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Children's Sleep Habits Questionnaire – Infant Version☆

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Abstract

Objectives: This study proposed a version of the Children's Sleep Habits Questionnaire for infants under 12 months (CSHQ-I).
Methods: The sample was comprised of 299 infants, aged between 2 weeks and 12 months.
Results: Exploratory factor analysis revealed four subscales: Bedtime Resistance, Sleep Anxiety, Positive Sleep Habits, and Daytime Sleepiness. The CSHQ-I total scale presented good test-retest reliability and internal consistency. The CSHQ-I also showed good concurrent validity, with significant associations found between the CSHQ-I total scale and subscales and a measure of infant sleep-wake behaviors.
Conclusions: The present study suggested the CSHQ-I as a reliable instrument to assess sleep problems in infants during the first year of life.
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Questionário de Hábitos de Sono das Crianças – Versão de Neonatos

Resumo

Objetivos: Este estudo propôs uma versão do Questionário de Hábitos de Sono das Crianças para bebês com menos de 12 meses (CSHQ-I).
Métodos: Amostra composta de 299 bebês, com idades entre duas semanas e 12 meses.
Resultados: A análise fatorial exploratória revelou quatros subescalas: Resistência em ir para a Cama, Ansiedade do Sono, Hábitos de Sono Positivos e Sonolência Diurna. A escala completa do CSHQ-I apresentou boa confiabilidade teste-reteste e consistência interna. O CSHQ-I também mostrou boa validade concorrente, com associações significativas encontradas entre a

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escala completa e subescalas do CSHQ-I e uma medida de comportamentos de sono-vigília dos bebés.

Conclusões: O presente estudo sugeriu o CSHQ-I como um instrumento confiável para avaliar os problemas de sono em bebés durante o primeiro ano de vida.

Introduction

Infant sleep problems are one of the most prevalent concerns of parents and clinicians, and 15% to 35% of Western children present a sleep problem during the first years.[1–3] The most common problems include frequent night wakings and resistance to initiate sleep.[4–6] Co-sleeping/bed-sharing and lack of parental agreement regarding infant sleep management are also reported by parents as sleep problems.[5] Moreover, studies suggested that sleep problems in early childhood tend to persist throughout life.[1,5,7]

The Children's Sleep Habits Questionnaire (CSHQ) was designed to identify sleep problems based on the International Classification of Sleep Disorders (ICSD-1).[8] The CSHQ psychometric characteristics were analyzed in preschool- and school-aged children, showing acceptable/good psychometric characteristics in several countries,[8–12] including Portugal.[13] Eight subscales were proposed: Bedtime Resistance, Sleep-onset Delay, Sleep Duration, Sleep Anxiety, Night Wakings, Parasomnias, Sleep-Disordered Breathing, and Daytime Sleepiness.[8] The CSHQ was also suggested as a useful tool to assess sleep problems in children aged from 2 to 5.5 years, with the same eight subscales.[14]

The CSHQ has been used in several studies to assess children's and infants' sleep problems.[15–20] In a study with 4-month-old infants (n = 184), a factor analysis of the CHSQ found two subscales.[18] The first subscale contained items related with resisting sleep, and was termed Sleep Resist; the second subscale, labeled as Sleep Anxiety, included items related with anxiety about being alone. Although this study analyzed the factor structure of this instrument, to the best of the authors' knowledge the CSHQ psychometric characteristics were not fully explored in infants under 1 year of age and there is no validated version of the CSHQ for infants.

Other measures have been used to assess infant sleep problems. The Infant Sleep Questionnaire (ISQ)[21] and the Brief Infant Sleep Questionnaire (BISQ)[22] are some of the validated instruments. However, these instruments do not base infant sleep problems in a standardized classification system of sleep disorders.

A version of the CSHQ for infants will allow clinicians to identify sleep problems at an early age, based in a standardized classification system of sleep disorders, and allow researchers to conduct longitudinal studies on infant sleep problems development. This study proposed a version of the CSHQ for infants (CSHQ-I), based on the CSHQ version for preschool- and school-aged children. The reliability of the items of the CSHQ-I was also analyzed in infants aged 0–3 months, 3–6 months, and 6–12 months.

Methods

Participants

The sample was comprised of 299 infants aged between 2 weeks and 12 months whose mothers completed the CSHQ.[8] Participants took part in a larger longitudinal study. Sample characteristics are presented at Table 1.

From the 299 mothers that completed the CSHQ at least once when their child was aged between 2 weeks and 12 months, 217 completed the questionnaire when the infant was aged between 2 weeks and 3 months (2–12 weeks, M = 5.08, SD = 3.58), 204 when the infant was between 3 and 6 months (13–25 weeks, M = 14.78, SD = 2.49), and 177 when the infant was between 6 and 12 months (26–52 weeks, M = 28.82, SD = 4.86). The CSHQ was completed in two time-points by 103 mothers (34.4%), and by 98 mothers (32.78%) in three time-points.

