the intended constructs. If the relevant assumptions were met, independent t-tests, analysis of variance (ANOVA) with Tukey's test, and Pearson correlation coefficients were used to examine the relationships between variables. In cases where the assumptions were not met, nonparametric tests such as the Mann-Whitney test, Kruskal-Wallis test, Mann-Whitney test with Bonferroni correction, and Spearman correlation coefficients were employed The statistical analyses were performed using SPSS software version 28 for data management and analysis. Additionally, AMOS software version 26 was used for conducting factor analyses and evaluating model fit. These software tools facilitated efficient and accurate statistical analysis in the study.

Results

Demographics

The study involved 249 medical students as participants, and the majority of them were female and single. The average age of the participants was 23.8 years, with a standard deviation of 2.5. Approximately half of the participants were medical interns. More information about the demographic characteristics of the participants can be found in Table 1. Based on the obtained results, the mean sleep quality score of SQQ was 19.31 ± 8.06, with the lowest and highest scores being 0 and 40, respectively. The average score for daily sleepiness was 11.68 ± 4.86, with the lowest and highest scores being 0 and 24. The mean score for sleep difficulty was 7.63 ± 3.72, with the lowest and highest scores being 0 and 16, respectively. The mean scores for the Pittsburgh Sleep Quality Index (PSQI) are as follows: Overall sleep quality: 76.3 ± 95.7 (ranging from 1 to 19); Sleep disturbances: 89.0 ± 43.1 (ranging from 0 to 3); Sleep latency (delay in falling asleep): 2.1 ± 40.1 (ranging from 0 to 3); Sleep duration: 93.0 ± 60.1 (ranging from 0 to 3); Sleep efficiency: 73.0 ± 36.0 (ranging from 0 to 3); Sleep disturbances due to sleep disorders: 51.0 ± 2.1 (ranging from 0 to 3); Use of sleep medication: 85.0 ± 58.0 (ranging from 0 to 3); and Daytime dysfunction: 97.0 ± 56.1 (ranging from 0 to 3).

Factors associated with SQQ score

The results of our analysis showed the SQQ score is significantly associated with age, year of education, and sleep duration in last 24 h (Table 2).

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 Extern	57 (22.9)
	Medical Intern	109 (43.8)
Residence	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)

Table 2 Factors associated with SQQ score

Explanatory variables	Total number	SQQ score (Mean ± SD)	*P* value
Gender			0.48
Male	109	19.71 ± 7.31	
Female	140	18.99 ± 8.6	
Year of Education			
Basic science	36	14.11 ± 7.25	**< 0.001**
Pre-clinical	47	19.98 ± 7.48	
Medical Extern	57	19.05 ± 8.21	
Medical Intern	109	20.78 ± 7.68	
Residence			
Dormitory	59	18.59 ± 8.59	0.09
Own house	97	20.68 ± 8.25	
With parents	93	18.35 ± 7.36	
Marital status			
Single	211	19.26 ± 8.01	0.823
Married	38	19.58 ± 8.38	
Sleep duration in the last 24 h			
< 6	37	22.13 ± 9.40	**0.01**
6–7	98	19.97 ± 7.40	
7–8	80	17.40 ± 7.71	
> 8	34	18.82 ± 8.29	
Age (years)	$r = 0.185$		**0.003**

Psychometric properties

To extract the number of factors in the Sleep Quality Questionnaire, exploratory factor analysis with varimax rotation was utilized. According to the obtained results, the number of factors is 2, which aligns with the original questionnaire. The factor loadings for each item under the two examined factors are provided in the following (Fig. 1).

The Table 3 provides a summary of the factor loadings of each item in the Sleep Quality Questionnaire based on factor analysis with varimax rotation. According to the obtained results, items 1, 2, 4, and 9 are associated with the first factor, while items 3, 5, 6, 7, 8, and 10 are associated with the second factor. These findings are consistent with the original questionnaire.

