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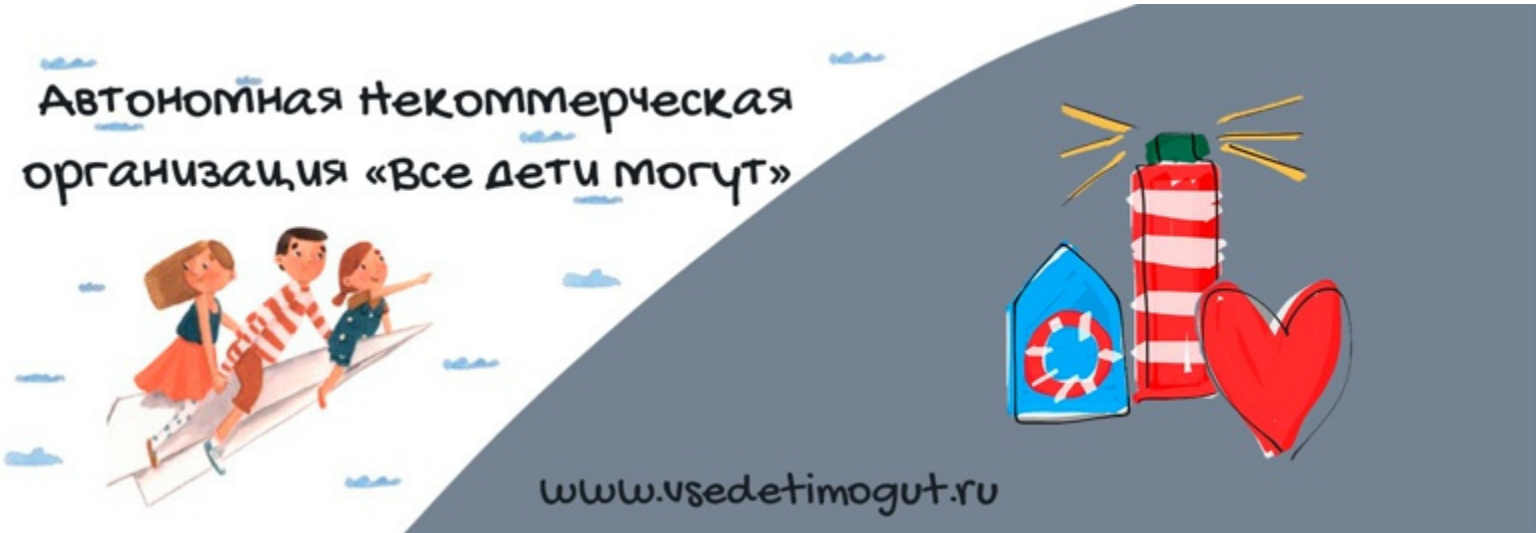

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The Children's Sleep Habits Questionnaire (CSHQ): Psychometric Properties of A Survey Instrument for School-Aged Children

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Study Objectives: To present psychometric data on a comprehensive, parent-report sleep screening instrument designed for school-aged children, the Children's Sleep Habits Questionnaire (CSHQ). The CSHQ yields both a total score and eight subscale scores, reflecting key sleep domains that encompass the major medical and behavioral sleep disorders in this age group.
Design: Cross-sectional survey.
Setting: Three elementary schools in New England, a pediatric sleep disorders clinic in a children's teaching hospital.
Participants: Parents of 469 school-aged children, aged 4 through 10 years (community sample), and parents of 154 patients diagnosed with sleep disorders in a pediatric sleep clinic completed the CSHQ.
Interventions: N/A
Measurements and Results: The CSHQ showed adequate internal consistency for both the community sample (=0.68) and the clinical sample (=0.78); alpha coefficients for the various subscales of the CSHQ ranged from 0.36 (Parasomnias) to 0.70 (Bedtime Resistance) for the community sample, and from 0.56 (Parasomnias) to 0.93 (Sleep-Disordered Breathing) for the sleep clinic group. Test-retest reliability was acceptable (range 0.62 to 0.79). CSHQ individual items, as well as the subscale and total scores were able to consistently differentiate the community group from the sleep-disordered group, demonstrating validity. A cut-off total CSHQ score of 41 generated by analysis of the Receiver Operator Characteristic Curve (ROC) correctly yielded a sensitivity of 0.80 and specificity of 0.72.
Conclusions: The CSHQ appears to be a useful sleep screening instrument to identify both behaviorally based and medically-based sleep problems in school-aged children.
Key words: Sleep habits; sleep survey; sleep disorders; pediatrics

