Validation of the Pittsburgh Sleep Quality Index Hebrew Translation (PSQI-H) in a Sleep Clinic Sample

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Abstract

Background: The Pittsburgh Sleep Quality Index is a standardized self-administered questionnaire for the assessment of subjective sleep quality. It has been translated into several languages and is widely used in clinical research studies.

Objectives: To assess the reliability and validity of the Pittsburgh Sleep Quality Index Hebrew translation in a sleep clinic sample and in comparison with the Technion Mini Sleep Questionnaire.

Methods: The PSQI was translated into Hebrew based on standard guidelines. The final Hebrew version (PSQI-H) was administered to 450 patients from two sleep clinics and to 61 healthy adults from the community as a non-clinical control sample. The MSQ was administered to 130 patients in one sleep clinic.

Results: For the PSQI-H, Cronbach's-alpha scores for sleep clinic and non-clinical samples were 0.70 and 0.52 respectively and 0.72 combined. Clinical sample scores were significantly higher than the non-clinical group, indicating lower sleep quality for the former. Significant correlations were found between the MSQ subscores and PSQI-H component scores for common underlying constructs.

Conclusions: The PSQI-H differentiated between clinical and non-clinical samples and showed adequate reliability and good validity. It may be used as a standardized tool for the assessment of subjective sleep quality in clinical research studies conducted in the Hebrew-speaking population.

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The Pittsburgh Sleep Quality Index, developed by Buysse et al. [1], is a standardized self-administered questionnaire to assess subjective sleep quality over the past month. Psychometric measures in psychiatric patients with major depression, healthy controls, and subjects with insomnia and excessive daytime sleepiness yielded good internal consistency (Cronbach's-alpha: 0.83) and overall test-retest reliability (Pearson's correlation coefficient: 0.85), as well as distinct group differences, suggesting good construct validity. Similar reliability and validity measures have been reported in patients with primary insomnia [2-4], in psychiatric patients [2], in patients with bone marrow and renal transplants [5], and in cancer patients [5,6]. Quantification of PSQI-based subjective sleep quality in non-clinical young and elderly subjects has also been reported [7,8]. To date however, psychometric properties have not been investigated in the sleep clinic population.

The PSQI has been translated into several languages including French, Japanese, German, Spanish and Chinese [2-4,9,10]. Thus, Doi and colleagues [2] psychometrically assessed psychiatric and control subjects and found an overall reliability coefficient (Cronbach-α) of 0.77. Backhaus et al. [3] reported a Cronbach-α score of 0.85 and high test-retest reliability (0.87) in primary insomnia patients. Similarly, Tsai and co-workers [4] reported overall reliability coefficients of 0.82–0.83 and test-retest reliability coefficients of 0.77 and 0.85 for primary insomnia and controls respectively. These studies found significant group differences (patients vs. controls) for average global and component scores, with higher scores in the patient groups, demonstrating good concurrent validity [2-4]. Collectively, these results demonstrate adequate reliability and validity of the PSQI, suggesting its utility as an assessment tool for research and clinical purposes in both clinical and non-clinical populations. A Hebrew translation of the PSQI would provide an internationally standardized sleep quality questionnaire for Hebrew speakers.

The PSQI is composed of seven clinically derived components of sleep difficulty, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, daytime dysfunction and sedative medication use, all of which are summed to a single global score [1]. Recently, Cole and team [11] examined the factor structure of the PSQI components, in comparison with the traditional single-factor scoring method, in community dwelling older adults. Initial exploratory analysis revealed a two-factor model, with one factor labeled "Sleep Efficiency" and the second "Perceived Sleep Quality." Additional modifications performed in the confirmatory analysis yielded a three-factor model with an added factor labeled "Daily Disturbances," which met all criteria of indices of fit, with better fit than either the traditional single factor model or the two-factor model. Additional studies are needed to confirm their models.

The Technion Mini Sleep Questionnaire was developed by Zomer et al. [12] for screening sleep disturbances in clinical populations. The original version included seven items reflecting symptoms of hypersomnolence and one item on sleep maintenance. Subsequently, three more items were added regarding

PSQI = Pittsburgh Sleep Quality Index
MSQ = Mini Sleep Questionnaire
PSQI-H = Pittsburgh Sleep Quality Index Hebrew

symptoms of insomnia. As the MSQ has been widely used in Israel as a screening tool for sleep disorders both in the sleep clinic and for sleep research [13-15], its comparison with the PSQI-H may be informative for sleep clinicians and researchers when choosing an appropriate screening tool in Hebrew-speaking populations.

