

Factor Analysis and Validation of Sleep Health Scale in Nursing Context

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Abstract

Background and Objective: Sleep health can be defined as a multidimensional pattern of sleep-awakening that is consistent with individual, social, and environmental needs and its absence endangers physical and mental wellbeing. The objective of the present study was to validate the Sleep Health Scale (SHS).

Materials and Methods: The population for this study consisted of all nurses in Arak Province, Iran, including 130 participants who were selected using the available sampling method (simple sampling). Data collection was based on the SHS by Buysse, which resulted in 120 completed questionnaires. SPSS software was used for exploratory factor analysis (EFA), reliability, and correlation between questions, and AMOS was used for confirmatory factor analysis (CFA). This scale was translated from English to Persian and then was back-translated from Persian to English. The questionnaire was examined in terms of cultural sensitivities, clarity of questions, conflicts, and errors in meaningfulness by a panel of experts.

Results: Cronbach's alpha coefficient for the questionnaire was 0.89; hence, the questionnaire was reliable. Factor loadings' examination using EFA and CFA showed 0.77 and 0.80 for the questions and this confirmed an acceptable construct validity. All items showed acceptable correlation (0.82 to 0.84). The results of test-retest reliability showed stability over time ($r = 0.83$) for sleep health assessment.

Conclusion: The Persian version of the questionnaire has acceptable validity and reliability and can be used for sleep health assessment, along with other questionnaires.

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Keywords: Sleep; Nursing; Validation study; Factor analysis; Statistical; Reproducibility of results

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Introduction

Sleep health can be defined as a multidimensional pattern for sleep-awakening that adapts to social and environmental needs and promotes physical and mental health and wellbeing (1). This concept points to a suitable frame for sleep, because sufficient sleep is the fundamental part of a healthy life style. Studies have indicated that sleep is one of the main components of physical and mental health (2). Sleep is necessary for cognitive

functioning including mental processes, emotional regulations, and desirable life quality (3).

Therefore, sleep can be considered as a dynamic and complex behavioral state that mainly influences working hours and facilitates physical and mental recovery (4).

Sleep health is an important part of the clinical care, because sleep problems may be primary sign of mental morbidities. Some mental disorders are accompanied by certain alterations in sleep physiology. Since human spends one third of his life in sleep and over 30% of people all around the world suffer from sleep disorders, it can be said that sleep disorders may constitute the largest group of mental disorders worldwide. Furthermore, sleep

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abnormalities usually lead to failures in daily performance of individuals (5). Therefore, sleep problems might cause various negative effects such as changes in body's immune system, metabolism, hormone functioning, delay in wound healing, fatigue, daily performance disorder, memory disorder, change in mood, and problems in social and family interactions (6).

Sleep problems exist in various occupational and non-occupational groups such as nurses who experience sleep changes over hospitalization period at hospitals. Sleep and rest assessment of hospital nurses is one of the organizational requirements that should be taken into consideration by authorities to identify factors affecting sleep health of nurses, modify abnormal sleep patterns, and promote sleep and physical and mental health of nurses (7). In terms of sleep health, the negative effects of night work, reduced tolerance level against job and life stressors as well as abusing various drugs can be pointed out (8).

Studies on nurses have reported that undesirable sleep quality was present in 77.7% of nursing units, 58.8% of nurses with rotating shift, and 12.2% of nurses with fixed shift. It also has been shown that 23.0% of nurses were using sleep drugs to deal with insomnia and treat sleep disorders (9). Jobs that have rotating shifts can cause disorder in the circadian rhythm followed by physiological consequences such as increased digestive problems, sleep changes, constant fatigue, cardiovascular problems, and behavioral changes such as reduced efficiency and simulation. Buysse, after reviewing the published articles about sleep and sleep disorders, concluded that many studies addressed five main factors in sleep health, including:

- 1) Sleep duration: total amount of sleep for every 24 hours,
- 2) sleep continuity of productivity: falling asleep easily,
- 3) timing: considering sleep during 24 hours,
- 4) awareness/sleepiness: awareness during awakening,
- 5) satisfaction/quality: mental assessment of sleep quality: being good or bad.

Sleep can be assessed through self-report (questionnaires and forms) at the behavioral, physiological, cellular, and genetic levels. In each of these analysis levels, sleep can be assessed in different dimensions such as quantity, continuity, timing, satisfaction, quality, stages, and activeness or inactiveness (1). Since presence of sleep health does not imply the lack of any problem or disorder,

for correct overall sleep assessment, different sleep dimensions should be taken into consideration (1, 2, 10).