INTRODUCTION

IN CONTRAST TO WHAT IS KNOWN ABOUT SLEEP HABITS AND SLEEP DISTURBANCES IN INFANTS AND TODDLERS[1-4] AND IN PRESCHOOL-AGED CHILDREN,[5-7] relatively few studies have addressed these issues in latency-aged children.[8-10] Those studies which have examined sleep behavior in middle childhood[11-13] have employed a variety of different interviews, brief questionnaires, and sleep survey instruments, many of which do not have reliability and validity data reported. This has led to considerable difficulties in comparing results across studies. Few of the sleep survey methods used in school-aged children examine both behaviorally-based (Limit Setting Sleep Disorder, Sleep Onset Association Disorder, etc.) and medical (Obstructive Sleep Apnea, Narcolepsy, etc.) sleep disorders, and most have not been formulated according to any of the standardized systems for categorization of clinical sleep disorders such as is contained in the *International Classification of Sleep Disorders (ICSD)* manual.[14] Finally, the definition of a sleep "disturbance" vs. a sleep "behavior" in these studies has been based on often arbitrary thresholds set by the authors and have not included parental definitions of sleep problems in the context of the individual family.

We present preliminary reliability and validity data on a parent-report sleep screening survey specifically

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designed for school-aged (4 years through 10 years) children, the Children's Sleep Habits Questionnaire (CSHQ). The design of the CSHQ is based on common clinical symptom presentations of the most prevalent pediatric *International Classification of Sleep Disorders* diagnoses.[14]

METHODS

Participants

The community sample population consisted of 1099 students aged 4—10 years inclusive, enrolled in three public elementary schools, each of which was comprised of grades kindergarten through fourth grade. The three schools were in a predominantly white, middle-income, English-speaking suburban school district in Southeastern New England and were selected both on the basis of accessibility and as representative of a typical suburban community school system. Participants from each of the three schools were surveyed separately during one of three periods during the school year (Spring, Fall, Winter), in order to minimize potential seasonal differences in sleep habits. Sixty parents also responded voluntarily to a request for test-retest completion of the survey approximately two weeks later.

Of the total of 1099 questionnaire packets mailed, 520 questionnaires were not returned; there were 54 refusals, and 10 subjects moved (response rate = 46.9%). Twenty-six 11-year-old children were eliminated because of the decision to restrict the sample age distribution in order to minimize possible pubertal influences on sleep. Twenty children were excluded from the final sample because of a parent-reported history of having been diagnosed with a psychiatric condition (such as ADHD or depression) that could impact on sleep onset or night wakings and/or were receiving medication with likely effects on sleep, such as psychostimulants, anticonvulsants, or antihistamines. The final sample consisted of 469 children. The mean age of the sample was 7.6 years ± 1.5 years. There were 240 boys (51.2%) and 229 girls (48.8%).[15] Socioeconomic status was determined using the Hollingshead Form Index of Social Status[15] which is based on occupation and education. The mean Hollingshead SES score was 45.5 (SD=11.3).

The clinical population consisted of 154 patients consecutively diagnosed with a behavioral sleep disorder, a parasomnia or sleep-disordered breathing in a pediatric sleep disorders clinic in a children's teaching hospital in Southeastern New England. The data was collected over a four year period due to presentation rates of the specific diagnostic entities in the selected age group. Patients were divided into the three primary diagnostic groups following an extensive evaluation in the sleep clinic. In addition, the diagnosis of Obstructive Sleep Apnea Syndrome (OSAS) in all patients in the sleep disordered breathing group was confirmed by standard one-night in-hospital polysomnographic (PSG) evaluation, including EEG monitoring for sleep staging, using a cut-off respiratory disturbance index of >1 to define OSA.[16] The mean age of the clinical sample was 6.8 years (SD=1.7 yr.). There were 91 boys (59.1%) and 63 girls (40.9%). The mean Hollingshead SES score was 33.0 (SD=13.8).

The characteristics of the three clinical sample diagnostic groups were as follows: Behavioral Sleep Disorders group (n=43) (including Limit Setting Sleep Disorders, Sleep Onset Association Disorder, and Adjustment Sleep Disorder); 22 M, 21 F; mean age = 6.6 years (SD=1.6); Parasomnias group (n=45) (including Sleepwalking, Night Terrors and Confusional Arousals); 25 M, 20 F; mean age = 7.1 years (SD=1.7); and Sleep-Disordered Breathing group (n=66); 44 M, 22 F; mean age = 6.7 years (SD=1.7).

MEASURE

The Children's Sleep Habits Questionnaire (CSHQ). The CSHQ is a retrospective, 45-item parent questionnaire that has been used in a number of studies to examine sleep behavior in young children.[17-19] The CSHQ includes items relating to a number of key sleep domains that encompass the major presenting clinical sleep complaints in this age group: bedtime behavior and sleep onset; sleep duration; anxiety around sleep; behavior occurring during sleep and night wakings; sleep-disordered breathing; parasomnias; and morning waking/daytime sleepiness. Parents are asked to recall sleep behaviors occurring over a "typical" recent week. Items are rated on a three-point scale: "usually" if the sleep behavior occurred five to seven times/week; "sometimes" for two to four times/week; and "rarely" for zero to one time/week. Some items were reversed in order to consistently make a higher score indicative of more disturbed sleep.

