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Validity of the Pittsburgh Sleep Quality Index (PSQI) among Nigerian university students

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Abstract

Objectives: Sleep-related problems and detection of them remain largely an unidentified public health issue, especially among university students. This study aims to assess the validity of the Pittsburgh Sleep Quality Index (PSQI) among Nigerian university students.

Methods: Five hundred and twenty students completed the PSQI, the 12-item General Health Questionnaire (GHQ-12) and questionnaires pertaining to socio-demographic details. The students were then interviewed for the diagnosis of insomnia according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth edition (DSM-IV) and the International Classification of Sleep Disorders, revised criteria (ICSD-R).

Results: The PSQI was of moderate value in screening for insomnia, with the best cut-off score at 5 (sensitivity 0.720, specificity 0.545, overall correct classification rate 0.554). The correlation between the PSQI and the GHQ-12 was 0.252 ($p < 0.001$). A 3-factor model was generated by principal component analysis.

Conclusion: The psychometric value of PSQI in screening for insomnia among Nigerian students was moderate compared to what has been obtained in Western cultures. Nonetheless, it is still a useful instrument in the detection of sleep problems in this population.

Keywords: Pittsburgh Sleep Quality Index; Sleep disorders; Nigerian students; Validity; Sensitivity; Specificity

1. Introduction

Sleep-related disorders are a major health issue. The estimated prevalence of sleep problems in the general population range between 15% and 24%, and prevalence as high as 62% has been reported in the elderly population [1]. Poor sleep quality has been associated with increased tension, irritability, depression, confusion and generally lower life satisfaction [2]. Students have been identified as a population group particularly affected by problems with sleep [3–5]. A majority of university students are in late adolescence and early adulthood, and, due to the stress of education and the academic workload, their sleep patterns and related problems could differ from non-students their age [6].

The extent of sleep-related problems among Nigerian university students is unknown. In a developing country like Nigeria, where there is inadequate personnel to assess sleep problems in students, a rating scale would be an invaluable tool to estimate sleep-related problems in this population. The most widely used sleep instrument is the Pittsburgh Sleep Quality Index (PSQI). The PSQI [7], introduced in 1989, has acquired extensive acceptance as a useful instrument in measuring sleep quality in diverse groups of patients. The questionnaire is easy to understand and can be completed in 5 min or less. It has been shown to have good validity for patients

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with psychiatric and sleep disorders [8] and for patients with other somatic diseases [9]. It has also been used among student populations [10].

Although the PSQI had been widely validated in various cultures and populations, searches of literature revealed no validation or use of the instrument in sub-Saharan Africa. The aim of this study was to assess the validity and usefulness of the PSQI among Nigerian university students.

2. Materials and methods

2.1. Sample population

The study population consisted of students of the Obafemi Awolowo University, Ile-Ife, a federal university in south-western Nigeria, which offers both undergraduate and postgraduate degrees. The university has 10 faculty members and a student population of about 30,000 students from virtually all ethnic groups, tribes and religions in the country.

A multi-stage, stratified sampling technique was used to recruit students for the study. Students were approached by faculty members, and 60 students were randomly selected by each one, for a total of 600 students.

2.2. Measures

2.2.1. The Pittsburgh Sleep Quality Index (PSQI)

The PSQI [7] is a standardized self-rated questionnaire developed to assist in measuring sleep quality and to alert physicians to the need for further evaluation of individuals showing symptoms of sleep problems. The 24-item questionnaire generates seven component scores, ranging from subscale scores 0 to 3: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction. The addition of these seven components yields a global score of subjective sleep quality. The global score ranges from 0 to 21, and a higher score is indicative of poorer subjective sleep quality. Advantages of the PSQI include the ability to determine patterns of sleep dysfunction over a one-month period through the assessment of qualitative and quantitative data, and to derive a simple global score that reflects both the number and severity of sleep problems [7]. The design of the PSQI is such that the items and the component scores represent standard areas that clinicians usually focus on when patients report sleep problems.

