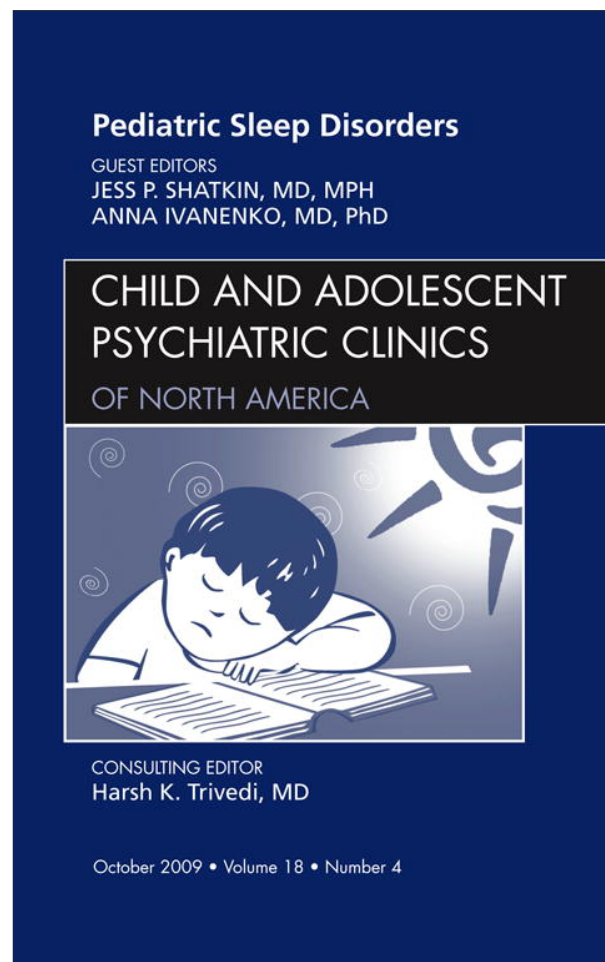


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Screening and Evaluation of Sleep Disorders in Children and Adolescents

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KEYWORDS

• Sleep screening • Sleep evaluation • Sleep disorders

One of the biggest pediatric health issues facing our country is the large number of children and adolescents with sleep problems or sleep disorders that go unidentified and untreated.¹ Most parents and pediatric professionals believe that infants and toddlers with sleep problems or sleep disorders will outgrow them by the time they reach elementary school. Although this is true of some sleep problems, many of the major sleep disorders only increase in severity with age. Some sleep disorders, like narcolepsy, typically have onset only in later childhood or adolescence. In addition, children can have many of the same major sleep disorders that adults can have.

Most professionals are unaware that 1 of every 3 elementary school-aged children may suffer from a significant sleep problem.² Although some of these sleep problems and disorders may be resolved during childhood, 12% to 15% of all students will have a sleep problem negatively affecting their daytime functioning that will not resolve itself without identification and treatment.³ Some of the major sleep disorders impact the neurocognitive, academic, social, and emotional functioning of these children. Because many professionals do not consider sleep disorders as a possible cause of poor academic performance or behavior problems, many children are never referred to a sleep specialist for treatment. Consequently, approximately 30% of students in special education for learning, behavioral, or emotional problems have a sleep disorder impacting their daytime functioning.⁴ Some research suggests that children's emotional and behavioral problems would improve significantly or be entirely resolved if the sleep disorders were corrected.⁴⁻⁶ Finally, there are also many potential health risks and consequences when pediatric sleep disorders go unidentified and untreated, such as obesity, high blood pressure, growth impairments,

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failure to thrive, developmental delays, pulmonary edema, cor pulmonale that sometimes results in congestive heart failure, SIDS, and vehicular and mechanical accidents resulting in disability or deaths.^{5,7,8}