No associations were observed between the infants whose mothers completed the CSHQ in the three time-points and the infants whose mothers completed the CSHQ only at one or two time-points regarding socio-demographic characteristics, except for gestational age ($\chi^2[1] = 5.15$, $p = 0.023$). The group that completed the CSHQ in three time-points presented a higher rate of full-term infants (gestational age ≥ 37 weeks).

Procedures

This study received previous approval from the Ethical Commissions of all the institutions involved. At the third trimester of pregnancy, 583 women were contacted at two public hospitals in the Northern Portugal, informed about the purposes and procedures of the study, and invited to participate. Women who were not able to read or write Portuguese, multiple births, and with gestational complications were excluded from the study (7.7%). Those who agreed to participate (90.5%) signed an informed consent form.

The CSHQ was sent by email or post to the mothers when their infants were aged 2 weeks, 3 months, 6 months, and 12 months. From the 487 mothers who agreed to participate and signed the informed consent, 299 (61.4%) completed the CSHQ.

The authors of the CSHQ were contacted and after to their permission, the scale was translated into

Table 1 Socio-demographic characteristics.

	0–3 months n = 217 %	3–6 months n = 204 %	6–12 months n = 177 %	Total N = 299 %
Mother				
Age at childbirth				
18–25	14.4	10.9	13.1	13.2
26–34	65.6	66.3	69.3	66.9
35–44	20.0	22.8	17.6	19.9
Ethnicity				
Caucasian	91.2	92.3	93.4	91.8
Other	8.8	7.7	6.6	8.2
Marital status				
Married/cohabiting	82.3	83.7	86.4	83.1
Single/divorced/widow	17.7	16.3	13.6	16.9
Occupational status				
Employed	74.0	73.3	76.1	73.0
Unemployed/household/student	26.0	26.7	23.9	27.0
Years of schooling				
<9	5.2	3.0	1.7	4.8
9–12	34.3	35.8	33.9	35.4
>12	60.6	61.2	64.4	59.9
Pregnancy and delivery				
Time of gestation				
<37	1.9	3.0	3.4	3.4
≥37	98.1	97.0	96.6	96.6
Resuscitation at birth				
No	91.6	91.1	90.4	90.5
Yes	8.4	8.9	9.6	9.5
Type of delivery				
Vaginal	64.5	64.9	66.7	63.6
Caesarean	33.5	35.1	33.3	36.4
Infant				
Gender				
Female	49.8	48.0	45.8	46.8
Male	50.2	52.0	54.2	53.2
Weight				
<2500 g	0.9	1.0	2.8	1.7
≥2500 g	99.1	99.0	97.2	98.3
Length				
<48 cm	21.9	22.3	22.6	22.4
≥48 cm	78.1	77.7	77.4	77.6
First born				
Yes	85.6	87.2	89.3	86.9
No	14.4	12.8	10.7	13.1
Sleep arrangement at 3 months				
Bed-sharing	13.7	12.7	15.0	12.8
Solitary sleeping	86.3	87.3	85.0	87.2

European Portuguese by two independent Portuguese native and English fluent-speaking researchers. The two researchers discussed the translation and another Portuguese native and English fluent-speaking researcher performed a back-translation. The three researchers discussed the back-translation and consensus was reached through discussion.

Sleep habits were recorded according to their frequency in a four-point Likert scale: usually (for behaviors occurring five to seven times in a week), sometimes (for behaviors

occurring two to four times a week), rarely (for behaviors occurring zero to one time a week), and not applicable (for behaviors that do not apply to infant's age). Following the authors' instructions, ten items were reverse scored to sum a total score indicative of more sleep problems and to avoid social desirability.

Measures

The CSHQ

The CSHQ[8] is a retrospective questionnaire where parents report their children's sleep habits and behaviors in a typical week, enclosing 48 items scored in a three-point Likert scale: usually, sometimes, and rarely. Higher scores in the CSHQ indicate more sleep problems. Parents also indicate children's evening bedtime, morning wake-up time, and total sleep duration.

