



Psychometric properties of a sleep questionnaire for use in individuals with intellectual disabilities

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ABSTRACT

We examined the psychometric properties of one part of the Sleep Questionnaire developed by Simonds and Parraga (SQ–SP; 1982), a questionnaire that is frequently used to explore sleep problems and behaviors related to sleep in individuals with intellectual disability (ID). The SQ–SP was completed for 345 individuals with ID (sleep clinic $n = 146$; control group $n = 103$; published studies $n = 68$; psychiatric clinic $n = 28$). Internal consistency was good (Cronbach's $\alpha = .80$) and test–retest reliability for the total SQ–SP score was also good (Spearman's rank correlation = .83, $p < .01$). Convergent validity was adequate ($r = .79$, $p < .001$) and concurrent validity was satisfactory ($r = .52$, $p < .001$). Exploratory factor analysis suggested a 5-factor structure (Snoring, Daytime sleepiness, Complaints related to sleep, Sleep apnea and Anxiety related to sleep). Internal consistency of the five factors ranged from modest (Cronbach's $\alpha = .57$) to good (Cronbach's $\alpha = .82$). Confirmatory factor analysis corroborated the 5-factor structure. The Composite Sleep Index, the total SQ–SP score and the factor scores on Daytime Sleepiness and Complaints related to sleep were able to differentiate the control group from the sleep clinic group. The SQ–SP appears to be a reliable and valid tool in assessing sleep and different types of sleep disturbance in individuals with ID.

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1. Introduction

Individuals with intellectual disability (ID) are at increased risk for developing sleep problems with reported prevalence rates from 15% to 85% of the samples (Didden & Sigafos, 2001). Prevalence of sleep problems is usually assessed by questionnaires. Two important limitations of assessing prevalence rates by questionnaires have to be considered. First, different questionnaires with unknown psychometric properties in individuals with ID are used across studies and more

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than half of the studies do not use standardized questionnaires to collect data. Second, about half of the studies use questionnaires that lack information on different types of sleep disturbances and solely address complaints about sleep (e.g., settling problems, night waking problems, daytime sleepiness) and as a result almost no prevalence rates are presented of types of sleep disturbances which are mentioned in the *International Classification of Sleep Disorders 2nd edition (ICSD-2; American Academy of Sleep Medicine – AASM, 2005)*. In the *ICSD-2* different types of sleep disturbances are subdivided in broad categories of sleep disorders such as Sleep Related Breathing Disorders, Circadian Rhythm Sleep Disorders, Parasomnias and Sleep Related Movement Disorders. Different types of sleep disturbances may reflect sleep disorders that could be the underlying cause of a presenting sleep problem (or complaint). Information on sleep disorders is necessary for treatment of a sleep problem (Wiggs & Stores, 2004).

Over the past decades several standardized questionnaires with items are based on the precursors of the *ICSD-2 (AASM, 2005)* have been developed in the field of pediatric sleep research. Examples of these multidimensional questionnaires addressing sleep in school-aged children and adolescents are the Sleep Questionnaire by Simonds and Parraga (SQ-SP; 1982), the Children's Sleep Behavior Scale (CSBS; Fisher, Pauley, & McGuire, 1989), the Sleep Disturbance Scale for Children (SDSC; Bruni et al., 1996), the Children's Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn, 2000) and the Behavioral Evaluation of Disorders of sleep (BEDS; Schreck, Mulick, & Rojahn, 2003). However, the SQ-SP was adapted for use in individuals with ID by Wiggs and Stores (1996) and at present the SQ-SP is the most often used standardized sleep questionnaire in sleep studies in individuals with ID (Brylewski & Wiggs, 1998; Didden, Korzilius, Aperlo, Overloop, & Vries, 2002; Didden, Korzilius, Smits, & Curfs, 2004; Hunt & Stores, 1994; Johnson, Wiggs, Stores, & Huson, 2005; Maas et al., 2008, 2009; Quine, 2001; Stores, Stores, & Buckley, 1996). Other questionnaires were used less often in individuals with ID, such as the CSHQ (Annaz, Hill, Ashworth, Holley, & Karmiloff-Smith, 2011; Breau & Camfield, 2011; Carter, McCaughey, Annaz, & Hill, 2008; Ghanizadeh & Faghih, 2011; Kronk, Dahl, & Noll, 2009; MacCrosain & Byrne, 2009), the SDSC (Bruni et al., 2004; Hartshorne et al., 2009), the BEDS (Conant, Thibert, & Thiele, 2009; Walz, Beebe, & Byars, 2005) and the CSBS (Sarimski, 1996).

Psychometric properties including the structure of the SDSC and BEDS were well examined in samples of children and adolescents without ID (Spruyt & Gozal, 2011), but it is unknown if these results may be generalized to samples of individuals with ID. Psychometric properties of the SQ-SP were examined to a lesser extent and were reported across one sample of individuals without ID (Simonds & Parraga, 1982) and two samples of individuals with ID (Hunt & Stores, 1994; Stores, Stores, Fellows, & Buckley, 1998). Test–retest reliability (after two weeks) for each of the items of the SQ-SP was high ($r = .83–1.0$) and the questionnaire was assumed to have face validity for children and adolescents without ID (Simonds & Parraga, 1982). Information obtained with the SQ-SP was found to correspond very closely to information obtained with sleep diaries kept by parents of children with ID who had Tuberous Sclerosis (Hunt & Stores, 1994). As for the structure, Stores et al. (1998a) performed exploratory factor analysis on the results of the SQ-SP in children with ID who had Down's syndrome and obtained three significant sleep factors: (a) Sleep onset problems, (b) Sleep maintenance problems and (c) Disordered breathing during sleep. This 3-factor structure has not been confirmed in other samples of individuals with ID. In other studies (Johnson et al., 2005; Maas et al., 2008, 2009; Stores, Wiggs, & Campling, 1998) targeting individuals with and without ID several items of the SQ-SP were grouped together to reflect five types of sleep disturbance encountered in clinical practice: (a) Poor quality sleep, (b) Anxieties about sleep, (c) Parasomnias, (d) Disordered breathing during sleep, and (e) Early waking. Until present, this structure has not been explored nor confirmed by factor analysis.