In confirmatory factor analysis, the aim is to assess the fit of a pre-defined factor model using observed data. In this model, each question has an impact on the respective dimensions through its coefficient. Confirmatory factor analysis is employed to obtain these coefficients. Based on the pattern proposed by the questionnaire itself, the coefficients and the extent of each question's influence on different dimensions can be examined. Specifically, questions 1, 2, 4, and 9 affect the sleep difficulty dimension, while questions 3, 5, 6, 7, 8, and 10 influence the daily sleepiness dimension. Therefore, the impact of all questions on their respective dimensions is investigated. The Fig. 2 illustrates the conceptual model with standardized coefficients. The non-standardized and standardized coefficients of this model, along with their significance, are presented in Table 4.

Based on the obtained results, the sleep difficulty dimension has a higher impact compared to the daily sleepiness dimension (based on standardized coefficients). Furthermore, within the sleep difficulty dimension, question 1 has the highest impact, while question 10 has the highest impact within the daily sleepiness dimension.

Assessing the goodness of fit of the conceptual model of the sleep quality questionnaire in the data of this study can be done using fit indices. Table 5 present the fit indices for the initial model.

Based on the results obtained from the exploratory analysis, it was found that there is not a high overlap between the two factors examined in the Sleep Quality Questionnaire, which confirms the divergent validity between the two factors. In assessing convergent validity, a significant correlation of 0.642 was obtained between the SQQ and PSQI questionnaires ($p < 0.001$). This result also confirms the convergent validity of the SQQ questionnaire.

The Cronbach's alpha coefficient for the SQQ questionnaire was found to be 0.882, which is confirmed considering the minimum value of 0.70. Additionally, using the test-retest method, a reliability coefficient of 0.740 was obtained, which is also confirmed considering the

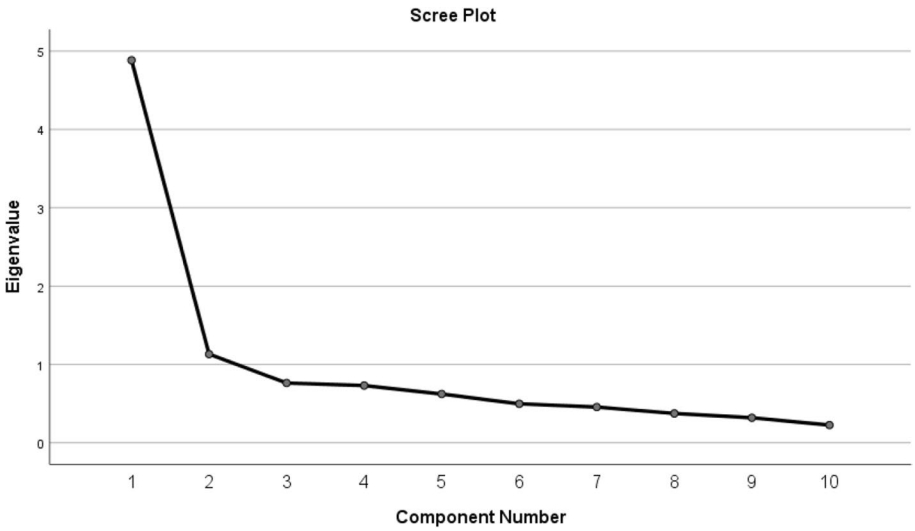

Fig. 1 The number of sleep quality questionnaire factors

Table 3 Results of confirmatory factor analysis

Item	First factor	Second factor
1	692/0	277/0
2	807/0	212/0
3	093/0	829/0
4	524/0	300/0
5	332/0	746/0
6	146/0	835/0
7	326/0	673/0
8	177/0	751/0
9	537/0	496/0
10	392/0	690/0

minimum value of 0.70. Also, utilizing the test-retest method, the reliability was found to be 0.74, which is acceptable according to the minimum value of 0.70.