CSHQ concurrent validity

To assess the concurrent validity of the CSHQ-I, the Infant Sleep Chronogram[23] was used. The Infant Sleep Chronogram was designed for parents to record infant sleep-wake behaviors over a 24-hour period, in a timeline comprised of 30-minute periods from 8 a.m. one day to 8 a.m. the next day. ''Daytime'' was defined as 8 a.m. to 8 p.m., and ''nighttime,'' as 8 p.m. to 8 a.m. Based on the mothers' records, the following variables were coded for the 24-hour period, day, and night: sleep hours, awake hours, awakenings, latency to sleep, and longest sleep period. 24-hour period sleep, awake hours, and awakenings were coded by the sum of the day and night, while the longest sleep period during the 24-hour period was coded using the longest sleep period in the whole day. Latency to sleep was coded by the average number of hours the infant took to fall asleep for each sleep period during the 24-hour period, both day and night. The Infant Sleep Chronogram presented an acceptable internal consistency.[23]

Data analysis

Analyses were performed using SPSS (IBM SPSS Statistics for Windows, Version 23.0. NY, USA). To examine the CSHQ-I factor structure, exploratory factor analysis (principal axis factoring analysis with orthogonal rotation [varimax]) was performed. Following recommendations, items with a factor loading <0.30 were removed.[24] To analyze test-retest reliability, Pearson's correlations were performed between the total scale and subscales 0–3 months and 3–6 months and between 3–6 months and 6–12 months. This analysis was performed in the sample that completed the CSHQ-I in the three time-points. To assess the CSHQ-I (total scale and subscales) internal consistency, analyses of Cronbach's alpha coefficient, item-subscale correlation, and mean item correlation were performed. Following recommendations, good internal consistency was considered when the Cronbach's alpha was >0.70, the item-subscale correlation was >0.30, and the mean inter-item correlation was >0.15.[24] To examine the CSHQ-I concurrent validity, Pearson's correlations between the CSHQ-I (total scale and subscales) and the Infant Sleep Chronogram were performed. These analyses were performed in the sample that completed the CSHQ

at least one time. A random selection was performed to ensure the inclusion of participants in only one assessment and group equivalence.

Results

Factor analysis was performed and, after removing items with factor loadings <0.30, 33 items remained. Bartlett's test of sphericity revealed significant correlations and indicated data adequacy for principal component analyses (χ^2[528] = 2588.23, $p < 0.001$). The Kaiser–Meyer–Olkin for measuring sample adequacy was 0.71. Four factors were generated, accounting for 35.3% of the total variance. The first factor contributed with 10.5% of the total variance and contained loadings for 12 items measuring Bedtime Resistance; the second factor contributed with 10.5% of the total variance and contained loadings for ten items measuring Sleep Anxiety; the third factor contributed with 8.2% of the total variance and contained loadings for six items measuring Positive Sleep Habits; and the fourth factor contributed with 6.4% of the total variance and contained loadings for five items measuring Daytime Sleepiness (Table 2 and Fig. 1).

The CSHQ-I test-retest reliability

The CSHQ-I total scale scores were positively correlated between 0–3 months and 3–6 months ($r = 0.641$, $p < 0.001$), and between 3–6 months and 6–12 months ($r = 0.732$, $p < 0.001$). The subscales Bedtime Resistance, Sleep Anxiety, and Positive Sleep Habits scores were also positively correlated between 0–3 months and 3–6 months (r range = 0.482–0.558, all $p < 0.001$) and between 3–6 months and 6–12 months (r range = 0.430–0.735, all $p < 0.001$). The subscale Daytime Sleepiness scores were positively correlated between 3–6 months and 6–12 months ($r = 0.229$, $p = 0.023$), but not between 0–3 months and 3–6 months ($r = 0.084$, $p = 0.410$).

The CSHQ-I internal consistency

The CSHQ-I total scale presented a Cronbach's alpha of 0.78. The Cronbach's alphas for the subscales were: Bedtime Resistance ($\alpha = 0.77$), Sleep Anxiety ($\alpha = 0.66$), Positive Sleep Habits ($\alpha = 0.58$), and Daytime Sleepiness ($\alpha = 0.52$). Over half of the items (60.6%) presented an item-subscale correlation >0.30, and the mean item correlation of all subscales was >0.15 (Table 2).

The CSHQ-I intercorrelations

All subscales scores were significantly correlated with the CSHQ-I total scale score: Bedtime Resistance, Sleep Anxiety, and Daytime Sleepiness were positively correlated with the total scale ($r = 0.890$, $p < 0.001$; $r = 0.619$, $p < 0.001$; and $r = 0.210$, $p < 0.001$, respectively), while Positive Sleep Habits was negatively correlated with the total scale, ($r = -0.540$, $p < 0.001$). Almost all subscales were significantly correlated: Bedtime Resistance was positively correlated with Sleep Anxiety, ($r = 0.437$, $p < 0.001$), and negatively correlated with Positive Sleep Habits,

Table 2 CSHQ-I factor analysis – factor loadings, communalities, mean item correlation, item-subscale correlation, and alpha if item was deleted.

