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Original research article

Validity and reliability of the Turkish version of the Visual Analog Sleep Scale

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INFORMACE O ČLÁNKU

Received: 2016-03-25
Received in revised form: 2016-04-29
Accepted: 2016-05-17
Published online: 2016-06-27

Keywords:
Sleep
Quality
Reliability
Validity

ABSTRACT

Objectives: The aim of this study was to adapt the English version of the Visual Analog Sleep Scale (VAS Scale) to Turkish, and to assess the validity and reliability of this Turkish version.
Material and methods: The study design was both descriptive and methodological. The study group was comprised of 75 patients, who agreed to participate in the study. Each had received total hip replacement surgery in an orthopedic clinical hospital. Data was collected using a Turkish translation of the VAS Scale. Psychometric testing of the adapted instrument was carried out to establish internal consistency, interim correlation, and construct validity. The Kaiser-Meyer-Olkin and Barlett's tests were applied to determine the sampling adequacy and suitability to the factor analysis.
Results: The Kaiser-Meyer-Olkin value was found to be 0.89, and this value indicates suitability for principal component analysis. Similarly, Barlett's test results (X^2 = 608.74, p = 0.000) also indicate the interrelationships of the data and suitability for the factor analysis. The eigenvalue of the VAS Scale reduced to 10 items was found to be 6.65 and the variance was 66.52. The VAS Scale Cronbach's alpha was 0.82 for the test items. The test-retest stability coefficient (validity of the scale) was 0.92. Alpha coefficient was found to be 0.94 for internal consistency.
Conclusion: The original VAS Scale consisted of three sub-scales and 15 items, whereas the Turkish version has one dimension and 10 items. The Turkish version of the VAS Scale adapted to the orthopedics clinic can be used as a one-factor tool.

Introduction

Sleep is a process that relaxes the individual and helps to restore mental and physical energy [1]. Adequate sleep and rest are considered to be an indicator of overall health status [2, 3]. Patients often need more sleep and rest compared to healthy individuals [3]. Hospitalized individuals' rest and sleep habits may change depending on the physical and mental states of the patient and other environmental factors [4, 5]. Comprehensive studies aimed at assessing the sleep status of patients have reported that hospitalized individuals experience sleep problems for many reasons, and that most sleep problems were experienced by patients

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http://dx.doi.org/10.1016/j.kontakt.2016.05.003

KONTAKT XVIII/2: 94–99 • ISSN 1212-4117 (Print) • ISSN 1804-7122 (Online)

Článek citujte takto: Çetinkaya F, Karabulut N. Validity and reliability of the Turkish version of the Visual Analog Sleep Scale. Kontakt 2016; 18(2): e84–e89; http://dx.doi.org/10.1016/j.kontakt.2016.05.003

hospitalized in surgical clinics [6, 7]. In addition, the patients hospitalized in orthopedic surgery clinics were found to have more sleep problems than patients in other clinics [8]. Inadequate sleep can cause various physical and psychological problems due to the effect of sleeplessness on cardiopulmonary, gastrointestinal and neuromuscular functions [1, 9]. Psychological effects of sleep disorders can lead to fatigue, decreased concentration, depression, increased anxiety, irritability, pain, muscle tremors, constipation and daytime sleepiness [10]. Early diagnosis of sleep problems in patients, in a hospital setting, is important for the prevention of such complications [5]. Sleep quality in a hospitalized patient can be measured by a variety of methods including the use of movement monitoring devices, brain electrical activity, sleep diaries and sleep scales. A sleep scale is an effective method of objectively determining the quality of sleep in hospitalized patients [11, 12]. Having an instrument to assess a night's sleep is important for research factors which interfere in the sleep of hospitalized patients, as well as for studies testing interventions to relieve sleep problems deriving from or stressed by hospitalization [13]. Although there are studies with valid and reliable scales on the sleep quality of patients, there was no study evaluating the patients' previous night's sleep quality with a scale in Turkish [14–16]. Identifying the sleep disorders of patients and performing the necessary actions to prevent such issues is important to positively influence the healing process. There is currently no measurement tool in Turkish to assess the sleep quality of patients.