SLEEP SCREENING RESULTS IN THE SCHOOLS AND THE RELATIONSHIP BETWEEN SLEEP PROBLEMS AND DAYTIME FUNCTIONING

Children's sleep problems can be screened by Child Find teams and other mental health or educational professionals. Child Find teams are early childhood screening teams consisting of 1 or 2 school psychologists, a school nurse, a speech pathologist, and 1 or more preschool teachers. These teams can detect problems of many kinds, including developmental or language delays and learning, behavioral, and emotional problems. Such screenings have provided surprising results and further evidence of the significant impact that these sleep problems have on educational and behavioral outcomes. Luginbuehl screened 595 students for sleep problems using the Sleep Disorders Inventory for Students–Children's Form (SDIS-C).^{4,9} The SDIS-C is an inventory for children that is rated by parents and screens for major sleep disorders. In this study, parents also rated their children on 12 behaviors (ie, irritability, moodiness, distractibility, impulsivity, depression, aggression, high activity level, oppositional-defiance, shyness, withdrawal, frustration, and tantrums) and reported their children's grade point average (GPA) if they attended school, their educational classification, and any mental health (DSM-IV) diagnoses. Significant relationships were found between sleep problems, lower GPA, and problem behaviors. Students with multiple sleep problems or a medically diagnosed sleep disorder had significantly higher rates of placement in special education and mental health diagnoses (ie, depression, bipolar disorder, conduct disorder, oppositional defiant disorder, and attention-deficit/hyperactivity disorder [ADHD]) than peers without any sleep problems or disorders. Moreover, 49% of the students with a medically diagnosed sleep disorder were already placed in special education before their diagnosis, which is much higher than the national average of only 12% to 14%. Twenty-four students had their sleep disorders corrected. Their GPAs and all behaviors except shyness improved significantly post-treatment, raising concerns as to whether these students' special education and/or mental health diagnoses were premature or unnecessary.

Three research studies have examined the relationship between sleep problems and pre-academic skills and behaviors among a group of at-risk preschool-aged children (total $n = 466$) who were referred to Child Find or mental health clinic screenings.^{10–12} Parents rated their children's sleep using the SDIS-C and other measures that assessed internalizing and externalizing behaviors. Pediatric professionals evaluated the children's conceptual knowledge, language, pre-academic skills, and motor skills. Results of these 3 studies indicated that 31% to 33% of the samples of children were rated as high risk on at least 1 sleep scale of the SDIS-C, and another 10% of these preschoolers scored in the cautionary range for a sleep disorder. Children who were at high risk for a sleep disorder had fewer of the pre-academic skills necessary for success in kindergarten and significantly higher externalizing and internalizing scores than peers without sleep problems.

Ax studied the occurrence of sleep problems in 216 second- and third-grade students from a school in New York state, most of whom were in general education.¹³ Additionally, this study investigated the relationship between symptoms of sleep disorders and variables of classroom behavior and academic achievement in reading and math. Symptoms of sleep disorders were measured by parent ratings on the SDIS-C. Significant symptoms of a sleep disorder occurred in approximately one-sixth (17%) of this general education sample. Students with many sleep disorder symptoms

had significantly poorer scores in reading and significantly more internalizing and externalizing behaviors than students without sleep disorder symptoms.

These research findings have demonstrated not only a correlation between sleep problems and difficulty with learning and behaviors, but also a high rate of at-risk preschoolers and elementary-aged general education students struggling with significant sleep problems needing identification and treatment. Moreover, other studies have demonstrated similar relationships between sleep problems and cognition, learning, and behavior problems, or they have noted significant improvements in these areas after sleep disorders were treated.^{14–21}

The high occurrence and negative impact of sleep problems and disorders on children's achievement and behaviors necessitates the implementation of a systematic screening process to identify and refer at-risk children for a comprehensive sleep evaluation and treatment before daytime functioning is significantly impaired. This systematic screening is especially necessary because most children with sleep disorders do not appear sleepy during the daytime. Execution of nationwide sleep screenings at all preschool Well Child Checks and Child Find visits, in kindergartens, middle schools, and high schools, in assessments for special education, and at any pediatric or mental health visits could guarantee that the majority of children with sleep disorders are identified early and treated. At the present time, most educational facilities and pediatric practices do not routinely screen children and adolescents to rule out sleep disorders. Many pediatric professionals will ask a few questions about a child's sleep, but when the parent concurs that the child has these sleep problems, many of these professionals do not follow up with a validated sleep screening instrument or refer the child to a sleep specialist. Thus, it is essential that psychiatrists and school or clinical psychologists rule out pediatric sleep disorders before diagnosing their clients with developmental or cognitive delays, learning disabilities, or a mental health disorder, because many correctable sleep disorders may cause or exacerbate these problems.^{6,7,14–21} If early sleep screenings could be conducted by all pediatric professionals, many of these children's educational and behavioral problems might be gradually resolved before long-term difficulties arise.