Reduction of Sleep Variables. For the purposes of further psychometric evaluation analysis, some of the CSHQ items were eliminated as redundant or ambiguous, and the remaining 35 were conceptually grouped into eight subscales reflecting the following sleep domains: 1) Bedtime Resistance, 2) Sleep Onset Delay, 3) Sleep Duration, 4) Sleep Anxiety, 5) Night Wakings, 6) Parasomnias, 7) Sleep-Disordered Breathing, 8) Daytime Sleepiness. Total Sleep Disturbance score included all items of the eight subscales, but consisted of only 33 items because two of the items on the Bedtime Resistance and Sleep Anxiety subscales were identical. Items contained in each of the subscales are listed in Table 1.

Statistical Analysis. The subscales were assessed for internal consistency using Cronbach's ∝-coefficients. Means and standard deviations of each item in the subscales and the total subscale scores are listed in Table 1. Test-retest reliability was calculated using Pearson's corre-

Table 1—Unadjusted Means, Standard deviations for individual items and subscales, N, F values, Test-retest, and Alpha coefficients for the Subscales of the CSHQ

Subscale Item	Control Sample Mean	SD	N	Clinic Sample Mean	SD	N	F	df	Z	Control Test-retest r[c]	Control Test-retest N	Control α	Control N	Clinic α	Clinic N
1. Bedtime Resistance	7.06	1.89	382	9.43	3.49	128	65.74	3, 506	--	0.676**	56	0.70	441	0.83	142
Goes to bed at same time	1.18	0.53	402	1.30	0.57	130			3.57	0.163	60	---	---	---	---
Falls asleep in own bed	1.21	0.57	400	1.52	0.81	129			5.10	0.335	58	---	---	---	---
Falls asleep in other's bed	1.21	0.52	401	1.48	0.76	129			4.53	0.580	59	---	---	---	---
Needs parent in room to sleep	1.17	0.48	390	1.57	0.82	129			6.67	0.886	58	---	---	---	---
Struggles at bedtime	1.13	0.41	392	1.70	0.86	130			9.50	0.265	58	---	---	---	---
Afraid of sleeping alone	1.19	0.49	388	1.85	0.91	128			9.60	0.597	59	---	---	---	---
2. Sleep Onset Delay Falls asleep in 20 minutes	1.25	0.53	403	1.80	0.88	128			7.58	0.620**	60	---	---	---	
3. Sleep Duration	3.41	0.93	398	4.94	1.98	122	102.68	3, 516		0.400	60	0.69	459	0.80	137
Sleeps too little	1.21	0.42	400	1.78	0.86	127			7.69	0.420	60	---	---	---	---
Sleeps the right amount	1.13	0.43	400	1.73	0.84	124			9.73	0.452	60	---	---	---	---
Sleeps same amount each day	1.07	0.34	398	1.42	0.63	125			8.84	0.062	60	---	---	---	---
4. Sleep Anxiety	4.89	1.45	374	7.09	2.44	119	114.13	3, 489		0.790**	56	0.63	432	0.68	132
Needs parent in room to sleep	1.17	0.48	390	1.57	0.82	129			6.67	0.886	58	---	---	---	---
Afraid of sleeping in the dark	1.38	0.68	387	2.08	0.87	129			9.23	0.585	59	---	---	---	---
Afraid of sleeping alone	1.19	0.49	388	1.85	0.91	128			9.60	0.597	59	---	---	---	---
Trouble sleeping away	1.17	0.44	386	1.56	0.79	120			6.10	0.551	58	---	---	---	---
5. Night Wakings	3.51	0.89	384	5.69	1.60	120	278.99	3, 500		0.634**	56	0.54	437	0.44	135
Moves to other's bed in night	1.17	0.44	392	1.76	0.82	126			9.58	0.584	59	---	---	---	---
Awakes once during night	1.31	0.55	393	2.13	0.76	121			11.45	0.682	58	---	---	---	---
Awakes more than once	1.03	0.16	385	1.86	0.83	126			15.19	0.018	57	---	---	---	---
6. Parasomnias	8.11	1.25	371	11.22	2.53	117	229.21	3, 484		0.618**	57	0.36	425	0.56	132
Wets the bed at night	1.12	0.43	380	1.30	0.61	125			4.48	1.000	58	---	---	---	---
Talks during sleep	1.22	0.44	393	1.72	0.77	127			7.97	0.392	58	---	---	---	---
Restless and moves a lot	1.37	0.58	390	2.26	0.83	127			11.30	0.572	59	---	---	---	---
Sleepwalks	1.04	0.22	384	1.36	0.65	128			8.76	1.000	58	---	---	---	---
Grinds teeth during sleep	1.25	0.52	386	1.50	0.70	124			5.07	0.668	57	---	---	---	---
Awakens screaming, sweating	1.02	0.12	385	1.50	0.77	125			12.03	1.000	58	---	---	---	---
Alarmed by scary dream	1.10	0.30	389	1.53	0.73	126			8.72	0.858	60	---	---	---	---

