

Reliability and validity of the Spanish version of the Children's Sleep Habits Questionnaire (CSHQ-SP) in school-age children

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Accepted for publication 2 May 2016

Abstract

Background Sleep disorders in schoolchildren are a common problem worldwide, and when are not adequately diagnosed and treated, their negative impact on daytime functioning may be significant. The aim of this study was to evaluate the psychometric properties of the Spanish version of the Children's Sleep Habits Questionnaire (CSHQ).

Methods Participants were 286 school-aged children from a community-based sample, aged 4 to 7 years. The sleep behaviour was evaluated using the CSHQ and actigraphy (ActiSleep monitor). The CSHQ was adapted to the Spanish language. The internal consistency of the questionnaire and the test-retest reliability between scores at baseline and three-weeks-later were estimated. Associations between CSHQ items and accelerometer sleep quality indicators were used as indicators of concurrent validity.

Results Cronbach's alpha coefficients for the subscales ranged from 0.60 to 0.81, and 0.81 for the full scale; the intraclass correlation coefficients ranged from 0.56 to 0.81. A moderate correlation was observed in sleep latency and awakenings measurements using both parents' reported sleep habits (CSHQ-SP) and sleep quality indicators (ActiSleep).

Conclusions The CSHQ-SP has demonstrated adequate psychometric properties, and it serves as a useful instrument for clinical and research setting.

Keywords

actigraphy, ActiSleep monitor, CSHQ, schoolchildren, sleep disorders, sleep quality indicators

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Introduction

Sleep disorders in schoolchildren are a common problem that has received increased attention in recent years (Owens *et al.* 2005) and have been related to several physical, cognitive, behavioural and emotional problems, and overall, to decreasing levels of quality of life (Astill *et al.* 2012).

It has been suggested that sleep disorders could be underdiagnosed in clinical practice (Meltzer *et al.* 2010)

because a high proportion of paediatricians do not regularly screen infants and toddlers for sleep problems (Owens 2001) and also because most parents do not report significant sleep disturbances to their paediatricians (Stein *et al.* 2001).

Recent studies, including children from birth to 36 months, using parent questionnaires and interviews, have reported sleep difficulties in 10–75% of children worldwide (Mindell *et al.* 2011). In Spain, sleep disorders seem to be a common problem in children (Pin Arboledas *et al.* 2011), although there is a lack

of recent data on sleep habits in children at early ages that has been obtained by validated measurement tools. The high prevalence of sleep problems, the negative implications for both infants and their parents and the high success rates of clinical and educational interventions (Mindell *et al.* 2006; Hall *et al.* 2015) all emphasize the need for early screening tools.

Psychometric properties of several instruments for sleep-related problems have been described (Spruyt *et al.* 2011), but probably the most extensively used instrument in clinical and research setting is the Children's Sleep Habits Questionnaire (CSHQ) (Owens *et al.* 2000), a screening tool for sleep difficulties in children aged 4 to 10 years, based on International Classification of Sleep Disorders Paediatric Diagnoses (Thorpy 2012). The original English version of the CSHQ has evidenced good psychometric properties (Goodlin-Jones *et al.* 2008) as have other language versions (Cortesi *et al.* 2004; Liu *et al.* 2005; Tzchishinsky *et al.* 2008; Schlarb *et al.* 2010; Waumans *et al.* 2010; Silva *et al.* 2014).

The aim of this study was to examine the psychometric properties of the Spanish version of the CSHQ.

Materials and methods

Participants

Participants were recruited from the baseline measurements of a cross-over cluster randomized trial (clinicaltrials.gov Identifier: NCT01971840) aimed at testing the effectiveness of a physical activity intervention to prevent obesity and improve academic performance in schoolchildren from 21 schools from Castilla-La Mancha, Spain (MOVI-KIDS). The selection of participant procedures has been extensively described elsewhere (Martínez-Vizcaino *et al.* 2015). In brief, this study included children attending third grade of pre-school education or first grade of primary education (4–7 years) that meet the following inclusion criteria: to be literate in Castilian Spanish, not have suffer any physical or mental disorder identified by parents or teachers, which in opinion of their paediatricians prevents the participation in the intervention physical activities.

