



## Proposing the Clinical Inventory of Sleep Quality<sup>☆</sup>



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### ABSTRACT

**Introduction:** The aim of the study was to propose the Clinical Inventory of Sleep Quality (CISQ), and compared it with the Pittsburgh sleep quality index (PSQI).

**Methods:** We studied 400 subjects with the CISQ. Cronbach's *alpha* coefficient was calculated to measure the reliability, and to determine the concurrent validity, a Canonical correlation analysis was performed. At next, we used an exploratory and confirmatory Factorial analysis with Varimax rotation for validity construct calculation.

**Results:** Cronbach *alpha* coefficient of the scale was significantly strong ( $\alpha=0.81$ ). Canonic correlation was=0.93, suggesting that data proved that the CISQ and PSQI are measuring identical subject. Confirmatory Factorial analysis model grouped items of the scale in four factors: 1. Daytime symptoms, 2. Nocturnal symptoms, 3. Sleep disordered breathing symptoms, and 4. Sleep-related movement disorders symptoms. We proposed five categories to score CISQ in a range of 0–52 points, as follows: Good quality of sleep, Mild bad sleep quality, Moderate bad sleep quality, Severe bad sleep quality, and Profound bad sleep quality.

**Conclusion:** CISQ is a promising tool to measure sleep quality and deserve more research to confirm its utility.

### 1. Introduction

Clinical scales are useful constructs for evaluation of several behaviors for human beings. Quality of life (QoL) is an important issue measured by several scales for mental health of subjects. QoL has been used for measure associated issues related to cancer [1], depression and anxiety disorders [2], disability [3], among others. QoL in sleep has been measured by few instruments [4–6], and there is a need of clinicians for more scales as a tools in their arsenal to search for QoL in patients with sleep disorders. Currently, although there are many scales to measure sleep disorders, some authors had suggested that there is a need to measure sleep disorders in alternative ways [7], because there is no perfect tool that can be used in every circumstance.

Sleep quality (SQ) is a very important measurement to weight QoL, because rest and recovery are among the most important functions of sleep. Several measurements of SQ had been designed. The most frequent worldwide used scale for SQ, is the Pittsburgh sleep quality index (PSQI) [4]. Although PSQI is widely used in sleep medicine, we believe that its use had some limitations, because: (1) The result of the index, only indicates good or poor SQ and does not establish different

levels of severity of sleep deficiency, (2) Its rating sometimes is complicated if examiner have no experience with the questionnaire, (3) Although PSQI was translated into the Spanish language and validated with psychiatric patients [8], and in other languages such as French [9], and others, some authors had reported that its internal consistency have no reach the level recommended for individual comparison [10].

For these reasons is important to develop more instruments for SQ measurement in other languages, such as Spanish. Thus, in this study, our objective was to propose and test the Clinical Inventory of Sleep Quality (CISQ), a novel developed instrument to measure SQ, and analyze its psychometric properties.

### 2. Material and methods

#### 2.1. Subjects

We included 400 subjects divided in two groups: the first group was constructed with citizens from Xalapa City in Veracruz State and from the Clinic of Sleep Disorders in Mexico City, in Mexico, they were the

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individuals from the asymptomatic group ( $n=258$ , 166 came from Xalapa, and 92 were healthy volunteers from Mexico City). For the second group, we studied 142 patients from the Clinic of Sleep Disorders with mild-moderate Obstructive sleep apnea-hypopnea syndrome (OSAHS). Exclusion criteria were chronic non-controlled illness, and illiteracy evaluated by the school degree. All subjects were studied by means of a general clinical examination, with CISQ, and PSQI. Mean age of the complete sample was 34.96 years of age, range 18–81 years, 53% were females, and 47% were males. Citizens from Xalapa City and Mexico City had a mean age of 31.94 years of age, 48% were females, and 52% males. Patients from the Clinic of Sleep Disorders had a mean age of 42.42 years of age, 60% were females, and 40% were males. Research protocol was approved by the Ethics and Research Boards of the participant institutions, and the research followed principles of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

### 2.2. Clinical Inventory of Sleep Quality (CISQ)

The CISQ consists of twenty questions in Spanish (see Appendix 1 and 2). The scale is self-administered, instructions for its use was given by the specialist in Sleep medicine, the estimated time to fill out the questionnaire was around 10 min. The questionnaire was constructed based on clinical queries used by clinicians and researchers in the Clinic of Sleep Disorders, taking into account the PSQI. From 200 questionnaires answered by college students, we identified the more predictive items for SQ measurement by means of a logistic regression. Afterward, we constructed a pilot questionnaire, and eliminated confused questions, items number one, two and four were joined to measure “Sleep efficiency” (SE), to construct the final version of the CISQ. SE was calculated dividing: number of sleep hours/time in bed $\times$ 100. Each question had five possible answers, from 0 to 4 points (see Table 1). In the end, we obtained a Total score, where low scores indicate a good SQ, while higher scores indicate a poor SQ.