The purpose of this article is to review possible screening tools, the referral process, and a comprehensive evaluation in a pediatric sleep clinic. A brief overview of several screening inventories is provided with respect to their intended uses, important psychometric properties, strengths, limitations, and implications for screening. Next, the sleep evaluation process is clarified to inform the readers of the sequential and thorough approach required to accurately diagnose a pediatric sleep disorder. Practitioners must be cautious not to quickly prescribe pharmacologic treatment to help children sleep better without first investigating the many serious but correctable sleep disorders, other than insomnia, that may cause sleep complaints. In many cases, medications merely conceal the real sleep or physical problems temporarily but do not correct the underlying cause that could result in damaging long-term health problems if not addressed. Finally, an effective collaboration process between the pediatric professional, the parents, and the sleep specialist to assure successful follow-through and treatment is discussed.

PHASE I SCREENING

All pediatric professionals need to be able to ask the right questions to recognize the symptoms of major pediatric sleep disorders and prevent premature diagnoses or misdiagnoses resulting in these children suffering years of health, educational, or behavioral and emotional consequences. Questions must be more specific than

quickly asking parents if their child has trouble sleeping. More than half of parents who have a child with a sleep disorder will deny such problems when asked directly.⁴ More specific queries asking if a child displays excessive daytime sleepiness (EDS), difficulty falling asleep, or frequent nighttime awakenings might identify about 25% to 30% of the children with sleep disorders.⁴ Nevertheless, these questions are still inadequate and miss 70% to 75% of affected children.⁴ Children with sleep disorders like obstructive sleep apnea syndrome (OSAS) seldom show signs of EDS unless they have more severe OSAS or unless they are in adolescence, when OSAS typically becomes more severe.²² Early onset narcolepsy and a few rare pediatric sleep disorders and health issues may cause EDS in younger children, but typically young children with sleep disorders more frequently show symptoms indicative of ADHD.^{19,23–25}

Considering the high prevalence of sleep problems in children with learning, behavior, or emotional problems, pediatric professionals encountering these at-risk children should always ask their parents about 5 to 10 specific questions about these children's sleep habits to identify the main symptoms of the major pediatric sleep disorders: (1) OSAS; (2) periodic limb movement disorder (PLMD); (3) restless legs syndrome (RLS); (4) behavioral insomnia of childhood (BIC); (5) delayed sleep phase syndrome (DSPS); and (6) narcolepsy. These preliminary questions will help the professional rule out a sleep disorder in roughly 60% of the youth they encounter in their practices. Two Phase I brief screeners ask specific preliminary questions that can be added to any clinical intake interview.

BEARS

Owens and Dalzell developed a quick 5-question screening tool that professionals can use with children and adolescents called the BEARS.²⁶ The 5 questions ask about (1) *Bedtime problems*, (2) *Excessive daytime sleepiness*, (3) *Awakenings during the night*, (4) *Regularity of evening sleep time and morning awakenings*, and (5) *Sleep-related breathing problems or snoring*. Owens and Dalzell noted that almost twice as many children's sleep problems were identified when the BEARS was used in a clinical setting instead of leaving it up to professionals to ask their own sleep questions. Parent endorsement of any BEARS screener questions would alert professionals that they need to proceed to a more comprehensive sleep screening inventory that can provide them with more accurate assessment information.

Strengths of the BEARS

It is a quick, simple screener for pediatric professionals to use universally for all children from 2 through 18 years of age to determine if a child needs a more comprehensive sleep disorders screening inventory administered (Phase II). Professionals can easily remember these brief questions because of the short "BEARS" acronym.

Limitations of the BEARS

Its main shortfall is that it does not ask questions about excessive leg or other movements in sleep and may overlook many children who have PLMD, RLS, or other parasomnias. No validity or reliability studies have been conducted on the BEARS.

The Ten Item Sleep Screener

The Ten Item Sleep Screener (TISS) is also a Phase I screener for use by pediatric and school professionals. The 10 questions, which are taken from the more comprehensive SDIS, can be easily integrated into any clinical interview.⁴ The TISS asks:

1. Does the child snore lightly or loudly at night?
2. Does the child exhibit excessive daytime sleepiness?

3. Does the child have difficulty falling asleep at night?
4. Does the child roll, kick, or move around frequently in sleep?
5. Does the child wake up frequently in the night?
6. Is the child difficult to awaken in the morning?
7. Does the child gasp, choke, or snort in sleep?
8. Does the child stop breathing during sleep?
9. Does the child get enough sleep at night compared with peers of the same age?
10. Does the child have a difficult temperament (irritable or easily frustrated)?

Strengths of the TISS

It is quick and simple to administer. It provides 1 or 2 questions that screen for each of the major pediatric sleep disorders, including OSAS, PLMD, RLS, BIC, DSPS, and narcolepsy.

Limitations of the TISS

No validity or reliability studies have been performed on the TISS. Although it is a good Phase I screener, it does not give enough information to know with confidence if a child should be referred for a costly sleep evaluation.