Valid and reliable tools are necessary in order to assess the sleep quality of patients. Verran and Snyder-Halpern have developed the "Visual Analog Sleep Scale" control to assess the quality of sleep of both patients and healthy subjects. The VAS Scale is conducted in English. This scale consists of 15 items and three sub-scales. In scoring the scale, each dimension's score is calculated by adding the scores of the related items. Scores taken in each dimension indicate the levels of disturbance, effectiveness and supplementation [17].

The aim of this study is to translate the Visual Analog Sleep Scale (VAS Scale) developed by Verran and Snyder-Halpern (VSH) into the Turkish language and to assess its validity and reliability for future studies.

Material and methods

Participants and settings

A descriptive and methodological research design was used for this study. The study was conducted with 75 patients who underwent a total hip replacement surgery between August 2011 and January 2012 in an orthopedics and traumatology clinic at a state hospital and private hospital. The inclusion criteria for the study was as follows. All patients had to be: (1) 18 years old or above; (2) have no communication disability or mental retardation which might prevent his/her audio-visual/verbal expressions concerning their sleep status; (3) not currently using any opiates; (4) experienced no complications developed in the pre, intra- or post-operative state for three days. Data was collected from patients who conform to the criteria research by the researcher through face-to-face interviews. A self-report questionnaire was used to capture demographic work characteristics and VAS Scale. Data were collected at the time when there were no visiting hours in the patient room. Data collection took an average of 15–20 min for each patient. In the literature, the number of subjects 5–10 times greater than the number of items in the scale is suggested when adapting the said scale to another culture. In addition, a group consisting of at least 30 people is suggested for the test-retest in order to ensure temporal stability of the scale [18, 19]. In this study, test-retest reliability was ensured by using a sample size (n = 75) 5 times greater than the number of items (15) in the VAS Scale. In the literature there are some examples studied 5 times the number of items of the scale [20–23].

Ethical considerations

Written permission of one of the initial researchers – Verran Joyce – who developed the scale was obtained by e-mail in order to start the study. Ethics Committee approval (No: 2011.3.1/6) was obtained from the Ethics Committee of Ataturk University, Faculty of Health Sciences. Permission was obtained from the clinic where the study was to be conducted and written consent of the patients was obtained after informing them about the study details.

Data collection tool

The "Visual Analog Sleep Scale (VAS Scale)" and "The Patient Information Form" were used for data collection.

The Patient Information Form: The patient Introductory Information Form, which was used for data collection, was prepared by the researcher in accordance with the literature, and includes questions on age, gender, marital status, surgical history and sleep patterns of patients [7, 8, 17]. VAS Scale: This instrument was developed by Verran and Snyder-Halpern in 1988 to assess the quality of sleep of patients and healthy individuals. The scale consists of 15 items and three dimensions. The dimensions consist of disturbance, effectiveness, and supplementation (daytime sleep) sub-scales. The sleep disturbance sub-scale contains questions on sleep disruptions and delays in falling asleep; the effective-sleep sub-scale consists of sleep quality and sleep duration; and the supplementation sub-scale takes note of daytime sleep additions. Each item in the scale is evaluated by a visual analog technique, consisted of a scale-chart ranging from 0 (left side) to 100 (right side).

This chart is presented as a blank line for self-assessment, and the scale is then read by the researcher using a ruler. In the scale, 15 items are directly measured, and the total sleep time is calculated by summing up the scores taken in the 1st (did not awaken / was awake for ten hours) and 2nd (had no sleep / excluding time awake / had ten hours of sleep) items; and this calculated result is interpreted as the 16th item. Since the sub-scales refer to different dimensions of sleep, an overall, total score is not provided

by the Visual Analog Sleep Scale, and each sub-scale is scored separately. In scoring the scale, each dimension (disturbance, effectiveness and supplementation) is obtained by totalling the scores of related items. Sleep disturbance, effectiveness, and supplementation are scored between 0 and 700, 0 and 600, and 0 and 400, respectively. The Cronbach's alpha values of the scale, developed by Verran and Snyder-Halpern, presented results of reliability and validity estimates in four samples: healthy adults in their usual sleep environment; adults with insomnia in their usual sleep environment, hospitalized adults in the United States and hospitalized adults in Taiwan. These results show Theta coefficients between 0.82 and 0.86 for the Disturbance Scale, between 0.72 and 0.81 for the Effectiveness Scale, and between 0.45 and 0.84 for the Supplementation Scale [17].