Table 1 Continued—Unadjusted Means, Standard deviations for individual items and subscales, N, F values, Test-retest, and Alpha coefficients for the Subscales of the CSHQ

Subscale Item	Control Sample Mean	SD	N	Clinic Sample Mean	SD	N	F	df	Z	Control Test-retest r[c]	Control Test-retest N	Control α	Control N	Clinic α	Clinic N
7. Sleep Disordered Breathing [d]	3.24	0.63	382	4.71	2.54	17	35.57	3, 395		0.688**	58	0.51	439	0.93	18[b]
Snores loudly	1.19	0.44	392	1.84	0.92	126			8.28	0.463	58	---	---	---	---
Stops breathing	1.01	0.13	385	1.46	0.83	24			8.14	1.000	58	---	---	---	---
Snorts and gasps	1.05	0.27	384	1.41	0.80	17			3.41	0.816	58	---	---	---	---
8. Daytime Sleepiness	9.64	2.80	381	11.99	3.39	119	1.59[a]	3,149[b]		0.649**	56	0.65	437	0.70	134
Wakes by himself	1.76	0.87	398	1.65	0.78	129			0.69[b]	0.666	59	---	---	---	---
Wakes up in negative mood	1.32	0.50	396	1.74	0.70	128			7.25	0.536	58	---	---	---	---
Others wake child	1.95	0.78	398	2.05	0.80	128			0.94[b]	0.543	60	---	---	---	---
Hard time getting out of bed	1.46	0.64	395	1.63	0.77	128			2.47[b]	0.415	59	---	---	---	---
Takes long time to be alert	1.25	0.49	393	1.55	0.72	127			5.42	0.607	59	---	---	---	---
Seems tired	1.23	0.43	392	1.85	0.69	123			10.76	0.291	60	---	---	---	---
Watching TV	0.19	0.53	400	0.65	0.75	124			8.57	0.451	60	---	---	---	---
Riding in car	0.50	0.81	401	0.77	0.81	124			4.46	0.637	60	---	---	---	---

a All F values for the subscale scores were significantly different at $P<0.001$ except where there are "a" superscripts.
b Z=Mann-Whitney U-test; all are significantly different at $P<0.001$ level except for those with "b" superscript.
c Subscale correlations are Pearson's r values; Item-by-item correlations are Spearman's r values.
d The items on this subscale were changed toward the end of clinic data collection, which accounts for the low number of subjects.

*** = significant at the 0.001 level
** = significant at the 0.01 level
* = significant at the 0.05 level

lation coefficients for the subscale scores and Spearman's correlation coefficients for the item scores. Because the subscale scores were not normally distributed, the scores were log transformed and then a Bonferroni correction was applied to the item analyses in order to correct for multiple comparisons. The control and clinical samples were compared using an analysis of covariance (ANCOVA), covarying age and SES. Individual items were compared on the Mann-Whitney U-test because age and SES varied across the samples, we also divided the samples by age (four to seven years/eight to ten years) and SES (low/high) and calculated Mann-Whitney U-tests on the items for each subdivided sample. Because the statistically significant findings changed little using these subsamples, only the findings for the total sample are presented.

PROCEDURES

Control Sample

A packet containing informed consent forms; a brief survey regarding parents' education and occupation and any significant medical problems and/or medication for the child; and the Children's Sleep Habits Questionnaire, were sent home with the student to be completed by the parent/guardian. A second mailing and reminder were sent to all parents who had not returned the questionnaire within two weeks of the initial mailing. This procedure was approved by the hospital Institutional Review Board as well as the town's school board. We were unable to obtain information on non-responders because of school board request for anonymity.

Clinical Sample

Patients referred to a pediatric sleep disorders clinic received the CSHQ in the mail to complete prior to the clinic appointment. Parents brought the CSHQ to their appointment at the sleep clinic and the responses were reviewed with the parents by staff conducting the clinical interview.

RESULTS

Preliminary Analyses

The community and clinical samples did not differ by gender, $\chi 2$ (1,623) = 2.92, ns. The two groups did differ by age, t (621) = 5.47, $p<0.001$, with the community sample (M = 7.6 years, SD = 1.5 years), significantly older than the clinic sample (M = 6.8 years, SD = 1.7 years). The two groups also differed by SES, t (538) = 10.47, $p<0.001$, with the community sample (M = 45.5, SD = 11.3) having a higher SES score than the clinic sample (M = 33.0, SD = 13.8).