For this validation study, we selected 473 (31.53%) participants by using non-probability consecutive sampling by sequence order of entry in the study, from children belonging to five schools of the MOVI-KIDS baseline measurement project. Of these, 286 (60.47%) parents completed the questionnaire correctly.

A letter providing information about the study objectives and methods as well as a request for authorization from the

principal and school board was sent to each school. Children were also asked to participate. Subsequently, a letter was sent to parents inviting them to a meeting in order to explain the study objectives and procedures. Parents were then asked to sign the agreement allowing their child to participate in the study, with a recommendation to consult with the child and to take their views into account. Data were collected from September 2013 to June 2014.

The study was approved by the Clinical Research Ethics Committee of the Hospital General Virgen de la Luz in Cuenca. The study follows the principles of the Declaration of Helsinki.

Measurements

In addition to socio-demographic variables, the sleep behaviour was evaluated using the following instruments:

CSHQ

The CSHQ (Owens *et al.* 2000) is a retrospective, 33-item parent-report questionnaire that evaluates sleep behaviours in school-aged children. The questionnaire is grouped into eight subscales according to the following sleep domains: 'Bedtime Resistance', 'Sleep Onset Delay', 'Sleep Duration', 'Sleep Anxiety', 'Night Wakings', 'Parasomnias', 'Sleep Disordered Breathing' and 'Daytime Sleepiness'. Items are rated on a 3-point scale; usually (5 to 7 times per week), sometimes (2 to 4 times per week) and rarely (0 to 1 time per week), and the scoring of some items was reversed. Higher score indicates more sleep problems.

Actigraphy

Actigraphy (ACT) is a non-invasive method used to study sleep–wake patterns and circadian rhythms by assessing movement (Morgenthaler *et al.* 2007). ACT has proven useful for describing sleep patterns and evaluating treatment responses (Morgenthaler *et al.* 2007; Stoner *et al.* 2013). We used the ActiSleep® monitor, a wristwatch device that monitors activity levels for extended, continuous periods. Worn during sleep episodes, the ActiSleep can monitor sleep onset, sleep latency – the length of time taken to fall asleep, calculated as the time between 'lights off' to the first period of 3 min of consecutive epoch scored as sleep, total sleep time, number and duration of awakenings and sleep efficiency – the ratio of time spent asleep (total sleep time) by the amount of time in bed. Participants wore the ActiSleep monitor on their non-dominant wrists for seven consecutive days. Parents were

instructed to keep a record by logging time spent in bed and time spent out of bed for each measured sleep episode, and to return a completed sleep diary with the ActiSleep monitor to the research staff. They were also asked to keep the actigraph on the child continuously, removing it only during times that it could get wet (bathing or swimming) or be subjected to shock.

Questionnaire administration strategy

Questionnaires were sent to each participant's school by post, and teachers were responsible for distributing a copy to each mother/father. Once the questionnaire was completed by parents, they were handed over to the teacher in a sealed envelope.

Completion of the CSHQ-SP requires four to six minutes' time. Criteria for inclusion in the study included the informed consent signed by parents, and the full completion of the questionnaire.

Statistical analysis and validation process

A descriptive analysis of the sample characteristics was performed, and the floor and ceiling effects (proportion of cases obtaining the minimum and maximum scores respectively) were calculated; scores for each subscale and the overall scale score were also calculated, according to the CSHQ instructions.

CSHQ-SP translation-back translation

The CSHQ cultural adaptation to the Spanish language (CSHQ-SP) was authorized by the authors of the original version (Owens *et al.* 2000). In order to define the final Spanish version, we adapted (with minimal changes) the Castilian version of the original scale provided by the authors. Back-translation was used to ensure cultural alignment of the original CSHQ and the Spanish version.