Since sleep is a ubiquitous phenomenon, it is one of the main behaviors of humans and constitutes one third of human life. A standard questionnaire is necessary for sleep assessment, because long sleep deprivation for any reason may lead to severe physical and cognitive damages, which might be irreversible. Thus, the objective of the present study was to validate the Sleep Health Scale (SHS).

Materials and Methods

The present study was an applied descriptive study. The statistical population included all nurses of Arak Province, Iran, during 2016-2017. In this regard, 130 nurses were selected based on convenience sampling strategy and according to the recommendation by Gall et al. (11). In this study, a 5-point Likert scale was used [absolutely disagree (1) to absolutely agree (5)]. For this reason, after sending an email to the original developer of the scale (in August 17, 2017 at 07:04 AM), the authors received a permission to translate it (in August 21, 2017 at 1:32 PM). This scale was validated by Becker et al. (10) as well.

To estimate the sample size, 15 subjects were considered for each measured variable, which led to a final sample size of 76 (considering that this scale has 5 items). Finally, 130 questionnaires were distributed, whereas 10 questionnaires were incomplete (11). The sample included 80 women and 40 men aged 24-50 years (mean age: 38.68 ± 9.42 years).

The instrument used in this study was SHS by Buysse that was scored according to a 3-point Likert scale (0 = rarely/never, 1 = sometimes, 2 = usually/always) (1). The questionnaire has one variable (sleep health) that consists of 5 questions. This questionnaire has not been translated and validated in Iran.

In the study by Becker et al., the 6-question version was examined and after confirmatory factor analysis (CFA), it reduced to 5 questions (10). In the present study, the 5-item version by Becker et al. was used. To translate the questionnaire, the approach proposed by Jones et al., indicating a mixture of symmetrical and asymmetrical strategies, was used (12). Since the instrument was designed for English speakers, to examine content validity, it was translated into Persian. SHS was

translated by two translators and to examine content validity, the opinions of seven experts were used. The questionnaire was reviewed several times to examine its Persian grammar accuracy and to ensure clarity and understanding of options, it was given to 5 people to express their ideas. In the end, in order to eliminate possible errors in translation, an English expert was asked to re-translate the questionnaire into English. The results confirmed the accuracy of the translation.

To examine construct validity, the questionnaires were distributed in the selected hospitals after seeking informed consent.

For data analysis, SPSS software (version 23, IBM Corporation, Armonk, NY, USA) and AMOS software (version 22) were used. SPSS software was used to analyze exploratory factor analysis (EFA) and determine the relationship between questions and related constructs, also to examine reliability, Cronbach's alpha, and Pearson correlation coefficient. AMOS was used to analyze CFA of the questionnaire. In factor analysis, χ^2 , $\chi^2/\text{degree of freedom (df)}$, root mean square error of approximation (RMSEA), comparative fit index (CFI), goodness of fit index (GFI), and adjusted goodness of fit index (AGFI) were used.

Participation in this study was voluntary and questionnaires were anonymous. Participants were ensured that information will remain confidential.

Results

After investigating statistical properties of scales and their alpha, EFA was used.

Descriptive characteristics of the participants are presented in table 1.

After examining normality of data distribution, Kolmogorov-Smirnov test (K-S test) was used based on varimax rotation method. This method was selected since it transfers factors to new axes to let test items, with the simple structure that displays the main lines, reaching interpretable solutions. However, other rotation methods have different interpretations, but all of them are em-

ployed to maximize the relationship between variables and some of the factors.

Table 1. Demographic characteristics of participants

Variable		n (%)
Gender	Female	80 (66.7)
	Male	40 (33.3)
Marital status	Single	105 (87.5)
	Married	15 (12.5)
Work history (year)	1 to 5	42 (35.0)
	6 to 10	28 (23.3)
	11 to 15	21 (17.5)
	16 to 20	21 (17.5)
	Over 20	8 (6.7)

To implement the main component analysis method and indicate this point that data correlation matrix is not zero, Bartlett's test was used and the results were significant (Bartlett's test = 315.87, $P < 0.001$). Therefore, it can be perceived that factor analysis based on the resulted correlation matrix can be explained (Table 2).

Table 2. Descriptive characteristics, validity, and reliability of the questionnaire

	Value
Mean	15.01
SD	6.07
Cronbach's alpha	0.89
KMO value	0.87**
Bartlett's test	315.87**

** *** were significant

SD: Standard deviation; KMO: Kaiser-Meyer-Olkin

EFA was used for factors that were regulated as 5-point Likert scale. After EFA, the questions reduced to 2 (Table 3). EFA (Table 4) and Cronbach's alpha (Table 2) were presented to examine reliability. Total reliability of the 5-item questionnaire was 0.89 (Table 2).