The purpose of this study is to demonstrate the reliability and the validity of the SQ-SP. First, reliability of the SQ-SP was examined by exploring internal consistency and test–retest reliability after three–four weeks. Second, convergent validity was explored by correlating total scores on the SQ-SP with total scores on the SDSC and concurrent validity was explored by correlating total scores on the SQ-SP with Composite Sleep Index scores. Third, an exploratory and confirmatory factor analysis was performed to define the factor structure of the SQ-SP and to evaluate if these factors fit into the types of sleep disturbance encountered in clinical practice and/or the sleep disorders mentioned in the *ICSD-2 (AASM, 2005)*. Finally, we assessed the degree to which the SQ-SP detected differences between individuals with ID from a control group and individuals referred to a sleep clinic.

2. Methods

2.1. Participants

The SQ-SP was completed for 345 individuals with ID and was completed by parents or professional caregivers of: (a) individuals who consulted the sleep clinic for individuals with ID ($n = 146$, 76 male, mean age = 11 years and 1 months, $SD = 10$ years and 6 months, range: 1 year and 3 months–66 years and 0 months), (b) individuals from a control group who attended a special day care center, special school or adult activity center for individuals with ID ($n = 103$, 64 male, mean age = 12 years and 10 months, $SD = 9$ years and 9 months, range: 1 year and 0 months–55 years and 8 months), (c) participants of two published studies ($n = 68$, 26 male, mean age = 11 years and 6 months, $SD = 8$ years and 1 month, range: 1 year and 7 months–47 years and 9 months; Maas et al., 2008, 2009), and (d) individuals who consulted a psychiatric clinic for children and adolescents with ID ($n = 28$, 21 male, mean age = 11 years and 5 months, $SD = 3$ years and 7 months, range: 5 years and 5 months–22 years and 5 months) (see Section 2.3 for information about recruitment).

Of the 345 participants, 187 participants (54%) were male and their mean age was 11 years and 8 months ($SD = 9$ years and 5 months, range: 1 year and 0 months–66 years and 0 months). Most participants (91%, $n = 309$) lived at home with their

parents and 23 participants (7%) lived in a group home or residential facility. Etiology of ID was known for 179 (52%) participants, including: (a) Down's syndrome ($n = 44$), (b) Jacobsen syndrome ($n = 35$), (c) Cri du Chat syndrome ($n = 29$), (d) Angelman syndrome ($n = 12$), (e) Prader–Willi syndrome ($n = 7$), (f) Rett syndrome ($n = 4$), (g) Smith Magenis syndrome ($n = 3$), (h) Williams syndrome ($n = 3$) and (i) Fragile X syndrome ($n = 2$) and (j) other ($n = 40$).

2.2. Materials

The SQ–SP was originally developed by Simonds and Parraga (1982) and was modified by Wiggs and Stores (1996, 2004) and consisted of five parts. Part one addresses demographic information (e.g., name and dosage of current medication and presence of seizure disorders). The second part covers current (i.e., last three months) behaviors related to settling to sleep, night waking and early waking. In part three, parents are asked to fill in at what times their child usually goes to bed, wakes up in the morning, among other topics related to the sleep pattern. The fourth part assesses the frequency of occurrence of 45 behaviors related to sleep (e.g., 'Bangs head in sleep or going off to sleep', 'Snore loudly during sleep', 'Doesn't want to go to bed because afraid') on a 7-point Likert-type scale, from 'Never' (1) to 'Daily' (7) (see Appendix A). The last part contains items about parents' impression of their child's current or past sleep problems, as well as treatment of the child's sleep problem. A total score on the SQ–SP could be retrieved on the basis of the sum of scores of 45 items in the part four. Three items were deleted because of insufficient reliability and as a result total score was calculated on the remaining 42 items (see Section 3.1.1) with a possible range from 42 to 294.

To assess concurrent validity the total score on the SQ–SP was compared with the Composite Sleep Index (CSI). The CSI is a construct that reflects the severity of sleep problems (Wiggs & Stores, 1998). The frequency of problems with settling, night waking, early waking and co-sleeping and the duration of settling and night waking were derived from the SQ–SP, resulting in the CSI index ranging from 0 to 12. A score of ≥ 4 is indicative of a severe sleep problem. A difference of 1 point on the CSI would suggest that an individual took more than 1 h to settle to sleep instead of 30–60 min.

