Development of a Slovenian version of the Pittsburgh Sleep Quality Index (PSQI-SLO) for use with older adults

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Abstract

Background: Poor sleep quality predicts poor quality of life, poor self-rated health, and chronic diseases and mental disorders among older adults. The Pittsburgh Sleep Quality Index (PSQI) is the most widely used self-report measure of sleep quality in older adults.

Objectives: This study aimed to assess internal reliability, face validity, content validity and internal consistency of the Slovenian version of the PSQI (PSQI-SLO) for sleep quality in older adults.

Methods: A cross-sectional study was used to evaluate content and face validity as well as reliability (α, ω and item-total correlations). Residents of 13 nursing homes and community-dwelling older adults from all regions of Slovenia were sampled. A total of 831 participants aged 65 years and older participated in the study between March and August 2019.

Results: All items were successfully translated to Slovenian. A minor cultural adaptation was made to improve the clarity of the meaning of all items. None of the items had an item content validity index (I-CVI) score lower than 0.50. Kappa indices were excellent for half of the items and good for the remainder. Internal consistency agreed with prior research ($\alpha=0.74$). Intraclass correlation coefficient for global PSQI-SLO was 0.62 ($p < 0.001$). The total score of PSQI-SLO (8.09 ± 3.64 (95%, CI=7.85-8.34)) was expected and comparable. Fifty-eight and four tenths' percent (95%, CI=55%-62%) had at least one chronic disease and 40% (95%, CI=37%-42%) lived in a nursing home.

Conclusions: PSQI-SLO showed adequate internal consistency and test-retest reliability, and adequate construct and criterion validity. The instrument can be important in assessing older adults' subjective sleep quality in nursing homes, home environment and clinical settings.

Implications for practice: The instrument can assess sleep efficiency among older adults in different settings and can help nursing staff develop a high-quality approach to reduce sleep deficiency.

Keywords

Sleep quality; chronic disease; older adults; reliability; validity

1   INTRODUCTION

Sleep quality is a significant indicator of health (Didikoglu et al., 2020; Hale et al., 2013; Hale, Troxel, & Buysse, 2020). Chronic sleep disorders are present in around 20% of the adult population (Mollayeva et al., 2016). In older ages, the prevalence of sleep problems may be as high as 70%, of which 32-45% of older adults reporting difficulty falling asleep or remaining asleep (Avidan, 2014).

Several characteristics predict sleep quality in older adults (Miner & Kryger, 2017). Older age, lower educational attainment, lower socioeconomic status, lack of health insurance, low physical activity and chronic diseases were significantly associated with lower sleep quality (Štefan, Vučetić, Vrgoč, & Sporiš, 2018). Increased prevalence of health problems (Qato, Wilder, Schumm, Gillet, & Alexander, 2016; Štefan et al., 2018) and use of multiple medications (Fried et al., 2014), age-related changes in circadian rhythms (Tranah et al., 2010), and lifestyle also frequently affect sleep quality (Štefan et al., 2018).

Poor sleep quality is associated with poor life quality, poor self-rated health and mental well-being (Štefan et al., 2018). Additionally, chronic sleep disorders are related to gastrointestinal symptoms (Khanijow, Prakash, Emsellem, Borum, & Doman, 2015), hypertension (Didikoglu et al., 2020; Lo, Woo, Wong, & Tam, 2018), cardiovascular diseases (Medic, Wille, & Hemels, 2017), fasting plasma glucose (Zhu, Li, Wang, & Yu, 2014) and glycosylated haemoglobin levels [HbA1c] (Barakat, Abujbara, Banimustafa, Batieha, & Ajlouni, 2019). Other predictors include obesity (Medic et al., 2017), depression (Didikoglu et al., 2020), poor health outcomes, including falls (Essien et al., 2018), cognitive impairment (Palmer, Mitolo, Burgio, Meneghello, & Venneri, 2018), medical morbidity and mortality (Kwok et al., 2018; Medic et al., 2017). Alvarez and Ayas (2004) emphasise the importance of healthy sleep for the neuroendocrine and immune system.