### 2.3. Pittsburgh sleep quality index (PSQI)

This questionnaire includes 19 items comprising seven equally weighted components: subjective sleep quality (1 item), sleep latency (2 items), sleep duration (1 item), sleep efficiency (3 items), sleep disturbances (9 items), day-time dysfunction (2 items) and sedative usage (1 item). The seven components were summed to obtain a single global PSQI score, with a possible scale range score from 0 to 21. A global score > 5 indicates a poor SQ. The PSQI was used as standard reference of the CISQ usefulness.

### 2.4. Statistical analysis

We calculated average ( $\bar{x}$ ) and Standard deviation (SD) of quantitative variables, and percentages (%) of qualitative variables. We used the Pearson’s correlation coefficient to weight strength and direction of correlation of each item of the CISQ. We used the Cronbach’s alpha

**Table 1**  
Possible answer and scoring of each question of the Clinical Inventory of Sleep Quality (CISQ).

Questions	Score				
	0	1	2	3	4
Sleep efficiency	100–90%	89–80	79–70	69–60	< 60%
How long it takes to sleep?	< 15 min	16–30	31–45	46–60	> 60 min
How many hours do you sleep?	7–8	6 or 9	5 or 10	4 or 11	3 or 12
How many nights do you wake up once slept?	0	1	2	3	4
What score give you to your sleep quality?	10–9	8–7	6–5	4–3	2–1
How do you consider your sleep quality?	Very good	Good	Fair	Bad	Very bad
Questions 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 18, 19, 20	0 nights/week	1–2 nights/week	3–4 nights/week	5–6 nights/week	$\geq$ 7 nights/week

**Table 2**  
Correlation of each questions us the Total score of the Clinical Inventory of Sleep Quality.

Question	r	No. of variables
1. Sleep efficiency	0.52	12
2. How long it takes to sleep?	0.39	9
3. How many hours do you sleep?	0.41	9
4. How many nights do you have insomnia?	0.24	6
5. How many nights do you have difficulties to sleep?	0.59	15
6. How many nights do you wake up once slept?	0.47	13
7. How many nights a week do you wake up once slept?	0.48	14
8. How many nights a week do you have nightmares?	0.28	9
9. What score give you to your sleep quality?	0.64	18
10. How many mornings do you have difficulties for wake-up?	0.46	8
11. How many mornings do you wake up tired?	0.65	15
12. How many days you have the need to sleep at a day?	0.55	10
13. How many days do you have malaise?	0.72	17
14. How do you consider your sleep quality?	0.79	18
15. How many nights do you have restless legs?	0.46	11
16. How many nights do you wake up with cramps?	0.43	12
17. How many nights do you snore?	0.47	12
18. How many nights do you have breathing pauses?	0.41	9
19. Do you have taken a drug for sleep?	0.34	9

coefficient to determine internal consistency [11], and the Canonic correlation analysis to determine the Concurrent validity of the scale, comparing CISQ with PSQI. We used an Exploratory factorial analysis with a Varimax rotation to weight the items of questionnaire and a final Confirmatory factorial analysis for construct validity. An  $\alpha$  value of  $p \leq 0.05$  was selected to accept measurements as significant.

### 3. Results

Mean of the total score of CISQ was  $15.78 \pm 8.47$ , in asymptomatic subjects CISQ had a mean total score of  $6.34 \pm 3.29$ , PSQI in asymptomatic subjects was  $5.66 \pm 2.47$ . Differences between average in the CISQ of sample from Xalapa City-Mexico City and from the Clinic of Sleep Disorders was significant (mean total score of asymptomatic group of citizens from Xalapa City and Mexico City was 12.57 while patients from clinic was 21.60,  $t=-11.84$ ,  $p < 0.001$ ). Cronbach alpha coefficient of the scale, was significantly strong ( $\alpha=0.81$ ). Correlation coefficients of each questions of the questionnaire vs the total score of CISQ is showed in Table 2. We eliminated the following questions because had lower values in the Correlation analysis: How long it takes to sleep?, How many nights do you have insomnia?, How many nights a week do you have nightmares?, How many nights a week do you have taken a drug for sleep?, How many hours do you sleep?, What score give you to your sleep quality?, the last couple of questions because they are closely related with sleep efficiency and subjective quality of sleep, respectively. Comparison of CISQ with PSQI by means of Canonic correlation was significantly strong (0.93).

In the Exploratory factorial analysis, we examined the correlation matrix with the Sphericity test of Bartlett and measured sample adequacy by Kaiser-Meyer-Olkin test, which showed a strong correla-

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