There was no difference between the three clinical subgroups by gender, $\chi 2$ (2,154)) = 2.92, ns; or age, F (2,151) = 1.14, ns. There was a significant difference on Hollingshead SES, F (2,132) = 6.76, $p<0.01$. Post hoc testing with Tukey HSD revealed that the Sleep-Disordered Breathing group (28.6±11.7) had a lower SES score than either the Behavioral (38.5±15.4) or Parasomnia (34.0±13.1) groups.

Internal Consistency

The internal consistency of the entire CSHQ was 0.68 for the community sample and 0.78 for the clinical sample. The alpha coefficients for the subscales are listed in Table 1. Alphas ranged from 0.36 to 0.70 in the community sample. Items were systematically dropped from each of the subscales, with the exception of sleep onset delay which has only one item, to determine if this improved internal consistency. For the community subjects, dropping items 2 (goes to bed same time) and 11(struggles at bedtime) from the Bedtime Resistance subscale only increased the alpha from 0.70 to 0.73. Dropping items from the Sleep Duration subscale lowered the alpha coefficient on the Sleep Duration subscale. Dropping items 12 (afraid of sleeping in dark) and 29 (trouble sleeping away) increased the alpha slightly from 0.63 to 0.65 on the Sleep Anxiety subscale; dropping single items only lowered the score. Dropping item 34 (awoken more than once) from the Night Wakings subscale increased the alpha from 0.54 to 0.55. If items 19 and 25 (bedwetting and teeth grinding) are eliminated from the Parasomnias subscale, the alpha coefficient improves from 0.36 to 0.45. Dropping item 26 (snores loudly) improved the alpha coefficient to 0.58 from 0.51 on the Sleep-Disordered Breathing subscale. Finally, on the Daytime Sleepiness subscale, dropping five items increased the alpha coefficient to 0.76 from 0.65 (wakes negative mood, takes long time to be alert, seems tired, falls asleep watching TV and riding in the car).

For the clinical sample, alpha coefficients ranged from 0.44 to 0.83. Dropping four items from the Bedtime Resistance subscale increased the alpha from 0.83 to 0.86; dropping item 18 (sleeps same amount) increased the Sleep Duration subscale alpha from 0.79 to 0.89; dropping items 12 and 29 raised the Sleep Anxiety subscale from 0.68 to 0.77; dropping item 33 (awakes once) increased the alpha on the Night Wakings subscale from 0.44 to 0.48; dropping item 19 from the Parasomnias subscale increased the alpha from 0.56 to 0.61; and dropping the five items (Above) increased the alpha on the Daytime Sleepiness subscale from 0.70 to 0.80. Dropping items did not change the alpha coefficient on the Sleep-Disordered Breathing subscale.

Test-Retest Reliability

Test-retest reliability was assessed in a volunteer sample of 60 parents from the community sample who responded to a request to complete a second rating of the CSHQ at a

Table 2—Intercorrelation matrix among CSHQ subscales for both control (N = 469) and clinical (N = 154) samples

	1	2	3	4	5	6	7	8
1. BEDTIME RESISTANCE	-	.397	.170	.203	.430	.228	.813	.372
2. SLEEP DURATION	.431	-	.292	.262	.410	.626	.345	.495
3. PARASOMNIA	.212	.133	-	-.160	.396	-.325	.229	-.003
4. SDB	.126	.057	.202	-	-.270	-.001	.153	-.176
5. NIGHT WAKINGS	.337	.239	.340	.016	-	-.057	.460	.266
6. DAYTIME SLEEPINESS	.152	.156	.127	.182	-.029	-	.264	.519
7. SLEEP ANXIETY	.629	.250	.186	.066	.284	.081	-	.316
8. SLEEP ONSET DELAY	.140	.265	.119	.080	.126	.163	.035	-

two-week interval. The Pearson's correlations for three subscales and the Spearman's rank order correlations for each of the items are presented in Table 1. The correlations for the subscales ranged from 0.62 to 0.79, which is an acceptable level. T-tests between the subscales for the two administrations were all non-significant.

Interrelationships Among Subscales

The correlation matrix for each of the subscales of the CSHQ was calculated separately for the community and clinical samples. As can be seen at least in part in Table 2, because the two subscales had two items in common, bedtime resistance and sleep anxiety for both the clinical (r =0.81) and community (r =0.63) samples were the most highly correlated subscales. When these two items were dropped and correlations were recalculated, the coefficients dropped in both the clinical (r = 0.42) and community (r = 0.19) samples. In general, the intercorrelations among the subscales were higher for the clinical sample than the community sample.