Item	Factor loadings				C	MIC	ISC	α if item deleted
	1	2	3	4				
Bedtime Resistance ($\alpha = 0.77$)						0.389		
Child falls asleep within 20 min after going to bed	−0.433				0.570		0.391	0.76
Child falls asleep alone in own bed	−0.649				0.491		0.488	0.75
Child falls asleep with rocking or rhythmic movements	0.701				0.492		0.491	0.75
Child needs parent in the room to fall asleep	0.623				0.441		0.412	0.76
Child resists going to bed at bedtime	0.587				0.500		0.569	0.74
Child struggles at bedtime (cries, refuses to stay in bed, etc.)	0.547				0.462		0.526	0.75
Child sleeps too little	0.473				0.423		0.488	0.75
Child sleeps the right amount	−0.337				0.426		0.410	0.76
Child moves to someone else's bed during the night (parent, brother, sister, etc.)	0.380				0.263		0.386	0.76
Child awakes more than once during the night	0.411				0.247		0.368	0.77
Child returns to sleep without help after waking	−0.357				0.203		0.262	0.77
Child wakes up very early in the morning	0.398				0.278		0.246	0.78
Sleep Anxiety ($\alpha = 0.66$)						0.341		
Child is afraid of sleeping in the dark		0.602			0.390		0.360	0.62
Child is afraid of sleeping alone		0.704			0.521		0.519	0.59
Child is restless and moves a lot during sleep		0.355			0.189		0.265	0.67
Child snores loudly		0.457			0.237		0.308	0.64
Child seems to stop breathing during sleep		0.491			0.335		0.391	0.62
Child has trouble sleeping away from home (visiting relatives, vacation)		0.361			0.143		0.220	0.65
Child awakens during night screaming, sweating, and inconsolable		0.600			0.490		0.516	0.61
Child awakens alarmed by a frightening dream		0.327			0.194		0.265	0.64
Child wakes up in negative mood		0.379			0.218		0.306	0.63
Child seems tired		0.315			0.162		0.258	0.65
Positive Sleep Habits ($\alpha = 0.58$)						0.326		
Child goes to bed at the same time at night			0.717		0.530		0.466	0.46
Child needs special object to fall asleep (doll, special blanket, etc.)			0.618		0.211		0.217	0.58
Child is ready to go bed at bedtime			0.413		0.504		0.448	0.47
Child sleeps around the same amount each day			0.408		0.320		0.252	0.56
Child wakes up by himself			0.637		0.316		0.291	0.56
Child has a good appetite in the morning			0.492		0.352		0.281	0.55
Daytime Sleepiness ($\alpha = 0.52$)						0.330		
Child falls asleep in parent's or sibling's bed				0.538	0.333		0.273	0.50
Child grinds teeth during sleep (your dentist may have told you this)				0.496	0.246		0.226	0.52
Adults or siblings wake up child				0.433	0.240		0.299	0.50
Child has difficulty getting out of bed in the morning				0.633	0.474		0.363	0.44
Child takes a long time to become alert in the morning				0.677	0.522		0.487	0.30
Removed items								
Child sleeps too much	0.055	0.243	0.072	0.160	0.093			
Child awakens once during the night	−0.096	−0.064	0.188	0.193	0.086			
Child wakes up with alarm clock	0.049	−0.038	0.169	−0.056	0.035			
Child naps during the day	−0.279	0.208	0.216	0.147	0.189			
Child suddenly falls asleep in the middle of active behavior	0.158	0.143	−0.032	0.169	0.075			

	Frequent emente (5-7)	Por vezes (2-4)	Rarame nte (0-1)	Não se aplica
Hora de deitar				

O meu filho deita-se sempre a mesma hora da noite
O meu filho adormece na cama dele
O meu filho adormece na cama dos irmãos
O meu filho adormece ao ser embalado ou com movimentos ritmados
O meu filho precisa do objecto especial dele para adormecer (boneca, cobertor especial…)
O meu filho precisa de um dos pais para adormecer
O meu filho está pronto para ir para a cama quando chega a hora de deitar
O meu filho resiste quando chega a hora de deitar
O meu filho faz birra quando chega a hora de deitar (chora, recusa-se a ficar na cama…)
O meu filho tem medo de dormir no escuro
O meu filho tem medo de dormir no escuro sozinho

Comportamento do Sono

Preencha o que o seu filho costuma dormir por dia: dias da semana _____horas e _____ minutos
(incluindo o que dorme durante a noite e sestas): fins de semana _____ horas e _____ minutos