To assess convergent validity the total score on the SQ–SP was compared with the total score on the Sleep Disturbance Scale for Children (SDSC). The SDSC (Bruni et al., 1996) consists of 26 items that are rated on a 5-point Likert-type scale, from 'Never' (1) to 'Always (daily)' (5). The scores of the items were summed to derive a total SDSC score with a possible range from 26 to 130. A total SDSC score of 39 has been reported to be a sensitive cut off to identify children with disturbed sleep (Bruni et al., 1996). Psychometric properties of the SDSC have been examined in two groups of children aged between 5 and 15 years without ID: (a) children referred to a sleep clinic, and (b) healthy control children from public schools (Bruni et al., 1996). Internal consistency of the total scale (Cronbach's $\alpha = .71$ for the sleep disordered group and Cronbach's $\alpha = .79$ for the control group) was adequate and test–retest reliability ($\rho = .71$) of the total scale was also adequate when administered to children with sleep disorders and healthy controls. Factor analysis explained 44% of the variance and yielded six factors: (a) Disorders of initiating and maintaining sleep, (b) Sleep breathing disorders, (c) Disorders of arousal, (d) Sleep–wake transition disorders, (e) Disorders of excessive somnolence, and (f) Sleep hyperhydrosis (Bruni et al., 1996).

2.3. Procedure

Sample recruitment procedures differed for the four groups (see Section 2.1). The parents or professional caregivers of the individuals from the sleep clinic completed the questionnaire as part of the assessment procedure. The parents of the individuals from control group were recruited via their child's day care center, special school or adult activity center. The parents of individuals participating in two published studies were recruited via the American 11q Research Group and the Dutch Cri du Chat Parent Association. The parents of the individuals from a psychiatric clinic were randomly selected by the director of the clinic.

All parents or professional caregivers received a questionnaire package by mail. Each package consisted of a covering letter, a questionnaire, a consent form and a stamped self-addressed envelope. Individuals for whom more than nine responses were missing or for whom more than four subsequent responses were missing on part four of the SQ–SP were excluded from this study.

2.3.1. Sleep clinic for individuals with ID

The SQ–SP was provided to parents or professional caregivers of 163 individuals referred to the sleep clinic by a pediatrician or physician specializing in people with ID during the period September 2005–July 2009. The SQ–SP was completed prior to an interview and no specific instructions were given on completion of the questionnaire. Seventeen individuals were excluded because of missing responses.

2.3.2. Control group

The SQ–SP was provided with a letter explaining the aim of the study (i.e., assessing the nature of sleep and prevalence of sleep problems in individuals with ID). Response rate of the control group was 119 out of 350 (34%). Parents or professional caregivers of six individuals refused to participate, one individual was a patient from the sleep clinic was therefore excluded and nine individuals were excluded because of missing responses.

2.3.3. Two published studies

The SQ–SP was provided with a letter explaining the aim of the study (i.e., assessing the nature of sleep and prevalence of sleep problems in individuals with a specific syndrome associated with ID; see Maas et al., 2008, 2009). Response rate was 50 out of 105 (48%) from individuals with chromosome 11q disorder (i.e., Jacobsen syndrome or other chromosome 11q disorder) and 30 out of 54 (55.5%) from individuals with in Cri du Chat syndrome. In this study data were reanalyzed and eleven individuals with chromosome 11q disorder and one individual with Cri du Chat syndrome were excluded because of missing responses.

2.3.4. Psychiatric clinic for children and adolescents with ID

The SQ–SP and the SDSC were provided with a letter explaining the aim of the study (i.e., assessing psychometric properties of the SQ–SP). One of the parents was asked to complete both the SQ–SP and the SDSC. To assess test–retest reliability three–four weeks after the completion of the first assessment, the same parent was asked to complete a second SQ–SP. Response rate of the first assessment was 30 out of 74 (41%). Parents of one individual refused to participate and one individual was excluded because of missing responses. Both the SQ–SP and the SDSC were completed for 23 out of 28 participants (82%). Response rate of the second assessment was 15 out of 28 (54%).

2.4. Statistical analyses

Cronbach's α coefficient and item-total correlation coefficients were calculated to assess internal consistency of part four of the SQ–SP. Cronbach's α coefficient was also calculated to assess internal consistency of five types of sleep disturbance encountered in clinical practice (see Section 1). Test–retest reliability for all items of part four of the SQ–SP was assessed by using percentage of exact and adjacent agreement and Spearman's rank correlation (because sample size was small, $n = 15$). Percentage of exact and adjacent agreement between the first and second assessment of the SQ–SP was calculated for each rater (parent or professional caregiver). Convergent validity of the SQ–SP was assessed by calculating Pearson correlation between total scores on the SQ–SP and total scores on the SDSC. Concurrent validity of the SQ–SP was assessed by calculating Pearson correlation between the total scores on the SQ–SP and the CSI. We expected that this correlation was neither 1.0 nor 0 (Cicchetti, 1994). Both the total score and the CSI measure aspects of sleep (therefore correlation not 0) but each measures different aspects of sleep (therefore correlation not 1.0). Exploratory factor analysis (EFA) was performed using SPSS (Version 15.0) and confirmatory factor analysis (CFA) was conducted with AMOS (Version 17.0). CFA was conducted to test competing theoretical structures and to assess which structure has the best empirical underpinning. To avoid excluding participants from the CFA because of one or a few missing items, missing values were substituted with median scores of all participants for that item. Differences on the SQ–SP between individuals from the control group and individuals referred to the sleep clinic were tested. Independent samples t -tests were performed to test differences on the CSI score and the total SQ–SP score between the groups. To test differences on factor scores between both groups Mann–Whitney tests were performed (because factor scores were not found to be normally distributed).

3. Results

3.1. Reliability

3.1.1. Internal consistency

See Table 1 for descriptive statistics on the items of part four of the SQ–SP. Reliability analysis was performed on item scores using 345 of the SQ–SP's completed by parents or professional caregivers. Missing data were excluded listwise and item 22 was deleted because of zero variance. Items 15 and 29 were deleted because of negative item-total correlations ($-.06$ and $-.04$). Cronbach's α for the SQ–SP was $.80$ ($n = 103$, 42 items), which indicates good reliability. Mean item-total correlation for the total scale was $.28$ ($SD = .14$) with a range from $.01$ to $.57$ (see Table 2). Cronbach's α did not significantly increase after deletion of single items.