Translation procedures

In this study, the linguistic validity was tested by the translation-back translation method. The items in the scale were ensured to be consistent with the Turkish language structure. Suitability of the items in the scale for measurement purpose and their representativeness related to the measurement area were also evaluated to ensure the content validity. After completing the translations, two university nursing professors were consulted, and after they discussed the suitability of the Turkish language, the items were finalized. At this stage, instead of the literal translation of the items, their corresponding equivalents in the Turkish language were considered. After receiving the linguistics opinions on the translation and intelligibility, the scale was applied to a group of 10 people as a pilot test, and intelligibility of the items was investigated for the target audience. The VAS Scale was checked one final time by the authors.

Data analysis

The Statistical Package for the Social Sciences (SPSS) for Windows, version 18.0 was used in coding and performing statistical analysis on the data. Factor analysis was used for the validity and reliability of the scale; Pearson's correlation technique was used to determine the item total score correlations, and Cronbach's alpha coefficients were used for determining the internal consistency of analysis. To test item clarity and content validity, the translated version of the VAS Scale was submitted to six specialists working in the Departments of Surgical Diseases Nursing and Psychiatric Nursing.

Each panel member evaluated the content of the final translated version of the VAS Scale and compared it with the original instrument by evaluating each item on a five-point scale, where 1 = *not suitable*, 2 = *unsuitable*, 3 = *partly suitable*, 4 = *suitable*, and 5 = *absolutely suitable*.

Cronbach's alpha was calculated to determine internal consistency. Polit and Beck indicate that internal consistency may be a necessary condition for homogeneity or being one factor of a scale and Cronbach's alpha should be 0.70 or more. Furthermore, the item-total correlations and mean inter-item correlations were included in the analysis. Polit and Beck recommended using the item-total correlation as a criterion for internal consistency. In our study, the value 0.30 was taken as the basis for the item-total score correlation [24]. Prior to the factor analysis, the Kaiser-Meyer-Olkin (KMO) and Barlett's tests were applied to determine the sampling adequacy and suitability to the factor analysis. In the analysis results, the KMO value was found to be 0.89, and this value indicates suitability for principal component analysis. According to the literature, a Kaiser-Meyer-Olkin (KMO) value greater than 0.80 indicates the suitability of the sample size for factor analysis, and a Barlett's test significance value less than 0.05 indicates that the data have a multivariate normal distribution, permiting factor analysis [25, 26]. Similarly, Barlett's test results (X^2 = 608.74, p = 0.000) also indicate the interrelationships of the data and suitability for the factor analysis. In this study, the KMO value was 0.89, and the p-value of Barlett's test was less than 0.05, indicating that the data was appropriate for factor analysis [25].

Results

The results of the introductory characteristics of patients are presented in Table 1.

Table 1 – The characteristics of patients (*N* = 75)

Characteristics	Mean	
Age	62.70	
	N	Percentage
Gender		
Female	63	84.0
Male	12	16.0
Marital status		
Married	70	93.3
Single	5	6.7
Education level		
Literate*	65	86.7
Primary school	9	12.0
High school	1	1.3
Previous operations?		
Yes	50	66.7
No	25	33.3
A chronic sleep disorder		
Yes	24	32.0
No	51	68.0

* Literate: literate but no diploma

Content validity

Four Turkish nursing professors independently translated the VAS Scale into Turkish and produced nearly identical results. Three linguists who performed the back-translation also produced similar translations. After the translations, two nursing professors evaluated the Turkish

version of the scale in terms of intelligibility and cultural aspects, and the scale was finalized after consensus was reached on appropriate Turkish words and cultural features. Finally, the language of the scale was checked by a Turkish language specialist. Before starting the validity and reliability studies, a linguistic equivalence study was performed to determine the consistency between the original and Turkish version of the Visual Analog Sleep Scale. In this study, both questionnaires were applied to 30 senior students who have a good command of English and study at the Department of English Language and Literature. After observing the equivalence of Turkish and English versions of the scale, it was applied to 10 patients – who were not included in the study sample – in order to evaluate intelligibility. The statements in the scale were found to be intelligible in this pilot patient group.