The Pittsburgh Sleep Quality Index- PSQI (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989) is a widely used standardised tool for evaluating sleep quality. PSQI is a self-report questionnaire designed to evaluate sleep quality and patterns of sleep in community-dwelling adults and patients with various diagnoses (Akman, Yavuzsen, Sevgen, Ellidokuz, & Yilmaz, 2015; Hita-Contreras et al., 2014; Nishiyama et al., 2014; Raniti, Waloszek, Schwartz, Allen, & Trinder, 2018). To date, the PSQI has been successfully translated into Hungarian (Takács et al., 2016), Italian (Curcio et al., 2013), Czech (Dudysová et al., 2017), Korean (Lee et al., 2020), Spanish (Hita-Contreras et al., 2014), Greek (Kotronoulas, Papadopoulou, Papapetrou, & Patiraki, 2011), Malay (Farah, Saw Yee, & Mohd Rasdi, 2019), Japanese (Doi et al., 2000), Indonesian (Setyowati & Chung, 2020) and Portuguese (Del Rio João, Becker, De Neves Jesus, & Isabel Santos Martins, 2017). The PSQI has

adequate psychometric properties and has been shown to correlate reliably with different diseases (Kang, Yoon, Lee, & Kim, 2012; Lou et al., 2015; Mellor, Waters, Olaithe, McGowan, & Bucks, 2014). At the same time, Nishiyama et al. (2014) caution that the PSQI has limited utility for identifying obstructive sleep apnoea, periodic limb movement disorder, rapid eye movement, sleep behaviour disorder, and narcolepsy and is not useful as a diagnostic instrument for polysomnography-defined sleep disorders.

Despite the routine use of PSQI in the research in different clinical settings, we know little about the reliability and validity of the PSQI with older adults. To this point, internal consistency reliability and validity of the PSQI has been assessed in older men with osteoporotic fracture (Beaudreau et al., 2012) and older women with osteoporotic fracture (Spira et al., 2012) in the U.S. and Iranian older adults aged 60 to 85 years (Chehri et al., 2020). The total score had adequate internal consistency, but multiple PSQI items and some subscales had low correlations with the total score (Beaudreau et al., 2012; Chehri et al., 2020; Spira et al., 2012). In Slovenia, the PSQI has not been tested in the general older adults' population. Advancement of knowledge regarding late-life sleep quality and daytime sleepiness also requires validating these measures in older adults. Psychometric properties of the PSQI for older adults are not well documented, suggesting additional research with this specific patient population is justified. The aims of the current study are 1) translation and cultural adaptation of the PSQI questionnaire for use with Slovenian older adults, and 2) establishing the internal reliability, face validity, content validity and internal consistency of a Slovenian version of the PSQI (PSQI-SLO) for sleep assessing quality in older adults.

2   METHODS

We set out to establish content, face validity, and internal consistency reliability as well as conduct exploratory factor analysis of the PSQI-SLO. To conduct the psychometric testing, we follow Polit & Beck's (2017) recommendations.

2.1   Instrument

PSQI (Buysse et al., 1989) is a 19-item self-report questionnaire measuring sleep quality and quantity among adults. PSQI consists of seven domains: subjective sleep quality (1 question), sleep latency (2 questions), sleep duration (1 question), habitual sleep efficiency (3 questions), sleep disturbances (9 questions), use of sleep medication (1 question) and daytime dysfunction (2 questions). Each question is scored from 0 to 3, with higher scores indicating more significant sleep impairment. Total scores range from 0 to 21. Higher scores indicate poorer sleep quality and a high level of sleep disorders. A global score   5 indicates clinically significant sleep impairment. PSQI's diagnostic sensitivity is 89.6%, and specificity is 86.5% (Akman et al., 2015; Buysse et al., 1989). We followed the authors' cut-off score (Buysse et al., 1989) of the original PSQI questionnaire.

2.2   Validation based on experts' agreement

2.2.1   The translation processes—After receiving permission from the original author to adapt the PSQI questionnaire, the first author translated from English to Slovene with the help of an independent translator (a researcher in nursing care). After processing and

harmonising the translation of the questionnaire into Slovene, reverse translation back into English by an independent translator (who had not seen the English version) was completed. We next compared the questionnaire in Slovene and Slovene return translation into English and formulated the final questionnaire wording. Both versions were compared and discussed by the authors, and disagreements were discussed until consensus was achieved.

In the translation process, no problems were identified. For the achievement of semantic equivalence, we used back translation so that each item's meaning should be the same in the target culture after translation as it is in the original (Polit & Beck, 2017). The items in the Slovenian version were easily understood, and the questionnaire was completed in approximately 10 minutes, which is comparable to other versions (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006; Hita-Contreras et al., 2014).