O meu filho dorme muito pouco
O meu filho dorme o suficiente
O meu filho dorme mais ou menos o mesmo tempo todos os dias
O meu filho fica irrequieto e mexe-se muito durante a noite
O meu filho muda para a cama de outra pessoa durante a noite (pais, irmão, irmão…)
O meu filho range os dentes durante o sono (o seu dentista pode já lhe ter dito isto)
O meu filho faz muito barulho ao ressonar
O meu filho parece parar de respirar enquanto dorme
O meu filho tem problemas em dormir fora de casa (em casa de
O meu filho acorda durante a noite a gritar, transpirar e inconsolável
O meu filho desperta com um sonho assustador

Despertar Durante a Noite

O meu filho desperta mais do que uma vez durante a noite
O meu filho volta a adormecer sem ajuda depois de despertar
Anote aproximadamente a quantidade de minutos que o seu filho fique desperto durante a noite: _____

Despertar Matinal

Preencha aproximadamente a hora a que o seu filho costuma despertar: dias da semana _____fins-de-semana _____

O meu filho acorda sozinho
O meu filho acorda mal disposto
Algum adulto ou irmão acorda o meu filho
O meu filho tem dificuldade em levantar-se da cama de manhã
O meu filho demora muito tempo até despertar por completo de manhã
O meu filho acorda muito cedo de manhã
O meu filho tem apetite de manhã

Sonolência durante o Dia

O meu filho parece cansado

Figure 1   CSHQ-I for infants aged 0–12 months (33 items).

($r = -0.242$, $p < 0.001$); and Sleep Anxiety was positively correlated with Daytime Sleepiness, ($r = 0.252$, $p < 0.001$). No correlations were observed between Bedtime Resistance and Daytime Sleepiness, between Sleep Anxiety and Positive Sleep Habits, and between Positive Sleep Habits and Daytime Sleepiness.

The CSHQ-I concurrent validity

The CSHQ-I (total scale and subscales) and the Infant Sleep Chronogram were assessed for correlation (Table 3).

The CSHQ-I total scale was negatively correlated with sleep hours during the 24-hour period and during the night, longest sleep period during the 24-hour period and during the night, and awakenings during the day; it was positively correlated with awake hours during the 24-hour period and during the night, latency to sleep during the 24-hour period and during the day, and awakenings during the night. Moreover, it was marginally correlated with latency to sleep during the night. The Bedtime Resistance subscale was negatively correlated with sleep hours during the 24-hour period, during the day, and during the night; longest sleep period during the 24-hour period and during the night; and awakenings during the day. It was positively correlated with awake hours during the 24-hour period, during the day, and during the night; latency to sleep during the 24-hour period, during the day, and during the night; and awakenings during the night. The Sleep Anxiety subscale was negatively correlated with sleep hours during the 24-hour period. Positive Sleep Habits subscale was negatively correlated with sleep hours during the day, awake hours during the night, awakenings during the night; it was positively correlated with sleep hours during the night,

Table 3 CSHQ-I concurrent validity – correlations with the Infant Sleep Chronogram.

	CSHQ total	Bedtime Resistance	Sleep Anxiety	Positive Sleep Habits	Daytime Sleepiness
24-hour period					
Sleep hours	−0.358[a]	−0.423[a]	−0.124[b]	0.084	−0.042
Awake hours	0.260[a]	0.320[a]	0.099	−0.018	0.052
Awakenings	0.038	0.013	−0.002	−0.104[d]	−0.064
Latency to sleep	0.142[b]	0.162[c]	0.030	−0.063	−0.007
Longest sleep period	−0.357[a]	−0.334[a]	−0.077	0.313[a]	−0.019
Day and night					
Sleep day	−0.087	−0.172[c]	−0.078	−0.162[c]	−0.011
Sleep night	−0.404[a]	−0.405[a]	−0.088	0.292[a]	−0.047
Awake day	0.038	0.117[b]	0.072	0.195[c]	0.022
Awake night	0.343 [a]	0.335[a]	0.058	−0.274[a]	0.050
Awakenings day	−0.169[c]	−0.187[c]	−0.097	0.036	−0.055
Awakenings night	0.188[c]	0.165[c]	0.074	−0.182[c]	−0.048
Latency to sleep day	0.166[c]	0.174[c]	0.058	−0.099[d]	0.014
Latency to sleep night	0.106[d]	0.130[b]	0.031	−0.011	0.036
Longest sleep period day	−0.019	−0.057	−0.096	−0.042	0.059
Longest sleep period night	−0.352[a]	−0.330[a]	−0.070	0.313[a]	−0.026

[a] $p < 0.001$.
[b] $p < 0.05$.
[c] $p < 0.01$.
[d] $p < 0.10$.

awake hours during the day, longest sleep period during the 24-hour period and during the night. Furthermore, it was marginally correlated with awakenings during the 24-hour period, and latency to sleep during the day.