This version consists of 32 of the 33 items from the original CSHQ. We have removed item 9 of the original CSHQ, 'sleep too little' as redundant and ambiguous. As in the original scale, the frequency of sleep-related behaviours was rated on a 3-point scale as 'usually' (5 to 7 times per week, scored as 3 points), 'sometimes' (2 to 4 times per week, scored as 2 points) or 'rarely' (0 to 1 time per week, scored as 1 point). The questionnaire also includes four non-scorable items related to the child's bedtime the previous night, child's wake time, getting out of bed and amount of sleep.

The scoring of some items was reversed as in the original version (items 1, 2, 3, 10, 11 and 26); thus, the full scale (32

items) and subscale scores could be calculated. The total score was the sum of the responses obtained on each item (range 32–96) and the highest scores indicated the worst sleep habits.

Construct validity

An exploratory factor analysis (EFA; principal components analysis) was conducted to assess whether each item was saturated in the appropriate subscale factor. The Kaiser–Meyer–Olkin (KMO) test and Bartlett's sphericity test were also used to assess whether the factor analysis was appropriate to test the scale structure. A factor analysis would be appropriate if the KMO test reached values above 0.5, and the Bartlett test obtained values lower than 0.05.

Reliability

Reliability was examined by using two different approaches: (i) the internal consistency of the scale, which was analysed using Cronbach's alpha coefficient for the total scale and also for each subscale; and (ii) the test–retest reliability, which was examined in a subsample of 89 children randomly selected from the whole sample of participants who completed the questionnaire twice in a three-week interval (considered a time gap long enough to ensure that participants would not remember their responses but short enough to avoid significant changes in the participants' sleep behaviour).

The Pearson correlation coefficient (Polychoric correlation coefficient in 'Sleep Onset Delay' subscale with a single item) and the intra-class correlation coefficient (ICC) were used to examine the relationship between baseline and three-weeks-later scoring.

Concurrent validity

Actigraphy analysis was conducted to examine the concurrent validity. Data analysis was performed with the ActiLife 6.9.2. Software, and recordings were registered at 1-min epochs and at a frequency of 30 hertz. Nocturnal sleep/wake measures were estimated from actigraphic data using a validated algorithm (Sadeh *et al.* 1994). Actigraph recordings were checked against the parent's diary. The analysis period for the sleep data presented here (*the scoring interval*) included the period from the bedtime to the wake time as given in the diary, as recommended by the American Academy of Sleep Medicine (Littner *et al.* 2003). Analysis of

actigraphy data required a complete collection of data throughout the night.

The parent-completed diary required a reasonable correspondence to the actigraphic data. To allow for small inaccuracies in parent-reported times, a window of 30 min before the parent-reported bedtime and after the wake time was visually inspected (Nixon *et al.* 2008). Registered data for ≥ 3 nights per child was necessary to convert the data to interpretable sleep quality indicators (Michels *et al.* 2013). After entering the parent's sleep diary data, and using the Sadeh algorithm in the ActiLife 6.9.2. Software, the following sleep quality indicators were obtained: sleep latency, awakenings, total sleep time and efficiency.

Subsequently, we identified those CSHQ-SP items that were apparently more related to the accelerometer sleep quality indicators (latency, awakenings, total sleep time and efficiency), and polyserial correlation coefficients were estimated between these accelerometer variables and the selected CSHQ-SP items. Furthermore, the intraclass correlation coefficient (ICC) between time in bed measured by both the CSHQ-SP and ActiSleep was estimated by sex.

All analyses were performed using IBM SPSS Statistics 22 software. For both polychoric and polyserial correlation coefficient estimation, the R.Hetcor package was used.