2.2.2 Content validity—To assess the content validity of the translated instrument, 10 Slovenian registered nurses that had expertise in care for older adults and working in nursing homes examined the instrument and rated each item for its relevance using a four-point scale (1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; 4 = highly relevant). Item content validity index (I-CVI) and scale content validity index (S-CVI) (Shi et al., 2012) were calculated. To calculate the S-CVI, we calculated the average scale validity index (S-CVI/Ave). CVI was rated as good when I-CVI was > 0.78, and S-CVI/Ave was > 0.90 (Polit & Beck, 2017).

To reduce the influence of chance agreement, we calculated a modified kappa (κ^*) statistic, which was used to adjust each I-CVI using the following formula: $\kappa^* = [\text{I-CVI} - P_c] / [1 - P_c.]$ To calculate κ^*, we calculated the probability of chance agreement by experts for each item individually: $Pc = [\frac{N!}{A!}] \times (N - A) \times 0.5^N$. Where N is the number of experts, and A is the number of relevant agreements. To evaluate the values of κ^*, we followed the recommendations of Cicchetti and Sparrow (1981), Polit and Beck (2004), and Polit, Beck, and Owen (2007), specifically moderate = κ^* of 0.40–0.59; good = κ^* of 0.60–0.74; and excellent = κ^* 0.75).

2.2.3 Face validity and culture adaption—Face validity and cultural adaption were evaluated by the same convenience sample of 10 Slovenian nurses with experience in older adult care. When items were identified as unclear, participants were asked to suggest a better formulation. All comments were discussed between the authors until consensus was reached, and a final version of the items was established (see online Supplement 1).

2.3 Psychometric testing based on the survey data

A cross-sectional study was used to evaluate the internal consistency of the PSQI-SLO. We used convenience sampling and calculated the sample size based on the recommendation of at least three people per item (Polit & Beck, 2017). The criterion for inclusion in the sample was being aged 65 years or older, regardless of community or nursing home residence. Participants had to have sufficient cognitive ability to self-assess their sleep habits by PSQI. There were no exclusion criteria. Data were collected between March and August of 2019. Based on prior ethical approval and written permission from participating nursing

homes and health centres the study was conducted in Slovenian nursing homes and the local community. To include older adults living at home, we were assisted by community registered nurses who perform preventive and/or curative visits. All participants provided informed consent to participate in the study. The research team distributed 2000 paper-based questionnaires (1000 paper-based questionnaires at nursing homes and 1000 to the older adults living at home), and 836 were returned (333 from nursing homes and 501 from older adults living at home). After removing five questionnaires because of missing data, we had 831 complete questionnaires for analysis (response rate was 41.6%).

2.3.1 Statistical analysis—Completed research questionnaires were entered into IBM SPSS 24.0 for analysis and checked for accuracy. We estimated descriptive statistics (M ± SD) with 95% confidence intervals. Internal consistency was evaluated using Cronbach's coefficient α as well as item-total correlations. Intraclass correlation coefficients were calculated to assess test-retest reliability. In line with the test-retest procedures, participants in the survey were invited (all previous participants) to answer the PSQ-SLO on two occasions over six months. We obtained test-retest data from 625 of 831 (75.2%) participants.

To evaluate the value of intraclass correlation coefficients we followed the recommendations of Cicchetti and Sparrow (1981) (good = > 0.6 and excellent = > 0.75). To evaluate Cronbach's coefficient α we followed the recommendations of Nunnally (1978) (adequate = > 0.7 and excellent = > 0.9). Corrected correlations of individual items with their respective scales were also estimated, with values $0.2 < r < 0.3$ (Mahieu, de Casterlé, Van Elssen, & Gastmans, 2013) being considered acceptable.

We also conducted an exploratory factor analysis with the help of the Kaiser–Meyer–Olkin index of sampling adequacy and Bartlett's test. The factor analysis was used to determine if there is sufficient covariance in the scale items to warrant factor analysis. The Kaiser–Meyer–Olkin index was 0.733, and Bartlett's test was 946.66 ($p < 0.001$), indicating that the data were factorable. Additional was using a Direct Oblimin rotation in this analysis. The Extraction of factors was based upon parallel analysis for Eigenvalues of equal to or greater than one and the scree plot (Patil, et al., 2007).