Internal consistency

Item numbers 3 ("did not sleep during the day yesterday / slept ten hours during the day"), 4 ("did not sleep yesterday morning / slept on and off yesterday morning"), 5 ("did not sleep yesterday evening / slept on and off yesterday evening"), 11 ("did not move / tossed and turned all night"), and 13 ("after morning awakening, stayed awake / after morning dozed on and off") were found to have score correlations less than 0.30 (Table 2); and, Cronbach's alpha coefficient was found to increase after removing these items. The 3rd, 4th, 5th, 11th and 13th items were removed from the scale since their contribution to the scale was lower according to the total score correlations of these items.

Table 2 – VAS Scale correlation between items and total scores taken in the items

Items		Item-total correlation
1. Did not awaken (continuous sleep)	Was awake ten hours	0.772
2. Had no sleep	Excluding time awake, had ten hours of sleep	0.740
3. *Did not sleep during the day yesterday*	*Slept ten hours during the day*	*–0.056*
4. *Did not sleep yesterday morning*	*Slept on and off yesterday morning*	*0.022*
5. *Did not sleep yesterday evening*	*Slept on and off yesterday evening*	*0.076*
6. Fell asleep immediately	Did not fall a sleep	0.764
7. Slept lightly	Slept deeply	0.574
8. Had no trouble with disrupted sleep	Had a lot of trouble with disrupted sleep	0.731
9. Did not wake at all	Was awake on and off all night	0.736
10. Had no trouble falling a sleep	Had a lot of trouble falling sleep	0.848
11. *Did not move*	*Tossed and turned all night*	*0.119*
12. Awoke exhausted	*Awoke refreshed*	*0.724*
13. *After morning awakening, stayed awake*	*After morning dozed on and off*	*0.226*
14. Had a bad night's sleep	Had a good night's sleep	0.676
15. Had enough sleep	Did not have enough sleep	0.733

Construct validity

Prior to the factor analysis, the Kaiser-Meyer-Olkin (KMO) and Barlett's tests were applied to determine the sampling adequacy and suitability to the factor analysis. In the analysis results, the KMO value was found to be 0.89, and this value indicates suitability for principal component analysis. Similarly, Barlett's test results (X^2 = 608.74, p = 0.000) also indicate the interrelationships of the data and suitability for the factor analysis. After removing 5 items with low item-total score correlations from the visual analog scale in quality of sleep, the 16th item also had to be removed due to it being obtained as a sum of the 1st and 2nd items. After removing these 6 items, Cronbach's alpha coefficient was calculated for the remaining 10 items and presented in Table 3.

The eigenvalue of the VAS Scale reduced to 10 items was found to be 6.65 and variance was 66.52. The VAS Scale Cronbach's alpha was 0.82 for the test items. The test-retest stability coefficient (validity of the scale) was 0.92.

Discussion

The internal consistency of the measurement instrument is defined as the ability of a scale to measure the variables of interest. The Cronbach's alpha coefficient is one of the methods used to test internal reliability [25]. In the literature, a value of Cronbach's alpha coefficient obtained between 0.60 and 0.80 is considered to indicate a highly reliable instrument [26]. Here, Cronbach's alpha coefficient was found to be 0.94 for internal consistency after 5 items were removed. The item-total score correlations that provide internal consistencies of the scale are expected to be over 0.30. In this study, the item-total scale correlations were between 0.56 and 0.84. Although Özdamar (2004) states that the item-total score correlations must not be negative and should be greater than 0.30, and the items with low correlation values can be removed from the measurement tool, he also states that this is not an exact

Table 3 – Factor loadings, item total correlations, and the factor loading matrix in factor analysis found after removing the items (n = 75)

Item number	Factor loading	Item-total correlation	r	Compenent 1	Variance	Alpha
1.	0.936	0.779	0.825(*)	0.830		
2.	0.937	0.761	0.806(*)	0.813		
6.	0.938	0.748	0.808(*)	0.800		
7.	0.941	0.671	0.738(*)	0.729		
8.	0.936	0.766	0.818(*)	0.815		
9.	0.937	0.753	0.798(*)	0.802		
10.	0.932	0.866	0.895(*)	0.895		
12.	0.935	0.789	0.833(*)	0.832		
14.	0.938	0.723	0.779(*)	0.782		
15.	0.935	0.806	0.845(*)	0.848		
					58707.279	0.943