Results

From the 473 children invited to participate, only the 286 children (60.47%) whose parents correctly completed the sleep questionnaire were included in this analysis. Participants were aged 4 to 7 years (mean = 5.27; SD = 0.61), and 149 (52.1%) were boys. No differences in mean age or sex composition were observed between children included and non-included in the study analysis. For the test–retest reliability analysis, we invited 89 parents to complete the questionnaire twice; at baseline, and three weeks later—but only 61 (68.54%) accepted the invitation. Furthermore, 60 of the 89 children wore the

accelerometer for one week. Sleep patterns of the ActiSleep sample children are described in Table 1.

The mean score of the 32-item CSHQ-SP for the total sample was 43.1 (SD = 7.25). Total score in the sample ranged from 32 to 81. Only 0.7% of the participants scored the minimum (floor effect), and no participants scored the maximum (ceiling effect). To set a cut-off score that categorized individuals as 'normal sleepers' vs. 'bad sleepers', we used as a criterion the total score mean + 1 standard deviation (SD); thus we considered those children who scored above the mean + 1 SD, in our case above 50.35 points as 'bad sleepers'.

Exploratory factor analysis

This analysis identified ten factors with an eigenvalue greater than 1; however, when we analysed the items' content in each subscale, many of them did not have a logical connection. Thus the face validity was poor. Thereafter, in the scree plot we observed that an eight factor model could be appropriated, although in this eight factor model many items were not allocated in the subscales according to clinical criteria. Thus, we finally decided to use clinical criteria, keeping the same factor structure as the original questionnaire, which is based on the International Classification of Sleep Disorders (Thorpy 2012).

Reliability

Internal consistency

Cronbach's α coefficient for the full CSHQ-SP 32-item scale was 0.81, and ranged from 0.60 to 0.81 for the subscales (Table 2). Eliminating item 'stops breathing' would increase the Sleep Disordered Breathing subscale from 0.66 to 0.83. However, we decided to keep this item in the final version of the CSHQ-SP in order to preserve the correspondence with the original scale. When other items were removed,

Table 1. Description of the quality of sleep indicators in the ActiSleep subsample

ActiSleep monitor Mean (SD)						
	<i>n</i>	Total time in bed (min)	Total sleep time (min)	Latency (min)	Efficiency (%)	Awakenings (<i>n</i>)
Boys	25	611.96 (28.92)	485.30 (42.28)	19.32 (11.40)	79.27 (5.40)	27.66 (5.09)
Girls	26	613.80 (30.10)	501.30 (29.74)	19.62 (8.70)	81.84 (4.63)	25.93 (4.32)
Total	51	612.90 (29.25)	493.46 (36.95)	19.47 (10.01)	80.58 (5.14)	26.78 (4.75)

SD, standard deviation; *n*, number; min, minutes.

Table 2. CSHQ internal consistency (Cronbach's α)* in community samples from different countries

	Spain	US	Portugal	China	Israel	Netherlands	Germany
Full scale	0.81	0.68	0.78	0.80	0.81	NP	0.68
Subscales:				0.49–0.72			
Bedtime resistance	0.65	0.70	0.74		0.78	0.68	0.70
Sleep duration	0.81	0.69	0.68		0.68	0.63	0.70
Sleep anxiety	0.74	0.63	0.44		0.65	0.54	0.55
Night wakings	0.69	0.54	0.58		0.49	0.62	0.49
Parasomnias	0.62	0.36	0.57		0.28	0.54	0.36
Sleep-disordered breathing	0.66	0.51	0.67		0.46	0.47	0.23
Daytime sleepiness	0.60	0.65	0.71		0.67	0.67	0.63
Study sample size	286	469	315	517	98	1145	298

CSHQ, Children's Sleep Habits Questionnaire; NP, not published.

*All the Cronbach's α coefficients were statistically significant at $P < 0.001$.

Cronbach's α coefficient decreased in both their own subscale and the full scale.