The purposes of the present study were to assess the following: internal reliability of the PSQI Hebrew translation (PSQI-H), concurrent validity in clinical and non-clinical samples using both the traditional single factor and the new three-factor structure of the PSQI, and convergent and discriminant validities of the PSQI-H components and factors with the MSQ insomnia and hypersomnia subscores. Specifically, we hypothesize that PSQI-H components, factors and global score will be higher in sleep clinic patients than in non-clinical controls with no subjective sleep complaints, and that PSQI-H components underlying the "Sleep Efficiency" and "Perceived Sleep Quality" factors will correlate with the MSQ insomnia subscore, whereas the components underlying the "Daily Disturbances" factor will correlate with the MSQ hypersomnia subscore. The importance of this study is that it provides a standardized, internationally recognized formal assessment tool of subjective sleep quality for Hebrew speakers in Israel, as well as psychometric assessment of the PSQI-H in the sleep clinic population.

Table 1. PSQI components, global score and factor structure based on the three-factor model

Components	Factor structure
1. Sleep Duration	Factor 1 – Sleep Efficiency
2. Sleep Disturbance	Factor 3 – Daily Disturbances
3. Sleep Latency	Factor 2 – Sleep Quality
4. Daytime Dysfunction	Factor 3 – Daily Disturbances
5. Sleep Efficiency	Factor 1 – Sleep Efficiency
6. Subjective Sleep Quality	Factor 2 – Sleep Quality
7. Hypnotic Medication Use	Factor 2 – Sleep Quality
PSQI global score	

Table 2. MSQ components divided into MSQ insomnia and MSQ hypersomnia subscores and a global score of the sum of all items

MSQ Insomnia	MSQ Hypersomnia
Difficulty falling asleep	Snoring
Waking up too early	Feeling tired upon waking up in the morning
Mid-sleep awakening	Excessive daytime sleepiness
Hypnotic medication use	Excessive movements during sleep
	Falling asleep during the day
	Headaches on awakening
Global score	

Subjects and Methods

The study was performed as a cross-sectional design from two sleep laboratory clinical samples and a community-based adult sample, all fluent in the Hebrew language. PSQI-H questionnaires were administered to 450 consecutive patients referred primarily for obstructive sleep apnea to two sleep centers – the Sleep Medicine Center at the Rambam Medical Center and the Sleep Disorders Unit at the Loewenstein Hospital – Rehabilitation Center. The combined clinical group completed 318 questionnaires (104/130 from Rambam, and 214/320 from Loewenstein). Additionally, as a control group, 61 questionnaires were administered to a convenience sample of healthy adults from the community with no subjective sleep complaints and not screened for sleep disorders.

Mean age (SD) for the clinical group was 48.19 ± 14.56 (97 females and 221 males), and for the control group 38.58 ± 8.46 (40 females and 21 males).

Measures

The PSQI was translated into Hebrew by two sleep researchers fluent in both Hebrew and English [Table 1]. The translation was then evaluated independently by a sleep clinician and two sleep researchers. One translator then back-translated the questionnaire from Hebrew to English, and final adjustments were made following reviews by all co-authors.

The PSQI comprises 19 self-rated questions, and these 19 items are grouped into 7 component scores (Subjective Sleep Quality, Sleep Latency, Sleep Duration, Sleep Efficiency, Sleep Disturbance, Hypnotic Medication Use, Daytime Dysfunction), each weighted equally on a 0–3 point scale. The seven component scores are then totaled to provide a global PSQI score. A cutoff score of 5 has been recommended, with scores > 5 indicating subjective insomnia [1].

For validity assessment of the three-factor model [11], PSQI component scores were averaged to: factor 1 – Sleep Efficiency (Sleep Duration and Sleep Efficiency components); factor 2 – Sleep Quality (Sleep Quality, Sleep Latency and Sleep Medication Use components); and factor 3 – Daily Disturbances (Sleep Disturbances and Daytime Dysfunction components).

The MSQ [Table 2] is a sleep quality questionnaire used in clinical studies for Hebrew-speaking subjects [12-15]. This questionnaire consists of 10 items rated on a 7-point Likert scale, ranging from 1 = low to 7 = high. Questions relating to insomnia include difficulty falling asleep, early and mid-sleep awakenings, and hypnotic medication use (MSQ-I); questions regarding hypersomnia include snoring, feeling tired upon awakening, excessive daytime sleepiness, and excessive movements during sleep, falling asleep during the day, and morning headaches (MSQ-H). The global score represents the sum of all items. Overall reliability values (α) in the present clinical and non-clinical samples were 0.74 and 0.73 respectively.