3 RESULTS

3.1 Validation based on experts' agreement

No problems were identified with the translation of the items; no items were identified for modification or removal.

3.2 Content validity

Table 1 shows the content validity for all items from the PSQI-SLO questionnaire. All items from the questionnaire had an I-CVI score of at least 0.50. Items 1, 3, 4, 5b, 5c, 5d, 5f, 5h, 5i, 5j and 7 were rated as excellent by the kappa index. Items 2, 5a, 5e, 5g, 6, 8, 9, 10a, 10b and 10e rated as good. Items 10, 10c and 10d were rated as moderate. The estimated S-CVI/Ave was 0.70.

3.3 Face validity

The experts suggested minor cultural adaptations to improve the clarity of the meaning of the items. All items were retained.

3.4 Psychometric testing based on the survey data

3.4.1 Sample characteristics—Of the 831 respondents, 66.5% (n = 553) were female and 33.5% (n = 278) were male. The majority lived in own home (60.3%; n=501) and the rest lived in nursing homes (39.7%; n=330). Mean age of participants was 76.5 ± 9.5 (95%, CI=75.9-77.2) years. Mean age of community-dwelling participants was 74.9±9.5 (95%, CI=74.0-75.7) and 79.0±9.0 (95%, CI=78.0-78.0) for nursing home residents. The majority were widowed (50.7%; 421, 95%, CI=47%-54%), 10.0% (n = 83, 95%, CI=8%-12%) single, 29.5% (n = 245, 95%, CI=26%-32%) were married, 5.9 % (n = 49, 95%, CI=4%-8%) were divorced and 4% (n=33, 95%, CI= 3%-5%) were in an extramarital partnership. Forty-one-point six percent (n = 346, 95%, CI=38%-45%) reported no chronic diseases and 58.4% (n = 485, 95%, CI=55%-62%) reported at least one chronic disease. Thirty-seven-point two percent (n = 309, 95%, CI=34%-40%) had one chronic disease; 19.4% (n = 161, 95%, CI=17%-22%) had two or three chronic diseases and 1.8% (n = 15, 95%, CI=1%-3%) had four or more chronic diseases. Approximately 57% (95%, CI=53%-61%) of community-dwelling participants reported at least one chronic disease as did 60% (95%, CI=55%-66%) of nursing home residents.

3.4.2 Internal consistency—Cronbach's coefficient α of the PSQI-SLO questionnaire was 0.67 (i.e., adequate). The McDonald Omega coefficient of the PSQI-SLO questionnaire was 0.68 (i.e., adequate). Pearson's correlations between components scores and the PSQI-SLO global score are shown in Table 3. Significant item-total correlations were observed for all components and ranged between 0.22 and 0.64 (p <0.001). The strongest correlations were found for daytime dysfunction (r=0.60; p<0.001), sleep disturbance (r=0.61, p <0.001), and use of sleep medication (r=0.58, p <0.001) and the lowest item-total correlation value was sleep duration (r=0.22, p<0.001).

Table 4 shows that, among community-dwelling older adults, corrected item-total correlations range from 0.21 to 0.54 and α if an item is deleted ranged from 0.68 to 0.72. Among nursing home older residents, item-total correlations ranged from 0.09 to 0.64 and α if an item is deleted ranged from 0.65 to 0.73. Cronbach's coefficient α of the PSQI-SLO for older adults at home environment was 0.72 (95%, CI=0.68-0.76) and for those in a nursing home was also 0.72 (95%, CI=0.67-0.76). Intraclass correlation coefficients for global PSQI score was 0.62 (95%, CI: 0.56 to 0.68, p < 0.001). For the PSQI-SLO instrument, there is high within-subject reliability based on the intraclass correlation coefficients, which was above 0.7.