Discussion

In 2014, Kato conducted a study to evaluate the validity and reliability of a 10-item form of the Sleep Quality Questionnaire (SQQ). This questionnaire consists of two main sections assessing sleep disorders and sleep duration. It was originally designed and validated in Japan, and despite its brevity, it can evaluate sleep quality in two distinct domains: insomnia-related problems and daytime sleepiness. Researchers recognize the need for appropriate tools to assess sleep disorders in different populations, which should demonstrate reliability and accurately represent the details of sleep disturbances in those populations. As no brief measure has been designed to evaluate both domains together, there is a need for a questionnaire that can assess these two aspects. Considering the high importance of assessing sleep quality among university students and its relevance to the field of health, it is necessary to evaluate the psychometric properties of the SQQ questionnaire in the population of medical students at Guilan University of Medical Sciences.

As mentioned earlier, the SQQ questionnaire has been developed as a brief self-report tool for subjective assessment of sleep quality in non-clinical populations. Initially, in order to explore the factor structure of the Sleep Quality Questionnaire and its conformity with the original questionnaire, the findings of the present study indicate that the questionnaire consists of two factors, consistent with the original questionnaire and the study by Kato et al. (2014). The factor analysis revealed that the SQQ consists of two components: daytime sleepiness and sleep difficulty. The CFA results supported the two-factor structure for the SQQ questionnaire. These two factors are related to sleep duration and the time it takes to fall asleep. The Cronbach's alpha coefficient and test-retest reliability indicate the internal consistency and stability of the SQQ questionnaire. Sleep difficulty is an important characteristic of insomnia and has long been defined as one of the complaints associated with sleep disorders. According to the NIH 1998, insomnia is an experience of insufficient or poor-quality sleep that is accompanied by one or more of the following: difficulty falling asleep, difficulty maintaining sleep, early morning awakening, and non-restorative sleep. There are existing questionnaires such as PSQI for assessing sleep difficulty or insomnia, and several questionnaires are available to evaluate daytime sleepiness, such as Epworth Sleepiness Scale (ESS).

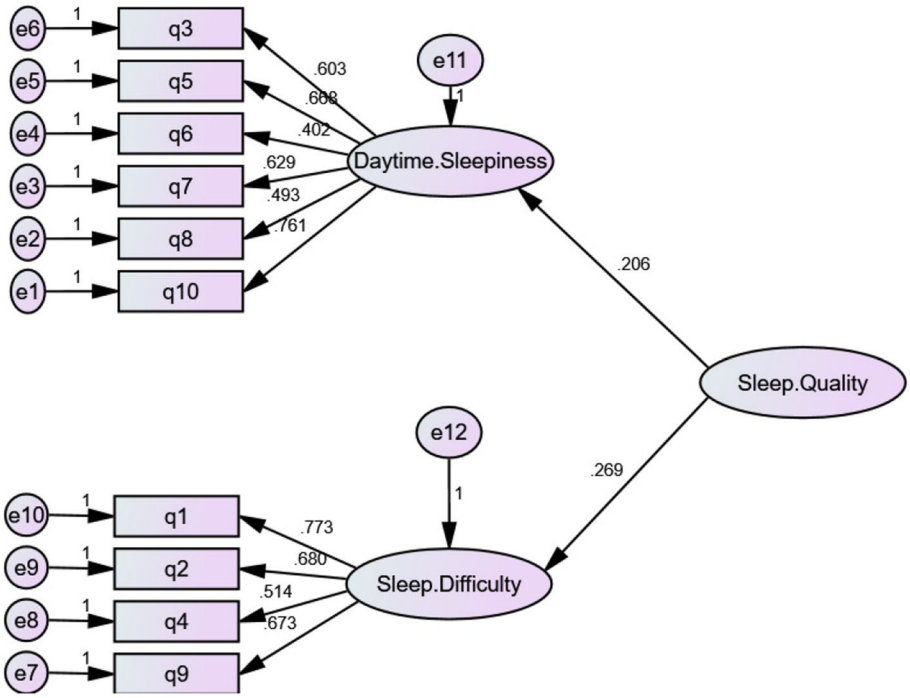

Fig. 2 The conceptual model of the sleep quality questionnaire along with standardized coefficients. In this model, each question has an impact on its corresponding dimensions. The questions 1, 2, 4, and 9 are associated with the dimension of sleep difficulty, while questions 3, 5, 6, 7, 8, and 10 are associated with the dimension of daytime sleepiness. The standardized coefficients indicate the strength and direction of the relationship between each question and its respective dimension