2.2.2. The General Health Questionnaire-12 (GHQ-12)

The GHQ-12 [11] is a 12-item self-rated questionnaire designed to assess general psychopathology in a population. The 12-item version has been well validated in the Nigerian population [12]. A cut-off score of 3 and above was considered indicative of clinically significant psychiatric morbidity.

2.3. Procedure

The ethics and research committee of Obafemi Awolowo University Teaching Hospital Complex (OAUTHC) approved the study protocol, and informed consent was obtained from students after the aims and objectives of the study were explained to them.

The participants first completed a questionnaire regarding socio-demographic characteristics, including age, sex and religion. The questionnaire also included the faculty, academic level, number of years spent in university, monthly allowance and the source, whether residing in university accommodations or not, average number of roommates, average time of day lecture starts and ends, when reading is most often done (during the day or at night), and average time spent reading in a 24-h period. Accommodation problems were assessed by asking whether participants have a personal bedspace or share with a fellow student. Academic problems were assessed by enquiring whether they had failed any course, which may then lead to spending extra academic sessions in school or increasing future academic workload. Questions regarding the use of alcohol, cigarettes, caffeinated beverages and kolanuts were also asked, after which participants completed the PSQI and GHQ-12. Four trained psychiatrists then assessed the students for the diagnosis of primary insomnia using the combined duration and severity criteria of DSM-IV [13] and ICSD-R [14], which include the following: (1) duration of the problems must be reported as lasting more than one month, (2) the problem must be reported as present as least two nights per week and (3) the problem must be reported as adversely affecting either social, occupational or cognitive daytime functioning.

2.4. Statistical analysis

Statistical analysis was conducted with The Statistical Package for the Social Sciences (SPSS11). Cases of sleep problems were defined according to DSM-IV diagnosis. Results were calculated as frequencies (%), means and standard deviations. Screening parameters including sensitivity, specificity and predictive values were calculated for the PSQI scores. Spearman's correlation was used to establish a relationship between PSQI and GHQ-12 scores. The psychometric properties of the PSQI were compared with the DSM-IV diagnosis using the receiver operating characteristics (ROC) curve. The area under the curve (AUC) was also calculated. Principal component factor analysis was done for the PSQI components, with Eigenvalues greater than 0.4 considered as loading on a factor. All tests were two-tailed, and the level of significance was set at $P < 0.05$.

3. Results

3.1. Socio-demographic and sleep-related data

Out of the 600 participants contacted, 52 refused participation and 28 had incomplete data, so only a total of 520 questionnaires were analyzed. The mean age of the participants in years was 23.24 (standard deviation (SD) 3.16). There were 318 (61.2%) males. A majority of the participants were Christian (85.4%), and 451 (87.1%) were from the Yoruba ethnic group. The mean number of years spent in school was 3.76 (SD 2.16). The average wake-up time in Greenwich Mean Time (GMT) was 5.06 (SD 1.00), and the average sleeping time in GMT was 22.04 (SD 22.60). The average number of minutes to fall asleep was 17.63 (SD 15.54), and the average hours of sleep per night was 5.95 (SD 1.58). The mean GHQ score was 1.85 (SD = 2.59), with a range of 0–12.

3.2. PSQI scores and diagnosis of insomnia

The mean global PSQI score was 4.43 (SD 2.67) with a range of 0–16. There were 25 (4.8%) participants identified as having insomnia according to the DSM-IV and ICSD-R criteria. The mean subcomponent scores for all participants and dichotomized cases and non-cases of insomnia, and the differences, are shown in Table 1. The table shows significant differences between cases and non-cases of insomnia in the areas of subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbances and global PSQI scores.

3.3. Psychometric properties of PSQI

When PSQI scores were subjected to ROC curve analysis, it was discovered that the questionnaire performed modestly against the psychiatric diagnosis with an AUC of 0.685 (95%CI 0.565–0.805). The sensitivity (ability of the PSQI to identify correctly all screened participants who actually had insomnia) and specificity (ability of the PSQI to identify correctly all screened participants who did not have insomnia) are shown in Table 2 and displayed in a ROC curve in Fig. 1.