Procedure

As part of the routine clinical assessment battery, the Hebrew version (PSQI-H) was administered to all sleep clinic patients. The MSQ was administered to the Rambam patients only. For the control group, questionnaires were administered and collected by fourth year nursing students. Ethical approval was obtained for the control group from the Institutional Review Board at Haifa University.

Table 3. MANOVA of PSQI-H components, global score and three factors between clinical and control groups with age and gender as covariates

PSQI-H	Sleep clinics (N=318)	Control (N=61)	*P*
Sleep Duration	1.15 ± 1.08	0.62 ± 0.71	0.005
Sleep Disturbance	1.65 ± 0.64	0.93 ± 0.54	< 0.001
Sleep Latency	1.04 ± 1.10	0.48 ± 0.67	< 0.001
Daytime dysfunction	0.91 ± 0.95	0.72 ± 0.71	0.008
Sleep Efficiency	0.58 ± 0.97	0.13 ± 0.39	0.001
Sleep Quality	1.56 ± 0.92	0.54 ± 0.70	< 0.001
Hypnotic medication use	0.44 ± 1.00	0.11 ± 0.37	0.019
PSQI-H Global Score	7.33 ± 4.04	3.54 ± 2.16	< 0.001
Factor 1	0.87 ± 0.92	0.38 ± 0.45	0.001
Factor 2	1.01 ± 0.75	0.38 ± 0.43	< 0.001
Factor 3	1.28 ± 0.59	0.83 ± 0.46	< 0.001

Values are means ± standard deviations.

Table 4. Pearson correlations between the PSQI-H and MSQ variables for RMC subjects (n=104)

PSQI-H	MSQ Insomnia	MSQ Hypersomnia	MSQ Total
Sleep Duration	0.47*	0.12	0.30
Sleep Disturbance	0.30	0.39*	0.43*
Sleep Latency	0.41*	0.09	0.25
Daytime Dysfunction	-0.05	0.40*	0.27
Sleep Efficiency	0.46*	0.16	0.33
Sleep Quality	0.53*	0.45*	0.59*
Hypnotic Medication Use	0.45*	-0.02	0.23
PSQI-H Global Score	0.68*	0.38*	0.60*
Factor 1: Sleep Efficiency	0.52*	0.15	0.34*
Factor 2: Sleep Quality	0.67*	0.23	0.50*
Factor 3: Daily Disturbance	0.12	0.54*	0.44*

* $P < 0.0045$ with Bonferroni correction for multiple comparisons.

Data analysis

All analyses were performed using SPSS 14.0 (SPSS Inc., 2006). Questionnaires with at least one incomplete item were excluded from analysis. To assess internal consistency of the PSQI-H 7 component scores, Cronbach's-α coefficients were computed for the clinical and control samples separately and combined. To assess concurrent validity between clinical and non-clinical control groups, multiple analysis of variance (MANOVA) was performed for PSQI-H components, global score and three factors based on the three-factor model with age and gender as covariates. To assess convergent validity for the Rambam group, Pearson correlation coefficients between PSQI-H components, factors and global score and MSQ subscores and global score were computed, with Bonferroni correction for multiple comparisons.

Results

Cronbach-α coefficients for the clinical and control groups were 0.70 and 0.52 respectively and 0.72 for both groups combined. Table 3 presents MANOVA for mean PSQI-H components, global score and factors (means ± SD) between clinical and control groups with age and gender as covariates. All PSQI-H components, global score and factors were significantly different between groups. All mean scores were higher for the clinical group, indicating poorer sleep quality.

Table 4 presents Pearson correlation coefficients between PSQI-H component, global and factor scores, and MSQ subscores and global scores for the Rambam group ($P < 0.0045$ with Bonferroni correction). The MSQ-I was significantly correlated with all PSQI-H components, global and factor scores, except for Daytime Dysfunction and Sleep Disturbance components, and factor 3, Daily Disturbance. The MSQ-H was significantly correlated with the PSQI-H Sleep Disturbance, Daytime Dysfunction and Sleep Quality components, global score and factor 3, Daily Disturbance. The MSQ global score was significantly correlated with PSQI-H Sleep Disturbance and Sleep Quality components, global score and all three factors.