Internal consistency of CSHQ-I for 0–3 months, 3–6 months, and 6–12 months

In infants aged 6–12 months, the CSHQ-I total scale presented a Cronbach's alpha of 0.82. The Cronbach's alphas for subscales were: Bedtime Resistance ($\alpha = 0.79$), Sleep Anxiety ($\alpha = 0.74$), Positive Sleep Habits ($\alpha = 0.45$), and Daytime Sleepiness ($\alpha = 0.41$). The mean scores for infants aged 6–12 months were: total scale ($M = 13.08$, SD = 7.62), Bedtime Resistance ($M = 6.77$, SD = 4.76), Sleep Anxiety ($M = 1.66$, SD = 2.32), Positive Sleep Habits ($M = 8.85$, SD = 2.11), and Daytime Sleepiness ($M = 0.44$, SD = 0.88). In infants aged 3–6 months, the CSHQ-I total scale presented a Cronbach's alpha of 0.78. Two items (''Child falls asleep in parent's or sibling's bed'' and ''Child grinds teeth during sleep [your dentist may have told you this]'') were removed as they presented no variance in the response, and 31 items remained. The Cronbach's alphas for the subscales were: Bedtime Resistance ($\alpha = 0.77$), Sleep Anxiety ($\alpha = 0.65$), Positive Sleep Habits ($\alpha = 0.40$), and Daytime Sleepiness ($\alpha = 0.54$). The mean scores for infants aged 3–6 months were: total scale ($M = 13.43$, SD = 7.04), Bedtime Resistance ($M = 7.00$, SD = 4.76), Sleep Anxiety ($M = 1.52$, SD = 2.01), Positive Sleep Habits ($M = 8.27$, SD = 2.08), and Daytime Sleepiness ($M = 0.24$, SD = 0.67). In infants aged 0–3 months, the CSHQ-I total scale presented a Cronbach's alpha of 0.72. The Cronbach's alphas for subscales were: Bedtime Resistance ($\alpha = 0.68$), Sleep Anxiety ($\alpha = .57$), Positive Sleep Habits ($\alpha = 0.61$), and Daytime Sleepiness ($\alpha = 0.46$). The mean scores for infants aged 0–3 months

were: total scale ($M = 15.77$, SD = 6.25), Bedtime Resistance ($M = 7.64$, SD = 4.12), Sleep Anxiety ($M = 1.27$, SD = 1.74), Positive Sleep Habits ($M = 6.62$, SD = 2.57), and Daytime Sleepiness ($M = 0.35$, SD = 0.78).

Discussion

This study proposed the adaptation of the CSHQ for infants aged up to 12 months. Results showed that, generally, the CSHQ-I is a reliable measure to assess sleep problems in infants in this age. Four subscales were proposed, contrary to the CSHQ version for preschool- and school-aged children, where eight factors emerged from a conceptual grouping of items.[8] In the CSHQ-I, Bedtime Resistance, Sleep Anxiety, and Daytime Sleepiness subscales were maintained and a new subscale, Positive Sleep Habits, was proposed.

Compared with the CSHQ version for preschool- and school-aged children,[8] the Bedtime Resistance subscale maintained four of the six items and added the subscales Sleep Onset Delay and Night Wakings, and items of the subscale Sleep Duration. This subscale appears to cover the most prevalent problems presented from infancy to preschool age: bedtime resistance and frequent night wakings.[4,6] These sleep problems are considered in the diagnostic category of Behavioral Insomnia of Childhood (BIC) proposed in the ICSD-2, which is characterized by difficulties in the initiation and maintenance of sleep,[25] and the items of the CSHQ-I appear to cover the two types of BIC.[25] While the item ''Child falls asleep with rocking or rhythmic movements'' could be included in the sleep-onset association type, the item ''Child resists going to bed at bedtime'' could be encompassed in the limit-setting type.

Compared with the CSHQ version for preschool- and school-aged children, the Sleep Anxiety subscale maintained three of the four items and included items from

the subscales Parasomnias, Sleep-Disordered Breathing, and Daytime Sleepiness. Despite maintaining the majority of the items, this subscale also included the previous subscales Sleep-Disordered Breathing and Parasomnias, which are not proposed as separate subscales in the CSHQ-I. Moreover, three items of the Parasomnias subscale were removed in the CSHQ-I. This difference may be due to the age range of the infants, as Parasomnias and Sleep-Disordered Breathing are more common in preschool- and school-aged children.[26] However, some symptoms of these problems appear to be already present during the first year of age.