From Table 2, it could be observed that the best cut-off score for diagnosis of insomnia is 5.0, with sensitivity of 0.720 and specificity of 0.545. The concurrent validity of the PSQI is further supported by its modest correlation with the GHQ-12 scores ($r = 0.252$, $P < 0.001$).

When principal component factor analysis was done (Table 3), results showed that the PSQI among Nigerian university students consist of three major factors. The first factor consists of subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbances and the use of sleep medication. The second factor consists of sleep duration and sleep disturbances, and the third factor consists of subjective sleep quality, habitual sleep efficiency and use of sleep medication.

Table 4 also shows that there were significant differences ($P < 0.001$) between subjects with a diagnosis of insomnia compared to those without a diagnosis of insomnia on all the three factors.

Table 1
The differences in the subcomponent scores of the PSQI between the cases and non-cases of insomnia

PSQI subcomponent	Total ($N = 520$)	Insomnia ($N = 25$)	Non-insomnia ($N = 495$)	Differences		
	Mean (SD)	Mean (SD)	Mean (SD)	T	Df	P value
Subjective sleep quality	0.48 (0.63)	0.84 (1.03)	0.46 (0.60)	2.978	518	0.003
Sleep latency	0.61 (0.63)	0.96 (1.02)	0.59 (0.77)	2.278	518	0.023
Sleep duration	1.48 (0.97)	1.84 (0.90)	1.46 (0.97)	1.889	518	0059
Habitual sleep efficiency	0.30 (0.76)	0.88 (1.30)	0.27 (0.72)	3.924	518	<0.001
Sleep disturbances	0.92 (0.46)	1.40 (0.76)	0.89 (0.63)	3.899	518	<0.001
Sleep medication	0.12 (0.45)	0.24 (0.66)	0.12 (0.43)	1.339	518	0.181
Daytime functioning	0.52 (0.76)	0.76 (0.97)	0.50 (0.74)	1.663	518	0.097
Global PSQI scores	4.43 (2.67)	6.92 (3.64)	4.30 (2.55)	4.883	518	<0.001

Table 2
Psychometric properties of the PSQI at different cut-off scores

PSQI score	Sensitivity	Specificity	Efficiency	LR+ve	LR−ve
3	0.880	0.210	0.230	1.110	0.571
4	0.840	0.380	0.402	1.354	0.421
5	0.720	0.545	0.554	1.565	0.514
6	0.600	0.667	0.663	1.818	0.600
7	0.480	0.784	0.769	2.182	0.663

NB: LR+ve, likelihood ratio for a positive result; LR−ve, likelihood ratio for a negative result.

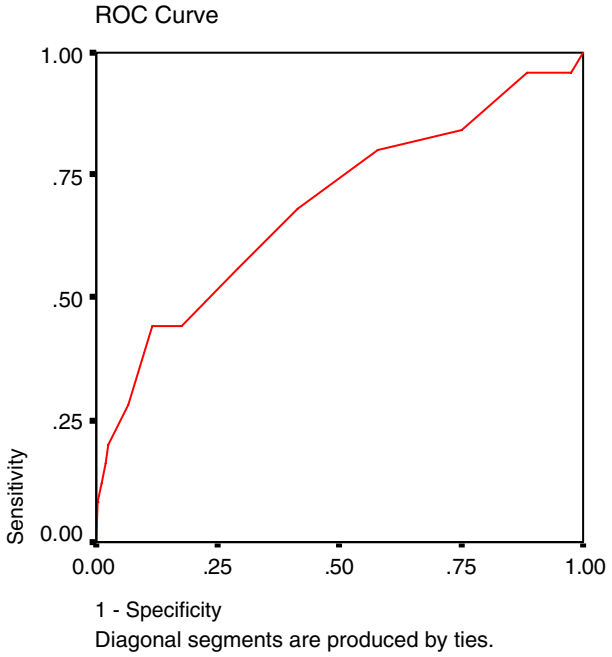

Fig. 1. ROC curve for PSQI against DSM-IV diagnosis of insomnia.