Table 4 Standardized coefficients of confirmatory factor analysis to examine the effect of each question on different dimensions of the questionnaire

Items		Dimension	Standardized coefficients	SE	*P*-value
Daily sleepiness	<---	Quality of Life	206/0	19/0	001/0>
Sleep difficulty	<---	Quality of Life	269/0	18/0	-
q1	<---	Sleep difficulty	773/0	131/0	001/0>
q2	<---	Sleep difficulty	680/0	115/0	001/0>
q3	<---	Daily sleepiness	603/0	106/0	001/0>
q4	<---	Sleep difficulty	514/0	107/0	001/0>
q5	<---	Daily sleepiness	668/0	112/0	001/0>
q6	<---	Daily sleepiness	402/0	113/0	001/0>
q7	<---	Daily sleepiness	629/0	099/0	001/0>
q8	<---	Daily sleepiness	493/0	121/0	001/0>
q9	<---	Sleep difficulty	673/0	-	-
q10	<---	Daily sleepiness	761/0	-	-

Table 5 Evaluation of the adequacy of the conceptual model of the sleep quality questionnaire

Model fit index	Criterion	Rate	Interpretation
CMIN/DF	< 3	18/1	✓
GFI	> 8/0	967/0	✓
CFI	> 9/0	988/0	✓
IFI	> 9/0	972/0	✓
RMSEA	< 08/0	041/0	✓

However, prior to this study, there was no brief questionnaire in the Persian language to simultaneously assess these two domains.

Based on the obtained results, questions 1, 2, 4, and 9 are related to the first factor (sleep difficulty), while questions 3, 5, 6, 7, 8, and 10 (daytime sleepiness) are related to the second factor. Therefore, the impact of all the questions on their respective dimensions was examined, and then the influence of each of the two dimensions on sleep quality was demonstrated, which is consistent with the original questionnaire (Kato 2014). Our investigations have shown that the dimension of sleep difficulty has a higher impact compared to the dimension of daily

sleepiness (based on the standardized coefficient). Additionally, within the dimension of sleep difficulty, question 1 has the highest impact, while within the dimension of daily sleepiness, question 10 has the highest impact. This finding is supported by the study conducted by Kato et al. and the alignment of our results with the original questionnaire (Kato 2014).

The convergent validity of the main questionnaire (Kato 2014) has been assessed using the Medical Outcomes Study (MOS) and ESS questionnaires. It was expected that the scores of the Sleep Quality Questionnaire (SQQ) would be correlated with the MOS scores, which are designed to assess general sleep problems, and the ESS scores, which are designed to assess excessive daytime sleepiness. Furthermore, the scores of the two factors of SQQ were significantly correlated with MOS and ESS, indicating the validity of the SQQ questionnaire. Convergent validity suggests that the assessed sleep quality measured by SQQ is directly related to higher scores on the widely used ESS and MOS scales. The sleep quality measured by SQQ is a predictor of lower general health, higher levels of depression symptoms, chronic fatigue, and lower quality of life. However, in the original questionnaire study, it was suggested to use major scales beyond ESS, such as the Pittsburgh Sleep Quality Index (PSQI), for future studies. Following this recommendation, we have utilized the PSQI in this study. From this perspective, an exploratory analysis revealed a significant correlation of 0.642 between the SQQ and PSQI questionnaires, confirming the convergent validity of the SQQ questionnaire. Furthermore, there is a high overlap between the two investigated factors of the sleep quality questionnaire, supporting the divergent validity between the two factors.