The Positive Sleep Habits subscale included items from the subscales Bedtime Resistance, Sleep Duration, and Daytime Sleepiness, as well as three items that were removed from the CSHQ version for preschool- and school-aged children. This new subscale includes items related with bedtime and morning waking habits.

The Daytime Sleepiness subscale maintained three from the eight items and included one item from the Bedtime Resistance and one item from the Parasomnias subscales. The differences between the CSHQ version for preschool- and school-aged children and the CSHQ-I in the Daytime Sleepiness subscale may be due to the age differences. Daytime Sleepiness subscale items present mainly the daytime consequences resulting from sleep disorders.[8] Although in the first year infants achieve the developmental task of concentrating their sleep during the night, they still maintain sleep hours during the day,[24] and some of the items of Daytime Sleepiness subscale of the CSHQ version for preschool- and school aged children appear to not be applicable to infants.

The Bedtime Resistance and Sleep Anxiety subscales also presented similarities with the two factors presented in a study with infants.[18] The Bedtime Resistance subscale maintained eight items from Resist Sleep and Sleep Anxiety subscale maintained four items from Sleep Anxiety.[18] Two subscales (Positive Sleep Habits and Daytime Sleepiness) were added in the CSHQ-I.

The CSHQ-I total scale and subscales showed good test-retest reliability. Acceptable test-retest reliability was also showed in the CSHQ version for preschool- and school-aged children.[8] The CSHQ-I total scale presented good internal consistency, with a Cronbach's alpha >0.70; over half of the items presenting an item-subscale correlation >0.30, and a mean-item >0.15.[24] The Cronbach's alpha of the CSHQ-I is similar to the Portuguese, Indian, and Chinese,[9,10,13] and higher than the American and German versions for preschool- and school-aged children.[11,12] Cronbach's alpha of the CSHQ-I subscales ranged from 0.52 (Daytime Sleepiness) to 0.77 (Bedtime Resistance). Three subscales presented an internal consistency below the recommended 0.70.[24] The subscales Positive Sleep Habits and Daytime Sleepiness presented the lowest internal consistency. That could be explained by the lower number of items and the lower variance presented by these two subscales. This result suggests that both these subscales appear to not be accurate to assess sleep problems in a community sample. This is consistent with a previous study that showed higher internal consistency in clinical samples,[8] which could indicate that the CSHQ is more accurate in the assessment of clinical samples.

The CSHQ-I also showed good concurrent validity, with significant associations found with the Infant Sleep Chronogram. However, the subscale Daytime Sleepiness was not significantly correlated and the subscale Sleep Anxiety showed only one significant correlation. This result may suggest that these subscales are not as reliable as the other subscales to measure sleep problems in this age. Good concurrent validity was also observed in the Indian version of the CSHQ for preschool- and school-aged children.[8] Infant Sleep Chronogram refers to infant sleep-wake behavior in the previous 24 h, while the CSHQ-I refers to sleep habits in the previous week and all the characteristics of sleep-wake behavior occurring within a week could not be gathered with the Infant Sleep Chronogram. As both Infant Sleep Chronogram and CSHQ-I were based in parents' reports, it would be important to analyze concurrent validity of the CSHQ-I with a more objective measure (e.g., actigraphy) in future research.

Given that infant sleep-wake behavior presents different developmental changes during the first months of life,[23] the reliability of the items of the CSHQ-I was also analyzed in infants aged 0–3 months, 3–6 months, and 6–12 months. A good internal consistency was found for the three age ranges in the CSHQ-I total scale. However, most of the subscales for the three ages presented an internal consistency below the recommended 0.70,[24] suggesting that these subscales should be used with caution. Two items were found not to be suitable for infants aged 0–3 and 3–6 months, suggesting these items should be removed when applying the CSHQ-I in infants under 6 months.

Further studies are warranted in order to assess CSHQ-I psychometric properties in comparison with a more objective measure or with sleep problems definitions.

This study presents some limitations. The voluntary nature of participation might have biased the results. Significant differences were found between the mothers that completed the CSHQ in the three time-points and those who completed the CSHQ at only one or two time-points on gestational age. The sample also presented homogeneity, considering the low rate of preterm infants, non-first-time infants, and infants with low birth weight and length.

This study provides the psychometric characteristics of the CSHQ-I, suggesting this instrument appears to be useful for clinicians to assess sleep problems and to detect potential specific sleep difficulties in infants under 12 months. This study also provides preliminary guidelines for how to use this instrument in infants. However, some of the subscales appear to not be accurate in assessing sleep problems in a community sample and caution should be taken when using them.

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Conflicts of interest

The authors declare no conflicts of interest.

References

1. Byars KC, Yolton K, Rausch J, Lanphear B, Beebe DW. Prevalence, patterns, and persistence of sleep problems in the first 3 years of life. Pediatrics. 2012;129:e276–84.