Discussion

In this study, the translated subjective sleep quality questionnaire (the PSQI-H) exhibited moderate reliability and good validity in clinical and non-clinical samples. Reliability was higher in the clinical sample than in the non-clinical control sample. Good concurrent validity was demonstrated by the differences between clinical and non-clinical samples: patients referred to the sleep clinic showed higher scores, indicating lower sleep quality, compared to the non-clinical controls. Furthermore, high convergent and discriminant validities were demonstrated by the relationships between the PSQI-H component, global and three-factor scores, and between the insomnia and hypersomnia subscores and global score of the MSQ, indicating common underlying domains of sleep disturbances.

Reliability measures in the present study were somewhat lower than those reported by other PSQI translations [2,4,10]. One possible explanation may be the different clinical samples used in previous reliability studies and in the present study. Our sample included a clinical sleep disorders population typically referred not for insomnia but for snoring, suspected obstructive sleep apnea and other disorders of hypersomnolence. Previous studies assessed reliability in primary insomnia, psychiatric or medical clinical populations [1-6]. Since the PSQI is a measure of subjective sleep quality and is often used as an assessment tool for insomnia, a sample comprised of sleep clinic patients referred for snoring and obstructive sleep apnea rather than primary insomnia patients may be considered an inappropriate limitation of the present study. On the other hand, the assessment of subjective sleep quality is a concern for health care practices, whether in the sleep clinic, in other clinical populations, or in the general population. Indeed, it is surprising that previous studies have not chosen sleep clinic patients as an obvious population for validation of the PSQI. Our data suggest that poor sleep quality is a common finding in patients suspected of having sleep apnea, supporting previous data [16]. Furthermore, it has been estimated that up to 90% of sleep apnea patients in Israel are either undiagnosed or untreated [17], and in an accompanying editorial,

Pillar [18] emphasizes the need for a taskforce to establish how to increase the awareness and identification of sleep disorders in general and sleep apnea in particular among Israeli physicians and patients. Based on our results, the PSQI-H could serve as a first-line screener for this purpose. Future studies may perform further psychometric assessment of the PSQI in the sleep clinic population.

Lower reliability measures in our study may also be due to the multilingual population typically seen at sleep clinics in Israel. Although patients not fluent in Hebrew were excluded from participation, for some patients, Hebrew is not a native language, thus measurement error may have increased.

Despite the compromised reliability measures, validity of the PSQI-H was found to be high. Patients' mean scores were higher than those of the control sample, indicating good concurrent validity, as higher scores indicate more disturbed sleep. Furthermore, correlations between the MSQ subscores, and the PSQI three-factor model and components converged and diverged in an expected manner, indicating good convergent and discriminant validities. While the Daily Disturbance factor and its two underlying components, Sleep Disturbance and Daytime Dysfunction, were highly correlated with the MSQ-H subscore, the Sleep Efficiency and Sleep Quality factors and their underlying components were highly correlated with the MSQ-I subscore. These relationships may indicate that the Daily Disturbance factor underlies a separate domain, relating to disorders of hypersomnolence and their daytime consequences; whereas the high correlations between the other two factors with the MSQ-I may indicate that these factors are useful for identifying insomnia.

An inherent limitation of the study is that a standardized diagnosis of insomnia was not obtained, and thus, accuracy measures of sensitivity and specificity and assessment of the cutoff score could not be computed. Previous validation studies of PSQI translations found high sensitivity and adequate to good specificity using cutoff scores of five and six for primary insomnia [2-4].

In summary, our results show that the PSQI–H demonstrated moderate reliability and good validity in a sleep clinic patient sample. PSQI-H scores based both on the traditional single factor and the new three-factor models showed significant systematic differences between sleep clinic patients and controls, indicating high concurrent validity. When comparing the PSQI-H one- and three-factor models with a widely used Hebrew questionnaire, the MSQ subscores and global scores, correlations reflected strong relationships between the two questionnaires on similar underlying constructs, i.e., insomnia and hypersomnia, indicating good convergent and discriminant validities. We conclude that the PSQI-H may be used in clinical research studies with Hebrew-speaking subjects, particularly when sleep quality is the main focus of the study and when international standardization is warranted.

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A successful marriage requires falling in love many times, always with the same person.

Mignon McLaughlin (1915-1983), American journalist and author