The strongest correlations were observed between sleep disturbance and daytime dysfunction and the lowest item-total correlation value was observed for sleep duration. Significant correlations were seen between higher global PSQI-SLO scores (poor sleep quality) and older age (r=0.16; p<0.001, 95%CI=0.10-0.22) and number of chronic diseases (r=0.33; p<0.001, 95%CI= 0.27-0.39). Moreover, all components: subjective sleep quality (r

= 0.18, p <0.001, 95%CI=0.12- 0.25), sleep latency (r=0.23; p<0.001, 95%CI=0.16-0.29), sleep duration (r = 0.08, p = 0.028, 95%CI=0.01-0.15), sleep efficiency (r = 0.11, p =0.002, 95%CI=0.04-0.17), sleep disturbances (r = 0.25, p <0.001, 95%CI=0.19-0.31), use of sleep medication (r= 0.24; p<0.001, 95%CI=0.18 – 030), and daytime dysfunction (r = 0.24, p < 0.001, 95%CI=0.17-0.30) were correlated with number of chronic diseases. There was also a significant correlation between sleep latency (95%, r = 0.13, p = <0.001, CI=0.07-0.20), sleep efficiency (95%, r=0.26; p<0.001, CI=0.20-0.33) and use of sleep medication (95%, r=0.10; p=0.005, CI=0.03-0.16) with older age.

3.4.3 Construct validity—Exploratory factor analysis of the PSQI-SLO among older adults suggested two factors. The Kaiser-Meyer -Olkin index (KMO adequacy index 0.733), and Bartlett's sphericity test (χ^2 = 946.66, df = 21, p < 0.001) showed acceptable values. We then proceeded to estimate communalities, i.e., the proportion of variance that is explained by common factors. In general, and with no values close to zero, it can be stated that all seven items load on factors. Principal axis factoring showed two factors which explained 53% of the variance. The first factor explained 35.6%, and the second factor explained 17.2% with factor loadings shown in Table 4. The first factor (external/environmental influences) includes: daytime disfunction, sleep disturbance, use of sleep medication, subjective sleep quality and sleep latency with factor loading between 0.51 and 0.83. The second factor (sleep effectiveness) includes sleep duration and sleep efficiency and had factor loadings of 0.76 and 0.81.

4 DISCUSSION

Our findings establish face and content validity and internal consistency for the PSQI-SLO in accordance with other studies (Beaudreau et al., 2012; Chehri et al., 2020; Doi et al., 2000; Hita-Contreras et al., 2014; Spira et al., 2012; Takács et al., 2016). We assessed content validity, which is not often used, yet recommended for psychometric testing of the survey and cultural adaptations (Polit & Beck, 2017). Content validity indexes were adequate for the PSQI-SLO questionnaire. The same was also true for content validity assessment of individual items. Content and face validity of all PSQI-SLO was found to be adequate. Three items did not meet the required criteria (they were assessed as moderate) but were retained because they are not part of any of the components of the total score of the PSQI and cannot affect the internal reliability of the PSQI-SLO; nevertheless, they still provide useful information about sleep disturbance among older adults.

Some authors have used a three-factor model (Cole et al., 20116; Mariman et al., 2012) but in our factor analysis, we have described a two-factor model in which five items (daytime dysfunction, sleep disturbance, use of sleep medications, subjective sleep quality and sleep latency, whereas other two (sleep duration and sleep efficiency) was clustered in the second component. The first component (external/environmental factors) explain almost 36% of the variance of sleep quality. Also, some other authors (Kotronoulas et al., 2011; Hita-Contreras et al., 2014; Sohn. Kim, Lee & Cho, 2012,) described the two-factor model.

Internal consistency of PSQI-SLO as assessed in Slovenian older adults was adequate (α=0.74). Although the values of α and ω were satisfactory in this study, it may be noted

that the tool has never been reported to show a value of this psychometric index within the ideal range, i.e., 0.90–0.95, and some authors would consider a scale like this with such high internal consistency to include redundant items (Streiner, 2003). In a meta-analysis, Mollayeva et al. (2016) noted that previous studies had reported α values between 0.58 and 0.83. Other researchers found lower internal consistency than in the original language: Japanese version α=0.72 (Doi et al., 2000), Malaysian version α=0.74 (Farah et al., 2019); Ethiopian version α=0.59 (Salahuddin et al., 2017) and Hungarian version α=0.79 (Takács et al., 2016).

Corrected correlation of individual items in the whole questionnaire met the required criterion of $0.2 < r < 0.3$. The Component Sleep duration includes only one item, which may account for this lowest value. The same component had the lowest correlations with the global score for older adults in a home environment (its removal very slightly increased internal consistency to α=0.724), and for older adults in nursing homes, its removal increased internal consistency α=0.733. This study suggests that PSQI-SLO is internally consistent for older adults.