2. Mindell JA, Meltzer LJ, Carskadon MA, Chervin RD. Developmental aspects of sleep hygiene: findings from the 2004 National Sleep Foundation Sleep in America Poll. Sleep Med. 2009;10:771–9.

3. Mindell JA, Sadeh A, Wiegand B, How TH, Goh DY. Cross-cultural differences in infant and toddler sleep. Sleep Med. 2010;11:274–80.

4. Mindell JA, Kuhn B, Lewin DS, Meltzer LJ, Sadeh A. Behavioral treatment of bedtime problems and night wakings in infants and young children. Sleep. 2006;29:1263–76.

5. Bayer JK, Hiscock H, Hampton A, Wake M. Sleep problems in young infants and maternal mental and physical health. J Paediatr Child Health. 2007;43:66–73.

6. Morgenthaler TI, Owens J, Alessi C, Boehlecke B, Brown TM, Coleman J Jr, et al. Practice parameters for behavioral treatment of bedtime problems and night wakings in infants and young children. Sleep. 2006;29:1277–81.

7. Lam P, Hiscock H, Wake M. Outcomes of infant sleep problems: a longitudinal study of sleep, behavior, and maternal well-being. Pediatrics. 2003;111:e203–7.

8. Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. Sleep. 2000;23:1043–52.

9. Li SH, Jin XM, Shen XM, Wu SH, Jiang F, Yan CH, et al. Development and psychometric properties of the Chinese version of Children's Sleep Habits Questionnaire. Zhonghua Er Ke Za Zhi. 2007;45:176–80.

10. Narendhran R, Bharti B, Malhi P. Children Sleep Habits Questionnaire (CSHQ): psychometric validation in Indian school children. Indian J Sleep Med. 2008;3:102–6.

11. Schlarb AA, Schwerdtle B, Hautzinger M. Validation and psychometric properties of the German version of the Children's Sleep Habits Questionnaire (CSHQ-DE). Somnologie (Berl). 2010;14:260–6.

12. Waumans RC, Terwee CB, Van den Berg G, Knol DL, Van Litsenburg RR, Gemke RJ. Sleep and sleep disturbance in children: reliability and validity of the Dutch version of the Child Sleep Habits Questionnaire. Sleep. 2010;33:841–5.

13. Silva FG, Silva CR, Braga LB, Neto AS. Portuguese Children's Sleep Habits Questionnaire – validation and cross-cultural comparison. J Pediatr. 2014;90:78–84.

14. Goodlin-Jones BL, Sitnick SL, Tang K, Liu J, Anders TF. The Children's Sleep Habits Questionnaire in toddlers and preschool children. J Dev Behav Pediatr. 2008;29:82–8.

15. Giannotti F, Cortesi F, Cerquiglini A, Vagnoni C, Valente D. Sleep in children with autism with and without autistic regression. J Sleep Res. 2011;20:338–47.

16. Holley S, Hill CM, Stevenson J. A comparison of actigraphy and parental report of sleep habits in typically developing children aged 6 to 11 years. Behav Sleep Med. 2010;8:16–27.

17. Souders MC, Mason TB, Valladares O, Bucan M, Levy SE, Mandell DS, et al. Sleep behaviors and sleep quality in children with autism spectrum disorders. Sleep. 2009;32:1566–78.

18. Hairston IS, Waxler E, Seng JS, Fezzey AG, Rosenblum KL, Muzik M. The role of infant sleep in intergenerational transmission of trauma. Sleep. 2011;34:1373–83.

19. Kelmanson IA, Adulas EI. Environmental characteristics and sleep in two-month-old infants. Klinische Padiatrie. 2003;216:259–63.

20. Kelmanson IA, Adulas EI. Massage therapy and sleep behaviour in infants born with low birth weight. Complement Ther Clin Pract. 2006;12:200–5.

21. Morrell JM. The Infant Sleep Questionnaire: a new tool to assess infant sleep problems for clinical and research purposes. Child Psychol Psychiatry Rev. 1999;4:20–6.

22. Sadeh A. A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. Pediatrics. 2004;113:e570–7.

23. Figueiredo B, Dias CC, Pinto T, Field T. Infant sleep-wake behaviors from two weeks, to three and six months. Infant Behav Dev. 2016;44:169–78.

24. Field A. Discovering statistics using SPSS. London: SAGE Publications; 2005.

25. American Academy of Sleep Medicine. International Classification of Sleep Disorders. 2nd ed. Westchester, IL: American Academy of Sleep Medicine; 2005.

26. Hoban TF. Sleep disorders in children. Ann N Y Acad Sci. 2010;1184:1–14.