In order to determine the reliability of the SQQ questionnaire, the Cronbach's alpha coefficient was calculated, resulting in 0.882, which is confirmed considering the minimum value of 0.70. Furthermore, the test-retest reliability yielded a coefficient of 0.740, which is also confirmed considering the minimum value of 0.70. In the original questionnaire, the descriptive statistics for daytime sleepiness in students showed a Cronbach's alpha of 0.830 and a test-retest reliability of 0.760, while for sleep difficulty, the Cronbach's alpha was 0.740, and the test-retest reliability was 0.790. Consequently, the results obtained from the present study are within acceptable values. Additionally, our investigations have shown that the developed model has a good fit.

SQQ has the ability to provide new information about sleep quality that is not accessible through other available scales. All the results from the present study indicate that SQQ is valid and reliable for the studied population. Brief self-report measures of sleep quality are equally important in clinical populations as they are in non-clinical populations. In non-clinical populations, self-report measures of sleep quality are more important than objective methods because they are cost-effective and easy to use. SQQ is designed for non-clinical populations and serves as a useful assessment tool for sleep quality (Kato 2014).

Medical students, due to the need for nighttime activities in certain stages and high levels of stress and workload, are more prone to sleep disorders (Seoane et al. 2020). Additionally, living in dormitories may lead to a decrease in sleep quality among this group. Studies conducted in our country on the prevalence of sleep disorders and their types are limited. The present research also examines the status and quality of sleep-in medical students of Guilan University, as they will be involved in community health due to the nature of their profession. Poor sleep quality may have an impact on various dimensions of quality of life. Our results showed that there is no significant difference in the mean sleep quality scores (SQQ) between male and female medical students. The lack of significant difference in sleep quality between female and male students aligns with the results of most previous studies that used the Pittsburgh Sleep Quality Index (PSQI) questionnaire, such as Gharishi and Aghajani (Ghoreishi and Aghajani 2008), Aghajanloo and colleagues (Aghajanloo et al. 2011), and Ghaeni and colleagues (Ghanei et al. 2011). However, it contradicts the results of some studies, such as Gaina and colleagues (Gaina et al. 2005) and Rezaei Ardani and colleagues (Amir Rezaei et al. 2012), which reported significant differences in sleep quality between females and males.

Another finding of the present study is that sleep quality measured by SQQ is significantly and positively correlated with age. Therefore, older individuals tend to have lower sleep quality, which may be due to increased levels of mental concerns and responsibilities associated with age.

One of the objectives of the present study was to determine the relationship between sleep quality (SQQ) with the educational level of medical students at Guilan University of Medical Sciences. The findings in this regard indicate that there is a significant difference in the average sleep quality (SQQ) among the four examined categories (basic sciences, physiopathology, externship, and internship), with the average sleep quality score being lower in the basic sciences category compared to the other categories. Obtaining a lower score on the sleep quality questionnaire by students in the basic sciences educational level implies higher sleep quality in these individuals. In support of this finding, the study by Gharishi et al. conducted in 2008 to investigate the sleep quality of medical students in Zanjan,

using the Pittsburgh Sleep Quality Index questionnaire, can be mentioned. According to their results, there is a clear relationship between educational levels and undesirable sleep quality, with the highest problem observed in students at the internship level and the lowest in the basic sciences level (Ghoreishi and Aghajani 2008). Sleep quality is at its lowest level in the internship level compared to other levels. The decrease in sleep quality in the can lead to a decline in overall performance and educational quality among this population (Steinbrook 2002; Baldwin and Daugherty 2004). Considering the fact that medical students in their clinical stage play a significant and direct role in patient care and this period has a high educational burden and a significant role in clinical medical education for students, a decrease in sleep quality in this group can have more undesirable consequences than it may seem (Howard et al. 2002; Rollinson et al. 2003). Night shifts and increased responsibilities can be causes of decreased sleep quality (Rollinson et al. 2003).

As expected, there is a significant correlation between the average sleep quality (SQQ) with the sleep duration of students. The average score of SQQ is lower in the 8 – 7 h category compared to the less than 6 h category. One of the reasons for this is that the time spent in bed is not necessarily equal to the sleep duration since delayed sleep onset can also be a sleep disturbance.