In the following, total variance explained is presented. The results showed that special values (values above 1) of a factor were larger than 1. Special values, variance percentage, and cumulative variance are presented in table 3.

Table 3. Total variance explained

Initial eigenvalues			Extraction sums of squared loadings		
Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
3.493	69.868	69.868	3.493	69.868	69.868
0.472	9.433	79.302	--	--	--
0.376	7.519	86.821	--	--	--
0.365	7.310	94.131	--	--	--
0.293	5.869	100.000	--	--	--

Table 4. Standard factor loads of the questionnaire

Row		Standard factor load (Becker et al.)	Standard factor load (current study)
1	I am pleased with the amount of my sleep	0.85	0.79
2	I am pleased with falling asleep	0.71	0.80
3	I am pleased with my sleep timing (having a time during 24 hours)	0.69	0.80
4	While awakening, I am not conscious because of sleepiness	0.81	0.79
5	I am generally pleased with the quality of my sleep	0.62	0.77

Figure 1 shows that the contribution of the first factor in the total variance of variables was significant and different from other factors. Moreover, after the second factor, the plot was cut and almost smooth. In table 4, factor load of each option in the present study and Becker et al. study is presented.

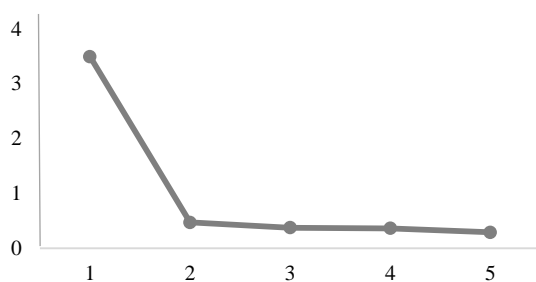


Figure 1. Scree plot in exploratory factor analysis (EFA)

Correlation matrix between research variables and the whole case is presented in table 5.

As can be observed, a positive correlation existed between research questions. Also, correlation existed between the research score and all questions.

The results of test-retest showed that there was a significant and positive correlation between the tests ($r = 0.82, P < 0.05$).

Reverse scoring

After EFA using AMOS, CFA was used for the questionnaire. The results showed that finally, CFA with 5 questions and 1 factor was confirmed and showed goodness of fit (GOF). The results of CFA are presented in table 6. All indices of the questionnaire were close to fitness standards and expressed desirable quality for structural pattern. As a result, the research model had acceptable GFI and was confirmed. CFI, fit index (FI), and the RMSEA indicated model's GOF. GFI that is the representative of absolute fitness yielded 0.91, indicating that the collected data were acceptable and the developed model was confirmed.

When the CFI used for this study was larger than 0.94, it indicated acceptable GOF. Absolute GFI asks whether the remained error variance after model fitness is significant. In the current study, since it was larger than 0.90, it indicated model's GOF. CFA of the questionnaire is presented in figure 2.

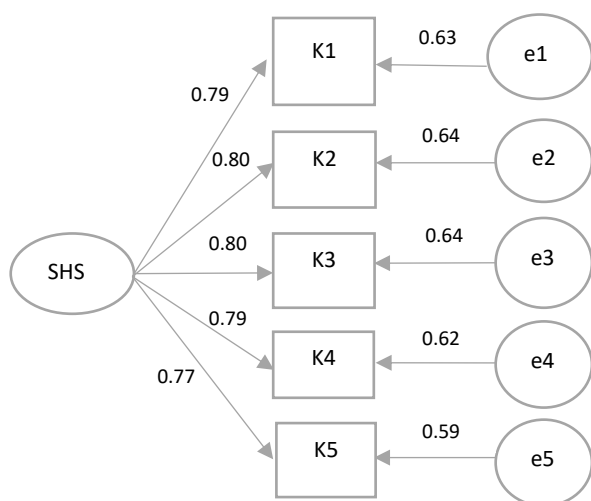
Table 5. Correlation matrix between research variables

		Total	K1	K2	K3	K4	K5
Total	Pearson correlation	1					
	P (2-tailed)						
	n	120					
K1	Pearson correlation	0.840	1				
	P (2-tailed)	< 0.001					
	n	120	120				
K2	Pearson correlation	0.840	0.638	1			
	P (2-tailed)	< 0.001	< 0.001				
	n	120	120	120			
K3	Pearson correlation	0.840	0.643	0.595	1		
	P (2-tailed)	< 0.001	< 0.001	< 0.001			
	n	120	120	120	120		
K4	Pearson correlation	0.836	0.619	0.625	0.673	1	
	P (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001		
	n	120	120	120	120	120	
K5	Pearson correlation	0.824	0.603	0.661	0.606	0.569	1
	P (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
	n	120	120	120	120	120	120