An Australian study found higher PSQI scores (8.09±3.64) among older adults (mean age 76.51 ± 9,521 years) compared with adults between 18 and 54 years old (5.39±2.87) (Magee, Caputi, Iverson, & Huang, 2008) and Ethiopian adults with mean age 25 years (6.96±3.34) (Salahuddin et al., 2017). African Americans adults with mean age 59.5±7.2 reported PSQI score of 6.3±3.4 (Buysse et al., 2008), Portuguese adults with a mean age of 39.93 years reported 5.7±2.63 (Del Rio João et al., 2017). Our total of PSQI was almost one point higher than the mean reported in the original PSQI study (7.4±5.1) (Buysse et al., 1989) but comparable with the total score (7.69±4.06) of the Persian older adults (mean age 68.33±8.75) (Chehri et al., 2020). Our results were expected to be higher than in other studies of adults; our participants were older on average than much previous research; 58.4% of our sample reported at least one chronic disease, and 40% lived in a nursing home. It is known that older adults living in a nursing home more often reported poor sleep quality and sleep disorders (Azri, Dahlan, Masuri, & Isa, 2016; Bjelajac, Lu anin, Lu anin, & Delale, 2019). Higher PSQI scores are found among patients with primary insomnia (8.93±4.10), patients with major depression (9.33±4.10), patients with a generalised anxiety disorder (9.63±3.40) (Doi et al., 2000), patients with cancer (8.88±4.51) (Kotronoulas et al., 2011), patients with psychiatric illness (12.33±5.50) (Takács et al., 2016), and patients with fibromyalgia (13.22±4.25) (Hita-Contreras et al., 2014).

We observed the highest scores on sleep efficiency (1.71±1.04), similar to Beaudreau et al. (2012), among older women with osteoporotic fractures. We observed the lowest scores on the use of sleep medications (0.64 ±1.04). This result also aligns with the values described by Beaudreau et al. (2012) in older women with osteoporotic fractures, Spira et al. (2012) in older men with osteoporotic fractures, Chehri et al. (2020) in Iranian older adult populations, Takács et al. (2016) with psychiatric patients, and Osorio, Gallinaro, Lorenzi-Filho, and Lage (2006) in patients with fibromyalgia.

This study confirms the content validity and the internal reliability of the PSQI-SLO; however, due to some limitations of the study, they should be interpreted carefully because

the study does not include polysomnography and detailed information on pharmacotherapy and other therapeutic interventions for an older adult. Furthermore, the results of the study may be gender-biased for women. Ideally, content validity should be executed twice (Polit & Beck, 2017), and so we recommend additional testing of the questionnaire with a larger sample.

5 CONCLUSIONS

As in other populations at risk for sleep disturbance and chronic conditions, older adults more frequently experience sleep-related problems, which can adversely affect the overall quality of life. It is of the greatest importance that psychometrically validated tools be available to assess the quality of sleep in the general older adults' population. For that purpose, our study has demonstrated that the PSQI-SLO is an easily applied instrument with acceptable psychometric properties applied in the older adult population.

Understanding how sleep quality is influenced by social, environmental and biological factors and constantly monitoring sleep quality may help prevent adverse health consequences of poor-quality sleep and help to generate strategies for better sleep hygiene practices in old age and early life of individuals.

6 IMPLICATION OF PRACTICE

This study suggests that the PSQI-SLO is a useful tool for the assessment of sleep quality for Slovenian older adults and that it performs similarly to the original version proposed by Buysse et al. (1989). Because of its simplicity, PSQI can be easily understood and completed by older adults living in community and nursing home settings. The instrument can assess sleep efficiency among older adults in different settings and can help nursing staff develop a high-quality approach to reduce sleep deficiency. The instrument can be used in future research for clarification and professional development of clinical research and education in the nursing care of older adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What does this research add to existing knowledge in gerontology?

- This methodological study affirms that PSQI-SLO is a reliable and valid instrument to evaluate sleep quality among older adults living in the community and nursing homes.

- This study supports the validity and reliability of all seven PSQI subscales, which are essential to evaluate sleep quality among older adults in the community and nursing homes.

What are the implications of this new knowledge for nursing care for older people?

- The PSQI-SLO can assess sleep efficiency among older adults and help nurses develop an empirically supported approach to addressing sleep deficiency.

- Nurses could use PSQI-SLO to identify vulnerable older adult subgroups and inform effective interventions to improve the sleep quality of older adults.