Distribution of CSHQ Total Scores

The total scores for the community sample ranged from 6 to 83 (M = 56.2, SD = 8.9). For the clinical sample, the total scores ranged from 7 to 114 (M = 68.4, SD = 13.7). An effect size of 1.06 was calculated, suggesting this difference was clinically significant. Fifty-six percent (56%) of the clinical group had scores one standard deviation above the mean of the community sample. The distributions of the community and clinical samples are displayed in Figure 1. There was also a significant difference between the three clinical groups on the total CSHQ score, $F(2,143) = 5.44$, $p < .01$. Post-hoc tests revealed that the Behavioral Sleep Disorders group (M=74.4, SD = 9.7) had significantly higher scores in the CSHQ than either the Parasomnias (M=66.3), SD = 12.9) or Sleep-Disordered Breathing (M=66.1, SD = 16.4) groups. Effect size calculations indicated that the differences between the Behavioral Sleep Disorders Group and the Parasomnia and Sleep-Disordered Groups were moderate to large (d= .61, d = .70, respectively). There was a larger percentage of children in both the Parasomnia and Sleep-Disorder Breathing groups (60.9%) that had total CSHQ scores below the clinical sample mean of 68.4 compared to the percentage in the Behavioral Sleep Disorders group (27.5%).

Sleep Duration

The only item not listed on Table 1 is the number of hours of sleep per night. The mean (weekday) sleep duration as reported by parents in the community sample was 10.16 hours ± 44.48 minutes (median = 10 hours), with a range from 7 to 14.0 hours. This broad range is somewhat misleading in that there were several outliers at both ends of the distribution. Age and sleep duration were significantly but modestly negatively correlated ($r = -0.17$, $p<0.01$) in the control sample.

In the clinical sample, the mean weekday sleep duration reported by parents was 9.4 hours±3 hours (median = 10 hours) with a range from 3.5 to 14.0 hours. Age and sleep duration were not significantly related in the clinical sample, (r=-0.01, ns). An ANCOVA comparing two groups and covarying age and SES revealed the clinical sample slept significantly less than the community sample $F(3,520)=104.36$, $p<0.0001$.

Validity

Validity was investigated by comparing the clinical sample to the community sample for each of the items and the subscales of the CSHQ. Due to the large number of comparisons, statistical significance was set at $p<0.001$ for the individual items based on a Bonferroni correction. Each of the items was compared across groups using a Mann-Whitney U-test analysis. As can be seen in Table 1, the clinical group had higher (worse) scores than the community group on all items with the exception of item 38 (wakes by self). For 30 out of 33 items, the difference was statistically significant at the $p<0.001$. Only three items on the Daytime Sleepiness subscale were not significant at the $p<0.001$ level.

ANCOVAS, covarying age and SES, indicated that the

clinical sample had significantly higher (worse) scores than the community group (P<0.001) on all subscales (see Table 1). There was also a significant difference between the clinical (M = 68.4, SD = 12.1) and the control (M = 56.2, SD = 8.6) groups on the total score of the CSHQ, after controlling for age and SES, $F(3,531)=136.56$, $p<0.0001$.

Because there were age differences between the clinical and community samples, the Mann-Whitney U-tests were repeated separately for younger (four to seven year olds) and older (eight to ten year olds) samples. The findings were identical in the younger sample. There were four additional nonsignificant differences between the clinical and community samples: goes to bed at the same time, falls asleep in other's bed, falls asleep riding in car, and wets the bed at night. The sample was also divided using a median split on SES and Mann-Whitney U-tests repeated for high and low SES samples. The result were identical to the entire sample.

The three clinical groups were also compared on the subscales of the CSHQ using an analysis of variance. Statistically significant differences were found on all subscales with post hoc testing indicating that differences were in the predicted direction. For the Bedtime Resistance subscale, $F(2,139)=11.11$, $p<0.0001$, the Behavioral group had significantly higher scores than both the Sleep-Disordered and Parasomnias groups. The same pattern was also true for Sleep Duration, $F(2,139)=14.07$, $p<0.0001$, Sleep Anxiety, $F(2,131)=7.25$, $p<0.001$, and Sleep Onset subscales, $F(2,140) = 45.27$, $p<0.0001$. As expected, the Parasomnias group had higher scores on the Parasomnias subscale, $F(2,129) = 7.91$, $p<0.001$, than the other two groups. The Sleep-Disordered Breathing group has significantly higher scores than the other two clinical groups on the Sleep Disordered-Breathing subscale, $F(2,15) = 54.61$, $p<0.0001$. There was a smaller number of subjects for this latter analysis because two of the three items on this subscale were added to the scale towards the end of the study. However, on the snoring item of the subscale which had complete data, the Sleep-Disordered Breathing group had higher scores than the other two clinical groups. On the Night Wakings subscale, the Sleep-Disordered Breathing group had higher scores than both the Behavioral and the Parasomnias group, $F(2,132)=9.67$, $p<0.0001$. On the Daytime Sleepiness subscale, the Sleep-Disordered Breathing had higher (worse) scores than the Parasomnias group.