Table 3
Principal component analysis for PSQI subcomponents

PSQI components	Factors		
	Factor 1	Factor 2	Factor 3
Subjective sleep quality	0.587	0.183	−0.560
Sleep latency	0.443	−0.258	−0.369
Sleep duration	0.316	0.832	E
Habitual sleep efficiency	0.487	0.398	0.561
Sleep disturbances	0.642	−0.421	E
Use of sleep medication	0.562	−0.308	0.518
Daytime functioning	0.671	E	E

4. Discussion

To our knowledge, this study is the first to examine the usefulness of a sleep screening instrument among university students in sub-Saharan Africa. The main finding from our study was differences in mean subcomponents scores of the PSQI compared to findings in the Western and non-Western cultures [8,9,15]. This may suggest that the quality of sleep differs among cultures or it may suggest that different cultures have a different perception of sleep and its problems. Since the PSQI was administered in English to educated undergraduate students whose official language is also English, we feel the differences are not due to language and translation problems. We attempted to validate the PSQI against the DSM-IV diagnosis of insomnia in this study, and we found the instrument to be of moderate use. The AUC of 0.685 found in our study is well below the recommended 0.800 for good diagnostic use [16]. Although most of the Western studies have reported better psychometric properties, these were done among patient populations, which may account for the differences.

In agreement with the authors of the instrument and studies done worldwide, we found the best cut-off score for the PSQI among our university students to be 5 and above. Although the instrument had a good sensitivity of 0.720 in this population, the specificity was low (0.545) and the accuracy was moderate (0.554). It is known that the PSQI is not intended for the assessment of insomnia alone but as an index of various qualities of sleep and its disturbances. This may account for it not being specific to the DSM-IV diagnosis of insomnia, which it was validated against. In addition, many students do not perceive their sleep problems to affect their functioning because they need to read, especially at night, to survive academic pressure; therefore, many who would have qualified for the DSM-IV diagnosis of insomnia may have been missed. Since the sensitivity and specificity of a screening instrument depends on the prevalence of the disease in the population, this instrument may not be ideal as a screening device for this study population.

The validity of PSQI in this study is further supported by good correlation with the GHQ-12. Clinical evidence shows that difficulty with sleep is one of the earliest manifestations of psychopathology, which is commonly measured with the GHQ-12.

When we factor-analyzed the PSQI in our study, we demonstrated a 3-factor score, which is in agreement with Cole et al. [17], who have also found a 3-factor model for the PSQI components in the Western culture. The validity of the 3-factor model is further supported by significant differences in the mean scores of each of the factors in the subjects with insomnia compared to subjects without insomnia.

The limitations of this study include a moderate sample size, narrow population type (university students) and the use of insomnia as the only sleep diagnosis.

Table 4
Differences of the 3-factor components of PSQI between subjects with insomnia and those without insomnia

Factors	Total ($N = 520$)	Insomnia ($N = 25$)	Non-insomnia ($N = 395$)	Differences		
	Mean (SD)	Mean (SD)	Mean (SD)	T	Df	P value
Factor 1	2.43 (1.91)	4.32 (2.43)	2.34 (1.84)	5.183	518	<0.001
Factor 2	2.39 (1.14)	3.24 (1.36)	2.36 (1.11)	3.834	518	<0.001
Factor 3	0.90 (1.21)	1.96 (1.79)	0.85 (1.15)	4.547	518	<0.001

The strength of the study lies in that it derives from a region not previously studied and in the use of psychiatric interview to make diagnosis of insomnia.

We have shown that the PSQI is of moderate use in screening for insomnia among university students in Nigeria, with the best cut-off score set at 5 and above. Further studies will be needed to assess the performance of this instrument and its local translated version among the general population.

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