How could the findings be used to influence research or practice?

- This study confirms PSQI-SLO as a valid, reliable, and consistent measure of older adults living in community or nursing homes, which enables further research as well as guiding nursing practice towards increased awareness of the content and importance of sleep quality among older adults in Slovenia.

- Availability of the PSQI-SLO in Slovenia and other European countries can facilitate international collaborations with other researchers to more fully identify and address sleep disorders.

Table 1:

Content validity of the PSQI-SLO questionnaire

No.	Item	N	A	I-CVI[i]	P$_c$[ii]	κ*[iii]	Evaluation[iv]
1	During the past month, when have you usually gone to bed at night?	10	8	0.80	0.00	0.800	Excellent
2	During the past month, how long (in minutes) has it usually take you to fall asleep each night?	10	6	0.60	0.01	0.600	Good
3	During the past month, when have you usually gotten up in the morning?	10	8	0.80	0.00	0.800	Excellent
4	During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)?	10	8	0.80	0.00	0.800	Excellent
5a	During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?	10	7	0.70	0.00	0.700	Good
5b	During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning?	10	9	0.90	0.00	0.900	Excellent
5c	During the past month, how often have you had trouble sleeping because you have to get up to use the bathroom?	10	9	0.90	0.00	0.900	Excellent
5d	During the past month, how often have you had trouble sleeping because you cannot breathe comfortably?	10	10	1.00	0.00	1.000	Excellent
5e	During the past month, how often have you had trouble sleeping because you cough or snore loudly?	10	7	0.70	0.00	0.700	Good
5f	During the past month, how often have you had trouble sleeping because you feel too cold?	10	8	0.80	0.00	0.800	Excellent
5g	During the past month, how often have you had trouble sleeping because you feel too hot?	10	6	0.60	0.01	0.600	Good
5h	During the past month, how often have you had trouble sleeping because you bad dreams?	10	8	0.80	0.00	0.800	Excellent
5i	During the past month, how often have you had trouble sleeping because you have pain?	10	10	1.00	0.00	1.000	Excellent
5j	During the past month, how often have you had trouble sleeping because of other reason(s), please describe?	10	8	0.80	0.00	0.800	Excellent
6	During the past month, how would you rate your sleep quality overall?	10	6	0.60	0.01	0.600	Good
7	During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?	10	9	0.90	0.00	0.900	Excellent
8	During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	10	6	0.60	0.01	0.600	Good
9	During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	10	2	0.60	0.01	0.600	Good
10	Do you have a bed partner or roommate?	10	5	0.50	0.01	0.500	Moderate
10a	If you have a roommate or bed partner, ask him/her how often in the past month you have had loud snoring?	10	7	0.70	0.00	0.700	Good
10b	If you have a roommate or bed partner, ask him/her how often in the past month you have had long pauses between breaths while asleep?	10	6	0.60	0.01	0.600	Good
10c	If you have a roommate or bed partner, ask him/her how often in the past month you have had legs twitching or jerking while you sleep?	10	5	0.50	0.01	0.500	Moderate
10d	If you have a roommate or bed partner, ask him/her how often in the past month you have had episodes of disorientation or confusion during sleep?	10	5	0.50	0.01	0.500	Moderate
10e	If you have a roommate or bed partner, ask him/her how often in the past month you have had other restlessness while you sleep? please describe.	10	6	0.60	0.01	0.600	Good
						[v]S-CVI/Ave:	0.704

*i*item content validity index/ number giving a rating of 3 or 4/number of experts.

*ii*P~c~ (probability of a chance occurrence) = $[Pc = [\frac{N!}{A!}] \times (N - A)] \times 0.5^N$

*iii*k* = kappa designating agreement on relevance.

*iv*Evaluation criteria for kappa: moderate = k of 0.40–0.59; good = k of 0.60–0.74; and excellent = k > 0.75.

*v*S-CVI/Ave (average scale validity index) = mean of I-CVI; A - No. of agreement; N - No. of experts

Table 2.