Table 6. Fitness indexes of confirmatory factor analysis (CFA) model in two studies

Fitness index result	Becker et al.	The current study	Basis	Index
GOF	2.86	1.25	≥ 3.00	χ^2/df
GOF	0.08	0.04	≥ 0.08	RMSEA
GOF	0.98	0.99	≤ 0.90	CFI
GOF	0.98	0.97	≤ 0.90	GFI
GOF	0.93	0.93	≤ 0.90	AGFI

GOF: Goodness of fit; χ^2/df : Chi-square to degree of freedom ratio; GFI: Goodness of fit index; CFI: Comparative fit index; AGFI: Adjusted goodness of fit index; RMSEA: Root mean square error of approximation

**Figure 2.** Confirmatory factor analysis (CFA) of Sleep Health Scale (SHS)

Discussion

Sleep and its related phenomena are among the issues that occupy the minds of different generations. Sleep is an organized behavior that is repeated to coordinate the rhythm of body and daily life regularly. One third of human life is spent during sleep that leads to energy conservation and recovery and promotes physical health, getting rid of stress and anxiety, adaptation ability, and performing daily activities. Therefore, it is necessary to study sleep health in details and this requires valid and reliable instruments. In this regard, the current study aimed to examine reliability and validity of SHS and provide new information about sleep health among Iranian nurses in Arak Province.

The objective of this study was to examine reliability and validity and structure of the Persian version of SHS by Becker et al (10). This scale has been standardized in different samples and languages. In this study, the final version of this scale was examined and its reliability and validity in Iranian population showed that its Persian version with the finalized questions and options had acceptable reliability and validity. Of 5 items of

sleep health assessment, all items were translated very clearly. Also, all questions of the Persian version had acceptable content validity, indicating that all questions have enough content validity. Moderations in concept and content validity were assessed by experts and finally, the instrument was introduced. All cases obtained 80% to 100% agreement among reviewers. This can indicate face validity for all the questions. Also, construct validity was confirmed by EFA and CFA, where standard factor analysis varied from 0.77 to 0.80 for each option. Therefore, the findings of the present study showed desirable evidence in confirming reliability and validity of SHS questionnaire. The findings showed that the 5-item questionnaire by Becker et al. in Persian version showed desirable validity and reliability.

The reliability of the questionnaire was estimated using Cronbach's alpha as 0.89 that shows desirable reliability and this is consistent with Becker et al. (10) and Buysse (1).

Kaiser-Meyer-Olkin (KMO) index points out that correlation matrix is suitable to carry out analysis. One factor (eigenvalue > 1) was discovered. More evidence was observed about construct validity of the scale. Moreover, power and direction of this correlation are conceptually meaningful and consistent with our knowledge about sleep health assessment.

In the end, to confirm the discovered factors, CFA was carried out. The results of CFA showed GOF of the questionnaire.

SHS by Becker et al. is a valid scale that includes different sleep parameters including sleep duration, sleep continuity, sleep timing, consciousness or sleepiness, and overall satisfaction of sleep quality. The score of item varies from 0 to 25 and the participant marks his or her understanding of sleep.

Generally, findings positively support the Persian version of the scale according to internal consistency through Cronbach's alpha, the observed

pattern in correlations in instrument, the results of EFA, and the results of CFA.

According to the studies on SHS and also the findings of this study, to promote sleep health assessment, it is suggested to conduct more studies and use exploratory studies to investigate the factors influencing sleep health. The reasons that make this study different from other studies are easy scoring compared with other questionnaires, low number of items (5 items) that leads to quicker cooperation of the respondents, and consideration of the main dimensions of sleep according to the previous studies.

According to the findings, it seems that the Persian version of this instrument with the finalized items and questions has acceptable reliability and validity in the study population; however, due to limited sample size of this study and being the first study, it is recommended to replicate this study in different contexts and larger populations due to cultural and ethnic differences in different parts of Iran. Undoubtedly, future researchers might add certain aspects or constructs to this instrument to assess sleep health due to necessity and with valid scientific resources. They have also the liberty to use more technical questions in different occupational groups. More studies can confirm reliability and validity of the present questionnaire.

Nurses, due to their profession, mostly work at night. This leads to disorder in their biological and circadian rhythm. Those who work based on rotating and fixed shifts have this problem that may cause sleep disorder, because it leads to reduced sufficiency and productivity compared to the standard level. Therefore, standard self-report instruments can facilitate sleep health assessment in this occupational population.

Conclusion

The results showed that the Persian version of the questionnaire had acceptable validity and reliability and could be used for sleep health assessment, along with other questionnaires.

Conflict of Interests

Authors have no conflict of interests.

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