Test–retest reliability

Only 52 of the 61 parents who agreed to complete the questionnaire twice, did so correctly. Intraclass correlation coefficients for the different subscales ranged from 0.54 (Daytime Sleepiness) to 0.79 (Sleep Anxiety) (Table 3).

Concurrent validity

The assessment of concurrent validity was conducted in those children who fulfilled both the sleep diary and the CSHQ-SP retest and with an adequate register of accelerometry ($n = 51$). Table 4 displays the correlation coefficients between sleep quality indicators reported by accelerometry and the CSHQ-SP items. The sleep quality indicators that had a moderate correlation between the CSHQ-SP items were 'latency' (item 14 = -0.318

Table 4. Polyserial correlation coefficients between sleep habits (CSHQ-SP) and ActiSleep indicators ($n = 51$)

ActiSleep	Items (CSHQ-SP)	<i>r</i>	SE
Latency (min)	14. Falls asleep in 20 min.	-0.318	0.175
	17. Trouble sleeping away	0.355	0.166
Awakenings	8. Awakes more than once.	-0.026	0.188
	22. Restless and moves a lot.	0.149	0.179
	25. Awakens screaming, sweating.	0.264	0.305
	27. Snores loudly.	0.334	0.189
Total sleep time (min)	10. Sleeps the right amount.	-0.153	0.199
	11. Sleeps same amount each day.	-0.154	0.196
	30. Wakes up in negative mood.	0.092	0.189
Efficiency (%)	32. Hard time getting out of bed	0.133	0.166
	34. Seems tired.	0.105	0.259

CSHQ-SP, Children Sleep Habits Questionnaire – Spain; n , number of subjects; SE, standard error; min, minutes.

and item 17 = 0.355) and 'awakenings' (item 27 = 0.334). The remaining correlation coefficients were negligible.

The ICC for the 'time in bed' reported by both the 'CSHQ-SP retest' and the sleep diary was 0.54 ($P < 0.001$) for the

Table 3. CSHQ's test–retest reliability in community samples from different countries

Subscales	Test–retest reliability		United States (Pearson's <i>r</i>)	Portugal (Pearson's <i>r</i>)	Netherlands (ICC)	Germany (ICC)
	Spain (ICC)	Pearson's <i>r</i>				
Bedtime resistance	0.75*	0.75*	0.68	0.85	0.83	0.74
Sleep onset delay	– ^a	0.69* ^b	0.62	0.59	0.65	0.72
Sleep duration	0.78*	0.81*	0.40	0.67	0.47	0.46
Sleep anxiety	0.79*	0.79*	0.79	0.82	0.93	0.73
Night wakings	0.56*	0.56*	0.63	0.80	0.79	0.68
Parasomnias	0.73*	0.74*	0.62	0.79	0.73	0.67
SBD	0.76*	0.77*	0.69	0.82	0.72	0.63
Daytime sleepiness	0.54*	0.60*	0.65	0.69	0.79	0.81

CSHQ, Children's Sleep Habits Questionnaire; ICC, intraclass correlation coefficients; SBD, sleep-disordered breathing.

* $P < 0.001$.

^a The ICC could not be calculated for 'Sleep Onset Delay' subscale because it contains a single item.

^b Polychoric correlation coefficient.

whole sample, with 0.63 ($P < 0.001$) for boys and 0.47 ($P < 0.05$) for girls.

Discussion

There is a lack of validated instruments in the Spanish language that are useful in clinical settings for the screening of sleep disorders. This study evaluates the validity and reliability of the CSHQ (Owens *et al.* 2000) in a sample of Spanish children aged 4 to 7 years. According to our data the Spanish version of the CSHQ seems to be an acceptable instrument to identify sleep patterns and disturbances in school-aged children, and their psychometric properties were similar to versions from other countries. In addition, two sleep quality indicators measured by actigraphy were moderately correlated with the parents' report diary.