Sample characteristics displayed

Variable		Descriptive statistics
Gender %(n)	Female	33.5(278)
	Male	66.5(553)
Relationship Status %(n)	Single	10.0(83)
	Married	29.5(245)
	Divorced	5.9(49)
	In a relationship	4.0(33)
	Widowed	50.7(421)
Age (Y; M ± SD)		76.5 ± 9.5
No. of chronic disease %(n)	One	37.2(309)
	Two to three	19.4(161)
	Four or more	1.8(15)
	None	41.6(346)
Living %(n)	At home	60.3(501)
	At nursing homes	39.7(330)

n – Semple size; % – Percent of participants; SD – Standard deviation; Y – Years; M – Mean

Table 3.

Pearson item-total correlation coefficients of the PSQI-SLO questionnaire

Component of PSQI-SLO	Corrected-item total correlation	Total Alpha if item is deleted
Component 1: Subjective sleep quality	0.490	0.715
6 During the past month, how would you rate your sleep quality overall?	0.490	0.715
Component 2: Sleep latency	0.480	0.709
2 During the past month, how long (in minutes) has it usually take you to fall asleep each night?	0.290	0.518
5a During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes.	0.486	0.499
Sum of 2 and 5a sub-scores	0.441	0.490
Component 3: Sleep duration	0.215	0.741
4 During the past month, how many hours of actual sleep did you get at night?	0.215	0.741
Component 4: Sleep efficiency	0.403	0.717
4 During the past month, how many hours of actual sleep did you get at night?	0.094	0.526
Sum of 1 and 3 sub-scores	0.201	0.551
Component 5: Sleep disturbance	0.608	0.707
5b During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning?	0.505	0.498
5c During the past month, how often have you had trouble sleeping because you have to get up to use the bathroom?	0.428	0.503
5d During the past month, how often have you had trouble sleeping because you cannot breathe comfortably?	0.689	0.492
5e During the past month, how often have you had trouble sleeping because you cough or snore loudly?	0.612	0.496
5f During the past month, how often have you had trouble sleeping because you feel too cold?	0.609	0.500
5g During the past month, how often have you had trouble sleeping because you feel too hot?	0.601	0.497
5i During the past month, how often have you had trouble sleeping because you bad dreams?	0.597	0.498
5j During the past month, how often have you had trouble sleeping because you have pain?	0.458	0.504
Component 6: Use of sleep medication	0.584	0.693
7 During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?	0.584	0.693
Component 7: Daytime dysfunction	0.640	0.682
8 During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	0.587	0.501
9 During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	0.481	0.502
Sum of 8 and 9 sub-scores	0.613	0.474
Cronbach's Alpha	0.74 (95%, CI=0.71-0.76)	
Mean ± Std. Deviation	8.09 ± 3.64 (95%, CI=7.85-8.34)	

Table 4.

Pearson item-total correlation coefficients of the PSQI-SLO questionnaire – differences of older adults lived at a home environment or in nursing homes

Component of PSQI-SLO	Community		Nursing homes	
	Corrected-item total correlation	Total Alpha if item is deleted	Corrected-item total correlation	Total Alpha if is item deleted
Component 1: Subjective sleep quality	0.439	0.699	0.526	0.694
Component 2: Sleep latency	0.514	0.680	0.481	0.691
Component 3: Sleep duration	0.206	0.724	0.093	0.733
Component 4: Sleep efficiency	0.468	0.686	0.118	0.734
Component 5: Sleep disturbance	0.470	0.702	0.644	0.680
Component 6: Use of sleep medication	0.480	0.691	0.569	0.669
Component 7: Daytime dysfunction	0.536	0.683	0.642	0.652
Cronbach Alpha	0.72 (95%, CI=0.68-0.76)		0.72 (95%, CI=0.67-0.76)	
Mean ± Std. Deviation	6.57±3.06 (95%, CI=6.57-7.01)		10.00±3.63 (95%, CI=6.61-10-39)	

Table 5.

Exploratory factor analysis of the PSQI-SLO questionnaire

Component	Factor loadings		Communality of component
	Factor 1	Factor 2	
Daytime dysfunction	0.827	—	0.662
Sleep disturbance	0.774	—	0.592
Use of sleep medication	0.717	—	0.504
Subjective sleep quality	0.595	—	0.369
Sleep latency	0.511	—	0.306
Sleep duration	—	0.814	0.643
Sleep efficiency	—	0.756	0.620
Total variance explained (%)	35.63	17.17	—
Component Correlation Matrix	1.000	0.183	—
	0.183	1.000	—
Cronbach's α 0.90 (each factor)	0.712	0.367	—