Five types of sleep disturbances encountered in clinical practice were distinguished in other studies (see Section 1). Cronbach's α for Poor quality sleep (item 6, 24) was $.08$ ($n = 329$), Anxieties about sleep (item 14, 15, 16, 17, 18, 19) was $.45$ ($n = 294$), Parasomnias (item 1, 2, 3, 4, 12, 13) was $.27$ ($n = 282$) and Disordered breathing during sleep (item 8, 9, 10) was $.40$ ($n = 318$). Cronbach's α could not be calculated for Early waking (item 32). Reliability of each of the types of sleep disturbance was poor.

3.1.2. Test–retest reliability

The mean interval between the first and second assessment was 32.7 days ($SD = 3.0$, range: 27–38 days, $n = 15$). See Table 3 for percentages of exact and adjacent agreements and Spearman's rank correlation coefficients for each of the items of the SQ–SP. Mean percentage of exact agreement was 82 ($SD = 12.6$, range: 47–100) and mean percentage of adjacent agreement was 90 ($SD = 8.5$, range: 71–100), which indicates good test–retest reliability. Mean Spearman's rank correlation between the first and second assessment for the items was $.65$ ($SD = .29$, range: $-.19$ to 1.0), which indicates moderate test–retest reliability. Spearman's rank correlation between the first and second assessment for SQ–SP total score was $.83$ ($p < .01$, $n = 15$), which indicates good test–retest reliability.

Table 1
Descriptive statistics for items of part four of the Sleep Questionnaire.

Item	<i>n</i>	Mean (SD)
1	334	1.88 (1.55)
2	339	1.10 (0.62)
3	322	2.19 (2.01)
4	342	1.61 (1.60)
5	339	1.89 (1.93)
6	333	3.17 (2.53)
7	339	1.05 (0.43)
8	334	2.75 (2.21)
9	341	1.38 (1.16)
10	331	1.40 (1.30)
11	334	4.40 (2.87)
12	313	1.29 (0.86)
13	337	1.26 (0.98)
14	329	1.36 (1.18)
15	328	1.04 (0.38)
16	332	1.94 (2.02)
17	323	1.94 (2.13)
18	340	4.08 (2.92)
19	335	4.66 (2.84)
20	333	2.50 (2.57)
21	336	1.21 (0.93)
22	323	1.09 (0.66)
23	339	1.98 (1.94)
24	341	2.87 (2.21)
25	334	3.00 (2.69)
26	333	1.81 (1.94)
27	329	1.83 (1.83)
28	290	3.91 (2.68)
29	315	1.26 (0.90)
30	340	2.40 (2.22)
31	335	2.44 (2.21)
32	330	2.51 (1.98)
33	334	1.49 (1.48)
34	327	1.88 (1.81)
35	268	1.13 (0.70)
36	339	2.90 (2.39)
37	334	1.31 (1.14)
38	337	2.23 (2.08)
39	327	1.96 (1.96)
40	337	1.27 (1.04)
41	302	1.69 (1.72)
42	340	1.40 (1.09)
43	308	2.50 (2.32)
44	331	2.65 (2.24)
45	286 ^a	2.14 (1.85)

^a A part of the participants (*n* = 55) completed a version of the SQ–SP without item 45.

3.2. Convergent and concurrent validity

Pearson correlation between the total scores on the SQ–SP and the total scores on the SDSC was .79 ($p < .001$, $n = 23$), which indicates adequate convergent validity. Pearson correlation between the total scores on the SQ–SP and the CSI was .52 ($p < .001$, $N = 345$), which shows a moderate correlation.

3.3. Factor analysis

3.3.1. Exploratory factor analysis

An EFA to identify empirically driven subscales was conducted using 345 of the SQ–SP's completed by parents or professional caregivers. Missing data were deleted pairwise. Initial EFA, using a principal axis factoring analysis with oblimin rotation was conducted on 42 items, extracting five factors with Eigenvalues > 1.0 (explaining 30% of the variance). Fourteen items were subsequently eliminated, 7 due to low communalities ($< .10$), 4 due to low communalities and with a loading $< .30$ and 3 due to cross loadings (factor loadings $\geq .30$ and the difference between the highest and second highest factor loading $< .20$). Subsequently a principal axis factoring analysis with oblimin rotation was conducted on the remaining 28 items and revealed five factors, which we labeled as: (1) Snoring, (2) Daytime sleepiness, (3) Complaints related to sleep, (4) Sleep apnea, and (5) Anxiety related to sleep.

Table 2

Item-total correlations for each item of part four of the Sleep Questionnaire.