* $p < 0.01$

general rule [26]. He stresses that the decision to remove an item should be made by assessing the changes in the "alpha if item deleted" and the "Scale mean if item deleted" columns [26, 27]. In this study, the Cronbach's alpha coefficient was 0.86 before removing the items with low item-total score correlations, whereas the Cronbach's alpha coefficient value was raised to 0.94 after removing the items. Due to this change, the items with lower item-total correlation coefficients were removed from the scale. Item 3 ("did not sleep during the day yesterday / slept ten hours during the day"), 4 ("did not sleep yesterday morning / slept on and off yesterday morning"), 5 ("did not sleep yesterday evening / slept on and off yesterday evening"), 11 ("did not move / tossed and turned all night"), and 13 ("after morning awakening, stayed awake / after morning dozed on and off) may not reflect hospitalized patients' reality; mainly that of surgical patients. Cronbach's alpha of the original VAS scale was three dimension 0.82, 0.72, and 0.73 for disturbance, effectiveness, and supplementation, respectively for 94 hospitalized adults in Taiwan [17]. In Begamasco and Cruz's (2007) study of the VAS scale, Cronbach's alpha was 0.80, 0.78, and 0.72 for disturbance, effectiveness, and supplementation, respectively. In the same study, item 13 displayed a low correlation with the other items, ranging between 0.02 and 0.20. In view of the reliability and factor analysis results, the decision was made to exclude item 13 for subsequent analyses [13]. Our results of analysis are different from the result the original VAS Scale and previous study results.

A factor analysis should be performed in scale adaptations in order to determine factorial structure of the scale and discern any similarities or differences from the original scale [28, 29]. The factor loading of all items of the VAS Scale was greater than 0.40 after factor analysis (Table 3). In a factor analysis, factor loadings of 0.30 and above are deemed acceptable [30]. These results show that the VAS Scale can be used for one dimension (sleep quality) only. This study's dimensions consist of disturbance and effectiveness (1., 2., 6., 7., 8., 9., 10., 12., 14., 15. item).

The original VAS scale consists of 15 items and three dimensions. The dimensions consist of disturbance (9., 1., 11., 7., 8., 6., 10., item), effectiveness (12., 14., 15., 2., (1+2)., item), and supplementation (3., 4., 5., 13., item) sub-scales [17]. The Portuguese version of the VAS Scale was defined with 14 items and three dimensions, these dimensions consist of disturbance (9., 1., 11., 7., 8., 6., 10., item), effectiveness (12., 14., 15., 2., (1+2)., item), and supplementation (3., 4., 5., item) sub-scales like in the original. Begamasco and Cruz' (2007) study of the VAS was removed from the Supplementation Scale (item 13) [13].

The test-retest is a method used to examine the temporal stability and result-consistency of a measurement instrument in different contexts [31]. The test-retest uses two different approaches. The continuous method is applied to a group without any time intervals or after a short rest and the discontinuous method is applied twice in a 2–4 week interval during the study [19, 29]. In this study, a continuous test-retest method was used on the same day as the questionnaire, since this tool allowed the researchers to assess the previous night's sleep quality and measure sleep quality differences at different times. Pearson correlation for test-retest reliability of VAS Scale was r = 0.92. The literature suggests that the acceptable minimum point for test-retest reliability is 0.70 [32]. The test-retest reliability was adequate for the scale.

Conclusion

The original VAS Scale consisted of three sub-scales and 15 items, whereas the Turkish version has one dimension and 10 items. This structure of the scale was found to comply with the reliability of the original scale. Testing the scale with larger samples will provide evidence for its generalizability. Studies with other samples are needed for a better analysis of the behavior of items 3, 4, 5, 11, 13. The availability of the permits assessing the sleep of hospitalized patients during the hospitalization period,

favoring not only patient care, but also instruments for research about sleep problems of hospitalized patients and about interventions to relieve them.

Conflict of interest

The authors have no conflict of interest to disclose.

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