Sensitivity and specificity were examined using the Receiver Operator Characteristic (ROC) curve.[20] The estimated prevalence score of 40% for sleep problems was based on previous survey data in school-aged children.[10,21-23] These studies have reported a combined prevalence of bedtime struggles and night wakings of between 25% and 35% and an overall prevalence of "sleep" difficulties of 43%.[22] A cut-off score which maximized sensitivity was sought based on the belief that it was more important to avoid false negatives than false positives. The cut-off score with the best diagnostic confidence, as determined by the intersect point of sensitivity and specificity, was 41, which corresponded to the upper 23.2% of the control group's CSHQ total score. Using the cut-off score of 41, sensitivity was calculated at 0.80 and specificity at 0.72. This score correctly identifies 80% of the clinical group.

DISCUSSION

This paper reports the psychometric properties of a sleep screening questionnaire designed primarily for surveying sleep habits and sleep disturbances in community populations. The distribution of scores for the total score and the subscales suggest that these scores have an acceptable range of variability. Based on the criterion of 0.70,[24] the internal consistency coefficients of the entire scale are near (0.68) or above (0.78), acceptable standards for the community and clinical samples, respectively. There was a wider range of internal consistency coefficients among the subscales, with the alpha coefficients of the subscales for the clinical sample higher than those for the community sample. The subscales with the highest internal consistency coefficients in the clinical sample were Sleep Duration, Bedtime Resistance, Daytime Sleepiness and Sleep Anxiety. The stability of the CSHQ was demonstrated by acceptable test-retest reliability coefficients.

The subscale-to-subscale correlations were strongest in the clinical sample and highest between bedtime resistance and sleep anxiety, sleep duration and daytime sleepiness, and daytime sleepiness and sleep onset delay. Similarly, in the community sample, sleep duration and bedtime resistance, and sleep anxiety and bedtime resistance, were most highly correlated. These subscale intercorrelations suggest that the CSHQ taps the relatively distinct sleep behaviors described in the sleep medicine literature. That is, daytime sleepiness, bedtime resistance, sleep anxiety, sleep duration, and even the sleep onset delay subscales are related, although there may be different underlying sleep disorders causing these sleep symptoms. However, the other subscales—parasomnias, sleep disordered breathing, and night wakings—represent other types of sleep problems. It is important to note that in order to achieve subscales with greater discriminatory power between subscales, more items per subscale would be necessary. We feel that the brevity of the CSHQ is a strength, however, and thus we have chosen to keep the scale at its current length.

The validity of the CSHQ was demonstrated by the ability of the items, subscales, and total score of the CSHQ to consistently differentiate non-sleep disordered children from those seeking an evaluation due to a suspected sleep disorder, although there was overlap in the distribution of scores. Given the high prevalence of sleep problems reported in the literature[6,7,10] in children of a similar age distri-

bution to those in the community sample, it is not surprising that we found this overlap. The broad range of CSHQ scores of both the clinical and community samples reflects this overlap; in addition, because the construction of the subscales on the CSHQ is weighted toward items pertaining to difficulties with initiating and maintaining sleep, the total CSHQ scores tend to be scored (higher) for those children in either sample with behavioral sleep disorders. When the clinical group was subdivided into different sleep disorders, the subscales differed across the three clinical groups in the predicted directions, suggesting the scale has utility within clinical populations. Within the community sample, as previously reported, CSHQ total and subscale scores did not differ significantly by gender or SES, but there was a higher frequency of reported bedtime struggles and night wakings in younger compared to older (grades 3 and 4) children.[23]

We elected to group items together conceptually according to presenting symptom constellations rather than to rely on a statistical procedure to derive empirically related subscales. There have been a few factor analytic studies published in the literature to date of similar children's sleep scales. For example, a factor analysis of the Children's Sleep Behavior Scale,[25] using a community sample, resulted in five factors characteristic of parasomnias, bedtime resistance, activity during sleep, sleep anxiety, and positive affect. These factors did not correspond very well to clinical diagnostic categories. The Sleep Disturbance Scale for Children[11] has a factor structure closer to the clinical categories of disorders of initiating and maintaining sleep, sleep disordered breathing, disorders of arousal/nightmares, sleep wake transition disorders, disorders of excessive somnolence, and sleep hyperhydrosis. Although this factor analysis seems more clinically useful than that derived from the CSBS, the categories are rather broad when compared to the conceptually derived subscales presented here.