Item	<i>r</i>	Cronbach's α if item deleted
1	.27	.79
2	.28	.80
3	.30	.79
4	.24	.80
5	.39	.79
6	.41	.79
7	.13	.80
8	.53	.78
9	.31	.80
10	.13	.80
11	.24	.80
12	.29	.80
13	.26	.80
14	.22	.80
16	.22	.80
17	.09	.80
18	.07	.81
19	.23	.80
20	.34	.79
21	.14	.80
23	.08	.80
24	.34	.79
25	.14	.80
26	.01	.80
27	.28	.79
28	.34	.79
30	.38	.79
31	.17	.80
32	.34	.79
33	.17	.80
34	.37	.79
35	.05	.80
36	.57	.78
37	.20	.80
38	.57	.78
39	.43	.79
40	.25	.80
41	.43	.79
42	.43	.79
43	.23	.80
44	.36	.79
45	.36	.79

Together, these five factors explained 39% of the variance. Eigenvalues and percentages of variances explained for each factor and factor loadings for each item are described in Table 4. Cronbach's α for the first factor was .81 ($n = 239$, 7 items). Cronbach's α for Factor 2 was .71 ($n = 301$, 5 items), Factor 3 was .71 ($n = 261$, 9 items), Factor 4 was .82 ($n = 316$, 3 items) and Factor 5 was .57 ($n = 280$, 4 items). The internal consistency for Factors 1 and 4 was good, for Factors 2 and 3 adequate and for Factor 5 modest. The internal consistency for the final 28 items was Cronbach's $\alpha = .77$ ($n = 153$), which indicates adequate reliability.

3.3.2. Confirmatory factor analysis

A CFA was conducted to test the hypothesized structure based on empirical research (i.e., EFA) and clinical experience using 345 of the SQ-SP's completed by parents or professional caregivers. CFA was conducted with items which loaded most strongly (i.e., $\geq .40$) on the five factors derived from the final EFA (see Fig. 1). Correlations between the latent factors and a few error terms were allowed. Goodness-of-fit was determined by evaluating the ratio of C-MIN to degrees of freedom (C-MIN/df), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) and Root Mean Square Error of Approximation (RMSEA). For C-MIN/df, values of < 1.00 constitute good fit and values between 1.00 and 2.00 acceptable fit. For both GFI and AGFI, values $> .95$ constitute good fit and values $> .90$ acceptable fit. For the RMSEA values $< .06$ constitute good fit (Byrne, 2010).

The final confirmatory model with the five factors demonstrated an acceptable fit to the data: C-MIN/df = 1.48, GFI = .93, AGFI = .91, RMSEA = .04. A model with four factors (in which items of Factor 1 and Factor 4 were lumped together) led to a worse fit to the data, indicating discriminating validity of Factors 1 and 4.

3.4. Comparison of SQ-SP scores between control group and sleep clinic group

The SQ-SP scores for individuals from the control group were compared to the SQ-SP scores for individuals referred to the sleep clinic. Individuals who received medication related to sleep problems were excluded in both groups to rule out the

Table 3

Percentage of exact agreement, percentage of adjacent agreement and Spearman's rank correlation for each item of part four of the Sleep Questionnaire.

Item	<i>n</i>	EA (%)	AA (%)	Spearman's rank (<i>rho</i>)	<i>p</i> (two-tailed)
1	15	47	87	.82	<.001
2	15	87	93	1	<.001
3	15	87	93	-.07	.80
4	15	100	100	–	–
5	15	93	93	1	<.001
6	14	71	79	.69	<.01
7	15	100	100	–	–
8	15	60	80	.18	.51
9	15	100	100	–	–
10	15	100	100	–	–
11	15	87	100	.90	<.001
12	15	60	93	.39	.15
13	15	100	100	1	<.001
14	15	73	87	.75	<.01
16	15	73	73	.68	<.01
17	14	86	100	.93	<.001
18	15	73	87	.81	<.001
19	14	71	71	.64	.01
20	13	85	85	.76	<.01
21	15	100	100	–	–
23	15	87	93	.53	.04
24	15	73	93	.78	<.01
25	15	80	87	.82	<.001
26	15	80	80	.58	.02
27	15	87	93	.73	<.01
28	15	67	73	.67	<.01
30	15	73	80	.62	.01
31	13	77	100	.92	<.001
32	14	79	93	.39	.17
33	14	86	86	.99	<.001
34	15	80	87	.65	<.01
35	15	80	80	.59	.02
36	15	87	93	.49	.07
37	15	93	93	–	–
38	15	67	80	-.19	.49
39	15	87	93	–	–
40	14	100	100	–	–
41	15	80	93	.26	.35
42	15	93	100	.73	<.01
43	15	67	80	.82	<.001
44	15	73	87	.73	<.01
45	15	80	87	.36	.19

EA, exact agreement; AA, adjacent agreement.

A dash indicates that data could not be obtained because scores on this item were a constant at the first or the second assessment.

effect of treatment of sleep problems. Leaving 91 individuals from the control group (57 male, mean age = 13 years and 2 months, SD = 9 years and 11 months, range: 1 years and 0 months–55 years and 8 months) and 77 individuals from the sleep clinic ID (39 male, mean age = 12 years and 1 months, SD = 11 years and 10 months, range: 2 years and 0 months–66 years and 0 months). More individuals from the control group had been diagnosed with Down's syndrome (32%, $n = 29$) than in the sleep clinic group (13%, $n = 10$) and this difference was statistically significant ($\chi^2(1) = 8.34$, $p = .006$). Therefore, in both groups individuals with Down's syndrome were excluded from further analysis, leaving 62 individuals in the comparison group (36 male, mean age = 11 years and 1 month, SD = 7 years and 1 month, range: 3 years and 3 months–31 years and 6 months) and 67 individuals in the sleep clinic group (30 male, mean age = 12 years and 4 months, SD = 11 years and 10 months, range: 2 years and 8 months–66 years and 0 months). Results of a Mann–Whitney test showed that there was no statistically significant difference between the groups on age in months ($z = 0.01$, $p = .99$) and sex ($\chi^2(1) = 2.28$, $p = .160$). The groups were comparable by level of cognitive functioning ($p = .82$, two-tailed Fisher's exact test).