According to the results, there is no significant difference in the average sleep quality (SQQ) based on the students' place of residence, including dormitory, personal home, and living with family.

Previous studies have shown that although the sleep needs of individuals vary, most people sleep an average of seven to eight hours per night. Some studies have also suggested six to nine hours as an adequate sleep duration (Dongen et al. 2003). Considering this, it seems that students sleep less compared to the general population, which may be due to increased stress, higher levels of worries, academic pressure, and the need for more study time. Regarding the prevalence of sleep problems in medical students, it can be said that factors such as being away from the family, lack of social, family, and financial support, changes in sleep patterns and wakefulness, prolonged waking hours, high volume of study materials, consecutive exams in short intervals, night shifts during certain stages of education as a study obligation and as a responsible caregiver in the absence of a treating physician, impose significant stress and anxiety on students, which are themselves factors contributing to sleeplessness. Finally, it can be said that sleep problems can lead to a decline in academic performance, increased fatigue in daily activities, and a decrease in the quality of life.

Limitations

One of the limitations of the present study was the lack of a large statistical population. SQQ was designed for non-clinical populations, and further studies are needed to examine the validity and reliability of this questionnaire in other populations, such as housewives and other students. This study had its limitations; psychological factors can have a significant impact on sleep quality and the way individuals respond to questions, and these factors cannot be controlled. Moreover, the selection of samples from among the students of Guilan University of Medical Sciences had its limitations, and generalizing the results to students from other universities should be done with caution, considering specific fields of study and levels of education. Since this study was cross-sectional and conducted over a very short period, further investigations during the students' education are recommended. On the other hand, it is necessary to use more valid methods, such as structured questionnaires completed by physicians or mental health professionals familiar with interview methods and data collection, to increase the credibility of the results. Also, we suggest the future studies to validate the questionnaire with observation reports or objective sleep studies with larger sample sizes and on homogeneous population regarding age, gender, seniority, and maybe other variables that would contribute to the sleep score values. Another limitation of this study was the use of self-report questionnaires, which can be influenced by response bias.

Conclusion

This study focused on the translation, validation, and psychometric properties of the Persian version of the SQQ questionnaire. The results of this study indicate internal consistency (Cronbach's alpha of 0.8) for the factors of this questionnaire, and the Persian version of SQQ has acceptable psychometric properties. This study aimed to establish the usability and validity of the SQQ questionnaire for the Iranian population in the Persian language. Based on the obtained results, the Persian version of SQQ has showed validity and accuracy. Therefore, it is recommended to investigate sleep quality in future studies using this questionnaire. Overall, we conclude that the Persian version of SQQ has ideal psychometric properties for assessing sleep quality in clinical and research settings.

Abbreviations

SQQ	Sleep Quality Questionnaire
PSQI	Pittsburgh Sleep Quality Index
MOS	Medical Outcomes Study Sleep Scale
ESS	Epworth Sleepiness Scale
GHQ	12-12-question general health questionnaire
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index

TLI	Tucker-Lewis Index
RMSEA	Root Mean Square Error of Approximation
CVR	Content Validity Ratio
CVI	Content Validity Index

Acknowledgements
Not applicable.

Authors' contributions
Conceptualization: AS, MS, AP; Data collection: AS, JF; Data analyzing: AS; Writing the original draft: AS, SG, HH; review & editing; All authors read and approve the final version of the manuscript.

Funding
Not applicable.

Availability of data and materials
Available through a reasonable request by contacting Dr. Arman Shafiee.

Declarations

Ethics approval and consent to participate
The study was conducted in conformity with the Helsinki Declaration on Human Experimentation, 1964, with subsequent revisions, latest Seoul, October 2008. Ethical approval was obtained from the Ethics and Protocol Review Committee of Guilan University of Medical Sciences (Protocol ID number: IR.GUMS.REC.1401.167) and each patient provided written voluntary informed consent after the rationale and procedure of the study were thoroughly explained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 1 October 2023 Accepted: 7 March 2024
Published online: 16 March 2024

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