In the Spanish version, the allocation of items to subscales by using principal component analysis differs substantially from the original one, which also occurred in the validation for other cultures (Silva *et al.* 2014). Our analysis extracted 10 factors, and although some items in this factor model were grouped in the same subscale as the original questionnaire, some subscales of this factor model included items from up to three different original CSHQ subscales, and this arrangement was apparently less congruent than the original version's item distribution. Also in the scree plot we observed that a model with fewer factors could work. Because in either of these two models the factorial arrangement was ruled not according to clinical entities, but using statistical criteria, and considering that this questionnaire is primarily a tool for clinical use, we finally decided to preserve the same structure as the original CSHQ, which is based on the International Classification of Sleep Disorders Paediatric Diagnoses (Thorpy 2012).

Considering the full sample, the total scale Cronbach's alpha (0.81) is above the recommended value of 0.70 (Streiner *et al.* 2015). Overall, also the internal consistency of the subscales was higher than those reported in community samples from the United States, Portugal or Germany, and similar to the sample from Israel, except for the subscales 'Bedtime Resistance' (0.65) and 'Daytime Sleepiness' (0.60). Thus, the reliability of the Spanish version of the CSHQ could be considered adequate.

Test-retest reliability analysis for subscales showed that both coefficients, Pearson and intraclass correlation, achieved similar or higher values than the original ones, and were analogous to those from other studies.

The small sample size could be behind the lack of precision of the confidence intervals of estimations of polyserial correlation coefficients between sleep habits and ActiSleep indicators. Moreover, recent studies found that actigraphy significantly overestimated nighttime wake minutes (Meltzer *et al.* 2012); thus, we can speculate whether in our study most of the awakenings recorded by actigraphy could be because of the high sensitivity of the accelerometer, and therefore these correlation coefficients might be underestimated. Other studies also have observed relatively low correlations between the corresponding questionnaire and actigraphic sleep measures (Sadeh 2004). Finally, the association estimated between sleep length recorded in the sleep diary by parents and accelerometer data was moderate (0.54) indicating that the CSHQ-SP is a good instrument for assessing some quantitative sleep parameters such as the nighttime sleep. Discrepancies with other studies might be attributed to the ACT setting instructions, because some sleep-related movements might not had been recorded at frequencies higher than 30 hertz.

Our study has some limitations. First, this study was limited to children aged 4 to 7 years; thus, we should be cautious regarding the validity and reliability of the Spanish version of the CSHQ to other age groups, although the sample was heterogeneous in geographic and socioeconomic characteristics. And because it is a cross-sectional study, we cannot ensure that the results will be maintained over time. Finally, we must realize that translation or cultural background might influence the performance of the CSHQ, and therefore we cannot exclude nor confirm that differences found by factor analysis may, at least in part, be because of the translation or cultural differences.

In conclusion, the Spanish version of CSHQ questionnaire shows acceptable psychometric properties and could be considered a valuable sleep-screening measure for both clinical and research uses.

Key messages

- This is the first study to evaluate the psychometric properties of the Spanish version of the Children's Sleep Habits Questionnaire (CSHQ-SP).
- The CSHQ-SP shows adequate psychometric properties and similar characteristics than versions from other countries.
- The CSHQ-SP could be used in primary care clinical practices to improve the screening of the current sleep disorders in children and, in this way, to treat these disorders early, thereby avoiding their significant impact on the children daily functioning.

Conflict of interest

The authors did not report any potential conflicts of interest.

Acknowledgements

We thank to all schools, families and pupils for their enthusiastic participation in the study.

This study was funded by the Ministry of Economy and Competitiveness-Carlos III Health Institute and FEDER funds (FIS PI12/02400 and FIS PI12/00761). Additional funding was obtained from the Research Network on Preventative Activities and Health Promotion (Ref. -RD12/0005/0009). The authors did not report any potential conflicts of interest.

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