The mean CSI for the control group was 1.45 and 10 individuals (16%) had a score ≥ 4 (SD = 1.82, range: 0–7). The mean CSI for the sleep clinic was 4.30 and 41 individuals (61%) had a score ≥ 4 (SD = 2.74, range: 0–10). This difference was statistically significant ($t(127) = 6.89$, $p < .001$), indicating that individuals from the sleep clinic showed more severe sleep problems than individuals from the control group.

The total scores on the SQ–SP for control group ranged from 41 to 143 ($M = 76.81$, SD = 25.04). For the sleep clinic, the total scores ranged from 52 to 155 ($M = 91.24$, SD = 21.84). This difference was statistically significant ($t(127) = 3.50$, $p = .001$), indicating that individuals from the sleep clinic showed more behaviors related to sleep disorders than individuals from the control group. Eighteen individuals (27%) of the sleep clinic group had total scores on the SQ–SP one standard deviation above the mean of the control group.

Table 4

Exploratory factor analysis for items of part four of the Sleep Questionnaire.

Factor		Factor loading	Eigenvalue	% Variance
Factor 1			4.52	16
Item 38	Snores more than half the time	.93		
39	Always snores	.84		
8	Snores loudly	.77		
36	Heavy or loud breathing	.61		
28	Mouth breathing	.47		
27	Sleeps with neck extended	.36		
43	Dry mouth on waking up in the morning	.30		
Factor 2			2.12	8
Item 44	Daytime sleepiness ^a	.91		
24	Seems drowsy, but can stop themselves from sleeping ^a	.68		
23	Has urges to go to sleep and cannot stop themselves ^a	.50		
32	Wakes in the morning before 5 AM and stays awake	.47		
20	Needs sleep medication	.35		
Factor 3			1.89	7
Item 5	Quick movements of arms or legs	.60		
6	Restless sleep	.57		
34	Startles or jerks part of the body while falling asleep	.52		
41	Legs feel restless	.51		
33	Sweats excessively while falling asleep	.47		
42	Episodes of confused behavior	.40		
9	Gags or chokes	.39		
30	Sweats excessively	.35		
13	Sleep terrors ^b	.30		
Factor 4			1.35	5
Item 10	Repeatedly stops breathing for 15–30 s	–.94		
40	Stops breathing	–.80		
37	Has trouble breathing or struggles to breath	–.53		
Factor 5			1.00	4
Item 14	Does not want to go to bed because afraid	.79		
17	Afraid of the dark	.62		
31	Reluctant to go to bed	.42		
12	Wakes in the night complaining of nightmares ^c	.32		

^a During the day.^b First half of the night.^c Last half of the night.

The mean factor scores and the SDs are shown in Table 5. Differences between groups on mean factor scores were explored using Mann–Whitney tests. Mean scores on all factors were higher for the sleep clinic group than for the control group. Differences between groups on Factor 2 and Factor 3 were statistically significant, suggesting that on average, individuals from the sleep clinic group showed more daytime sleepiness and complaints related to sleep than individuals from the control group. Differences between groups on Factor 1, Factor 4 and Factor 5 were not statistically significant, suggesting that in the main, there was no difference between both groups in frequency of snoring, sleep apnea and anxieties related to sleep.

4. Discussion

This study is the first to investigate internal consistency, test–retest reliability, convergent and concurrent validity and factor structure of part four of the Sleep Questionnaire by Simonds and Parraga (SQ–SP; 1982) that assesses behaviors related to sleep in individuals with ID. Part four of the SQ–SP has good internal consistency and test–retest reliability. Convergent validity was adequate.

A moderate statistically significant correlation was obtained between the total score on the SQ–SP and the CSI, which indicates that the total score reflects *frequency* of behaviors related to sleep, but not *severity* of sleep problems. Vice versa a more severe sleep problem does not automatically lead to a higher frequency of behaviors related the sleep. A high total score on the SQ–SP may indicate the presence of one or more sleep problems with multiple underlying sleep disorders.

EFA revealed five factors (i.e., Snoring, Daytime sleepiness, Complaints related to sleep, Sleep apnea and Anxiety related to sleep), with internal consistency ranging from modest to good. In CFA the 5-factor structure could be confirmed. The 5-factor structure does not fit the five types of sleep disturbance encountered in clinical practice reported in other studies (Johnson et al., 2005; Maas et al., 2008, 2009; Stores et al., 1998b). EFA did not reveal a factor that could be labeled as the clinical type Parasomnias. Items of part four of the SQ–SP referring to parasomnias were eliminated from EFA because of low communalities and/or low factor loadings. The latter is not surprising, because these items refer to different types of parasomnias (i.e., sleepwalking, sleep enuresis) and are not interrelated (see low internal consistency for Parasomnias, Cronbach's $\alpha = .27$). Items of the clinical type Disordered breathing were assigned on the basis of results of EFA to three