It should be noted that the CSHQ is designed primarily to be a screening tool. The sleep domains reflected in seven of the CSHQ subscales do parallel symptom constellations associated with *ICSD* (revised) classifications that represent the most common sleep disorders in this age group: Dyssomnias—Intrinsic and Extrinsic Sleep Disorders, including Sleep Onset Association Disorder, Limit Setting Sleep Disorder, Adjustment Sleep Disorder and Inadequate Sleep Hygiene, and Circadian Rhythm Sleep Disorders, including Delayed Sleep-Phase Syndrome, (CSHQ Subscales, Bedtime Resistance, Sleep Onset Delay, Sleep Duration, Sleep Anxiety and Night Wakings); Parasomnias; Obstructive Sleep Apnea (CSHQ Subscale, Sleep-Disordered Breathing). The Daytime Sleepiness Subscale reflects the daytime consequences common to many of these disorders. However, it should be noted that the subscale labels were not intended to be diagnostic or to define the underlying etiology of the presenting sleep symptoms. The items on the Sleep Anxiety Subscale, for example, could be associated with sleep onset delay related to such diagnostic entities as a circadian phase delay, nightmares, or a more generalized anxiety disorder, among others. The utility of the various subscale scores on the CSHQ is in both alerting the clinician of a potential sleep disorder and providing information that would serve as the starting point for a more detailed clinical evaluation. It is also important to note that clinical category systems for diagnosing childhood sleep disorders, including the *ICSD* classification, have yet to be sufficiently validated.

The limitations of this study must be considered in evaluating the suitability of this scale. As in any parent report measure, the role of both parental and retrospective bias in completing the scale must be considered. Despite data suggesting that parental report is reasonably accurate for identifying many types of sleep disturbances when compared to objective data such as actigraphy,[16] parents of older children, in particular, may not always be aware of any difficulties initiating and maintaining sleep. The survey was cross-sectional and asked only for the frequency of sleep behaviors over a week time period, which may have resulted in inaccurate assessments of the prevalence of more episodic sleep phenomena, such as sleepwalking or night terrors. In addition, the short time frame might have resulted in relative over-reporting of very transient sleep disturbances. However, the test-retest reliability results suggest that there was good consistency in the types and severity of sleep disturbances reported over at least a three-week period. The survey also did not significantly address possible irregularities in sleep-wake cycles related to differences in bedtimes on school vs. non-school nights. However, it would be important to specifically ask parents to clarify any discrepancies in using the survey in older children, in particular.

An additional limitation is the use of the 20 minute criteria for prolonged sleep onset latency, which may be an overly liberal definition for school-aged children. The validity of the CSHQ in the clinical setting, therefore, would be enhanced by the addition of a sleep log to some specifically delineate any sleep delay. Also, because of the importance of developmental factors in sleep disturbances, the results of this study may not be generalizeable to children older than the age range of the sample. We chose to limit the upper age range of the sample to 10 years in order to minimize the possible effects of pubertal changes on sleep behavior. More detailed results of the influence of age on sleep behavior from this study have been reported previously.[23] Finally, an additional limitation is that there may also have been children in the community sample who had undiagnosed sleep disorders.

The sensitivity and specificity analysis suggest that the CSHQ may have utility as a screening instrument for sleep

disorders in the clinical practice setting. Data from a recent survey of almost 500 pediatric health care providers[22] suggests that practicing physicians inadequately screen for sleep problems, especially in middle childhood. Thus, a brief parent-report survey such as the CSHQ could provide a relatively simple tool for identifying problematic sleep in the context of a well child encounter, for example. The eight CSHQ subscales roughly correspond to the most common presenting sleep complaints in pediatric practice —bedtime struggles; difficulty falling asleep, inadequate sleep, nighttime fears, sleepwalking/night terrors, night wakings, and difficulty getting up in the morning.[23] Although the CSHQ should not be used to make definitive sleep disorder diagnoses, both the cut-off total score and individual subscale score could be utilized to identify children with sleep disturbances, and highlight sleep domains which warrant further clinical evaluation. With that in mind, the cut-off was set at a level that maximized sensitivity and thus minimized false negatives. It should be noted, however, that because behavioral sleep disorders "drive" the CSHQ, even children with low total scores may have a sleep problem in a specific, "non-behavioral" (e.g., parasomnias) area. Therefore, it is important to examine the individual subscales in all children, regardless of the total score.

In summary, the CSHQ appears to be a useful sleep screening instrument to delineate sleep habits and identify problematic sleep domains in school-aged children. In particular, the CSHQ could be useful in identifying co-morbid sleep disturbances which might complicate the presentation of underlying medical or mental health concerns in children, including chronic illnesses such as juvenile rheumatoid arthritis,[24] and psychiatric diagnoses, such as attention deficit hyperactivity disorder.[25] Additional studies should address the use of the CSHQ in other populations, in order to provide further evidence of its utility in a variety of settings.

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