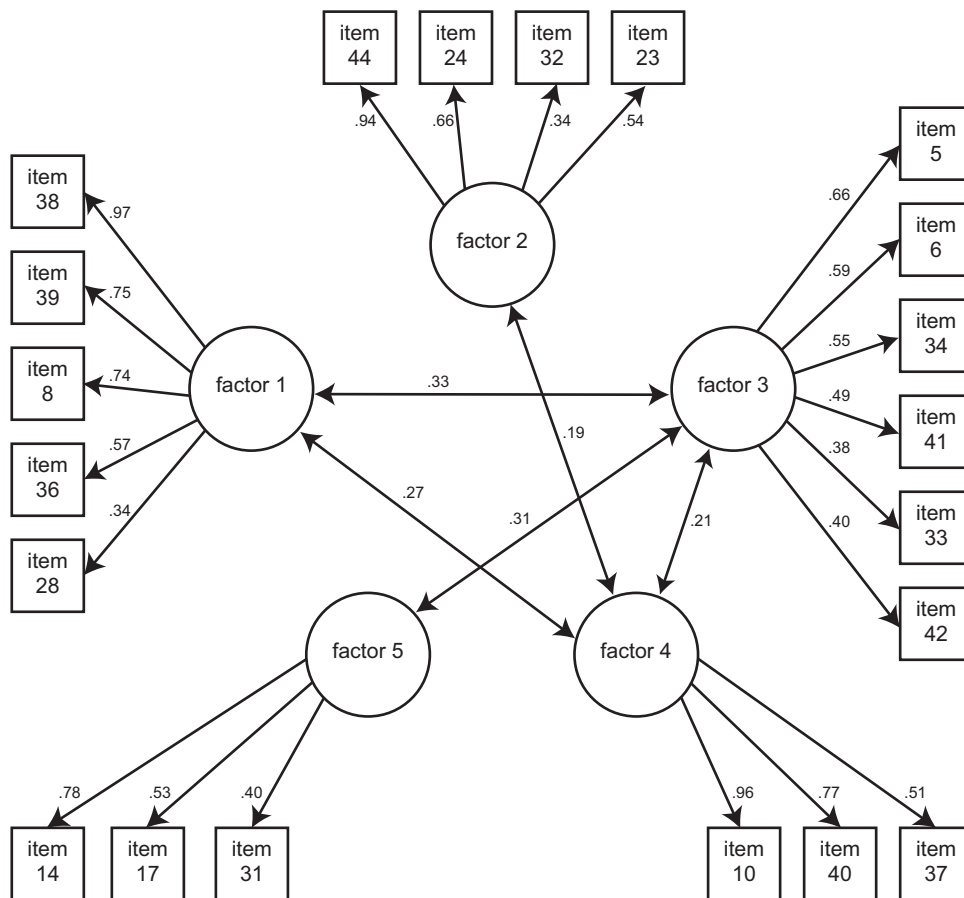


Fig. 1. Relationship among observed and latent variables.

different factors (i.e., Snoring, Sleep apnea and Complaints) related to sleep, which indicates that the factors Snoring and Sleep apnea are symptoms reflecting specific sleep disorders. This is remarkable because in other questionnaires such as the SDSC snoring and sleep apnea make one factor (Bruni et al., 1996). Items of the clinical types Poor quality sleep and Early waking were lumped together in the factor labeled as Daytime sleepiness. Daytime sleepiness seems to reflect a consequence of both poor quality sleep and early waking. Although one of the factors is labeled as Anxiety related to sleep, this factor has only two items (Afraid of going to bed; Afraid of the dark) in common with the clinical type Anxieties about sleep. Three of

Table 5
Mean scores (SDs) and median scores for sleep factors by group.

Factor	<i>n</i>	Mean (SD)	Median	<i>z</i> ^a	<i>p</i>
Factor 1: Snoring					
Sleep clinic	51	13.80 (9.39)	12	0.44	.66
Control group	46	12.93 (9.03)	11		
Factor 2: Daytime Sleepiness					
Sleep clinic	56	13.39 (6.40)	13	6.01	<.001
Control group	57	6.74 (3.91)	5		
Factor 3: Complaints related to sleep					
Sleep clinic	45	11.93 (6.82)	10	2.93	.003
Control group	54	8.72 (4.77)	6		
Factor 4: Sleep apnea					
Sleep clinic	58	3.98 (3.45)	3	0.58	.57
Control group	58	3.48 (1.66)	3		
Factor 5: Anxiety related to sleep					
Sleep clinic	53	5.91 (4.07)	3	1.58	.11
Control group	57	4.96 (3.58)	3		

^a Mann–Whitney tests.

the remaining items of the clinical type Anxieties about sleep (i.e., Insists on sleeping with somebody else; Needs security object; Insists on bedtime ritual) seem to refer to circumstances concerning falling asleep or sleep-onset associations. In this study, these three items were eliminated because of low communalities or multiple factor loadings and therefore do not compromise a specific sleep factor. This is striking because these three items together fit into the sleep disorder Behavioral Insomnia of Childhood (Sleep-Onset Type) of the *ICSD-2* (AASM, 2005). In addition, the five factors of the SQ-SP do not exactly match the six broad *ICSD-2* categories of sleep disorders (i.e., Insomnia, Sleep Related Breathing Disorders, Hypersomnias of Central Origin, Circadian Rhythm Sleep Disorders, Parasomnias and Sleep Related Movement Disorders) that are distinguished in the *ICSD-2*. Each factor of the SQ-SP consists of behaviors that reflect complaints or symptoms that belong to different sleep disorders.

The validity of the SQ-SP was also demonstrated by the ability of the CSI and the total score on the SQ-SP to differentiate between individuals with ID from the control group and individuals with ID referred to the sleep clinic. Individuals referred to the sleep clinic showed more severe sleep problems than individuals from the control group. Factors that were more prevalent in the sleep clinic group were Daytime sleepiness and Complaints related to sleep (e.g., sleep related movement disorders). Within the control group some individuals (16%) had severe sleep problems and were under consideration for referral to the sleep clinic.

Our data suggest that the SQ-SP has good potential for assessing prevalence of different types of sleep disturbances in individuals with ID, both in research and in clinical practice. However, there are some limitations in the use of the SQ-SP to assess prevalence of different types of sleep disturbances. First, parent or caregiver reports such as the SQ-SP are subjective and omissions might occur if parents or caregivers are not present or awake during the whole period when the individual is asleep (Wiggs & Stores, 2004). Second, the SQ-SP provides a general screening for sleep disturbances and it is not possible to make a diagnosis of sleep disorders (*ICSD-2*; AASM, 2005) based on the SQ-SP solely. To make a clinical diagnosis of a specific sleep disorder additional information about sleep is necessary such as information about sleep scheduling, the sleep environment, pre-sleep activities and daytime activities (i.e., sleep hygiene). This information can be obtained by sleep history, sleep diary and sleep hygiene questionnaire. Furthermore, information about developmental, medical and psychiatric history is necessary. Diagnosis of some sleep disorders requires more objective measurements, such as audiovisual recordings (video) and/or polysomnography for assessing sleep disorders included in the categories Parasomnias or Sleep Related Breathing Disorders (Wiggs, 2007).

Results of the present study must be interpreted in the context of the study's methodological shortcomings. The first shortcoming relates to the heterogeneity of the sample which may limit the validity of the results. All individuals with ID were included, leading to a sample with a wide age range, different levels of ID and comorbidity. In this study no exclusions were made based on medical condition (e.g., epilepsy), psychiatric condition (e.g., autism spectrum disorder) or medication use (e.g., anticonvulsants, methylphenidate, melatonin), which may influence sleep. In this study no exclusions were made because heterogeneity is an essential feature of the population of individuals with ID and the purpose of this study was to examine the psychometric properties of the SQ-SP in this population. Furthermore, the relatively small sample size did not allow subdividing the sample to explore the factor structure in specific groups of individuals with ID (such as autism spectrum disorder). The second shortcoming relates to the fact that we did not compare the data to a clinical diagnosis of sleep disorders or objective measurements such as polysomnography. Therefore it remains unclear how the different factors of the SQ-SP exactly relate to different sleep disorders as described in the *ICSD-2* (AASM, 2005). The third shortcoming relates to the method of CFA. Often CFA is conducted on another sample than the initial EFA. However, the number of participants in this study was too low to divide the sample in two samples.

Despite these shortcomings, this study shows that the SQ-SP is a reliable and valid tool in assessing the prevalence of different types of sleep disturbance in individuals with ID. Further research is required to evaluate the preliminary results of this study (specifically results of the CFA in a new sample and comparison of results with clinical assessment and objective measurements) and to evaluate other psychometric properties of the SQ-SP (such as intrarater reliability).

Appendix A. Sleep Questionnaire

PART FOUR

*During the LAST THREE MONTHS has your child has shown any of the following behaviors?
Please put a tick in the box which describes how often each behavior happens.*

Description	Never	Less than once a month	About once a month	2 to 4 times a month	1 or 2 times a week	3 to 6 times a week	Daily
1) Talks in sleep							
2) Walks in sleep							
3) Grinds teeth in sleep							
4) Bangs head in sleep or going off to sleep							
5) Has quick movements of arms or legs during sleep (e.g. kicking, jumping, arm flailing)							
6) Moves around a lot in bed during sleep (restless sleep)							
7) Bites tongue during sleep							
8) Snores loudly during sleep							
9) Gags, chokes or snorts loudly during sleep							
10) Seems to repeatedly stop breathing for periods of time lasting up to 30 seconds during sleep							
11) Wets bed during sleep							
12) Wakes in night complaining of nightmares or frightening dreams and seems quite anxious. This usually happens in the last half of the night.							
13) Wakes during the night screaming in terror. Anxiety may be so bad that sweating, gasping or trembling may happen. This usually happens during the first half of the night. She/he is not aware of their surroundings and will not remember it the next day.							
14) Doesn't want to go to bed because she/he is afraid							
15) Expresses fear that if she/he goes to sleep they might die							
16) Insists on sleeping with somebody else at sleep onset/in night							
17) Afraid of the dark							
18) Needs security object (e.g. teddy bear) before she/he goes to sleep							
19) Insists on bedtime ritual (e.g. bedtime story) before sleep							
20) Needs sleeping medication							
21) During the day, muscles become so weak that she/he falls to the ground or has to lie down before falling (usually after laughing, crying or being frightened)							

Description	Never	Less than once a month	About once a month	2 to 4 times a month	1 or 2 times a week	3 to 6 times a week	Daily
22) Upon waking or going off to sleep, feels paralyzed even though she/he is aware of the surroundings							
23) During the day, has urges to go to sleep and can't stop herself/himself							
24) Seems drowsy during the day, but can stop herself/himself from sleeping							
25) During the day, appears more active than other children							
26) Rolls from side to side rhythmically in sleep or while going off to sleep							
27) Sleeps with head tipped right back							
28) Breathes through mouth rather than nose when asleep							
29) Complains of headaches on waking up							
30) Sweats a lot during sleep							
31) Reluctant to go to bed							
32) Wakes in the morning before 5am and stays awake							
33) Sweats excessively whilst falling asleep							
34) Startles or jerks part of the body whilst falling asleep							
35) Experiences vivid-dream like scenes whilst falling asleep							
36) Heavy or loud breathing							
37) Have trouble breathing or struggle to breath							
38) Snores more than half the time while asleep							
39) Always snores							
40) You have seen your child stop breathing during the night							
41) Legs feel restless when in bed							
42) Wakes from sleep in the night confused so that you can't get through to them							
43) Dry mouth on waking up in the morning							
44) Has a problem with sleepiness during the day							
45) Has a fit of laughter, screaming, crying or weeping at night							

END OF PART FOUR

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