The BEARS and TISS are only meant to be used in an initial clinical interview to determine if a child has any sleep problems. In a high-risk population of children or adolescents, about 40% to 50% of their parents will endorse 1 or more of the BEARS or the TISS questions; however, the professional still does not know if the child's sleep problems are severe enough to refer him or her to a pediatric sleep specialist. To determine the severity or need to refer, the professional should proceed to a more thorough Phase II screening instrument capable of predicting with much higher accuracy if a child has a good probability of having a sleep disorder needing treatment by a pediatric sleep specialist. These Phase II screening inventories only require about 8 to 15 minutes for the parent to complete.

PHASE II SCREENING

A more comprehensive Phase II screening should help the pediatric professional determine with more certainty 1 of 3 things about a child's sleep: (1) It is typical for a child of this age; (2) the child has a high likelihood of having a major sleep disorder that warrants a referral to a pediatric sleep specialist; or (3) the child has a significant behavioral sleep problem, but the problem can probably be corrected by the professional working together with the parent and child on better sleep habits. The following section summarizes 3 Phase II sleep inventories that professionals may want to consider using for a comprehensive screening. When considering the psychometric qualities of a screening inventory, "adequate" validity, internal consistency, and test-retest reliability coefficients range from .70 to .79; "good" coefficients range from .80 to .89; and "highly desirable" coefficients are .90 or greater.²⁷

Children's Sleep Habits Questionnaire–Abbreviated Form

The Children's Sleep Habits Questionnaire–Abbreviated Form (CSHQ) was created by Owens and colleagues.²⁸ Three elementary schools and a Pediatric Sleep Disorders Clinic at Rhode Island Hospital in southeastern New England assisted in the development of this instrument. There were 623 students: the community sample consisted of 469 children aged 4 through 10 years without sleep disorders, and the clinical sample had 154 children diagnosed with a sleep disorder. The community and clinical samples did not differ by gender, but the community sample was significantly older

and had a higher socioeconomic status (SES) than the clinical sample. Both samples were mostly Caucasian, middle-income, English-speaking suburban families and not demographically representative of the 2000 US Census.

The CSHQ is a 33-item questionnaire for children aged 4 through 10 years that is rated by parents on a 3-point scale and is available only in English. The CSHQ yields a total score and 8 sleep domain scale scores: (1) bedtime resistance, (2) sleep duration, (3) parasomnias, (4) sleep-disordered breathing, (5) night awakenings, (6) daytime sleepiness, (7) sleep anxiety, and (8) sleep onset delay. A more comprehensive CSHQ exists but has not been validated.

The CSHQ subscales and total score can discriminate between the community sample and children with sleep disorders. The CSHQ had an overall sensitivity of .80, indicating that 80% of the clinical group with one of these sleep disorders would have been correctly identified by the CSHQ. Internal consistency was .68 for the total CSHQ on the community sample and .78 for the clinical sample. The 8 subscales exhibited varying psychometric qualities based on their validity and reliability coefficients. Six of the 8 sleep scales on the community sample and 3 sleep scales on the clinical sample had internal consistency coefficients below .70, rendering them inadequate for clinical use. The sleep onset delay scale had only 1 item, which does not constitute a scale. Seven of the 8 sleep scales had test-retest reliability coefficients below .70.

Strengths of the CSHQ

It was developed by a leading pediatric sleep specialist. Its rating scale is well-defined to prevent misinterpretation by parents, and the cut-off score to refer children for a comprehensive evaluation is clearly defined. It can predict some of the major pediatric sleep disorders, such as sleep-disordered breathing and various nighttime behavioral problems; and it has adequate internal consistency on the bedtime resistance subscale for both samples and adequate internal consistency for the clinical sample for sleep duration, sleep disordered breathing, and daytime sleepiness but not for the community sample. It is the only pediatric sleep inventory to date that screens for sleep anxiety.

Limitations of the CSHQ

It was normed and validated in only 1 sleep clinic and 3 schools in 1 region of the United States. There were significant differences in SES and ages between the community and clinical samples, which may have confounded the results. The CSHQ participant demographics do not reflect the 2000 US Census, which questions its use with children from differing ethnic backgrounds or socioeconomic levels. All of the subscales, except bedtime resistance, had an internal consistency alpha coefficient score of .70 or less for the community sample, which is somewhat problematic for use in widespread community screenings in the schools or private practices. Only 1 subscale (sleep anxiety) had an adequate test-retest reliability coefficient of .70 or greater. The most important sleep-disordered breathing scale has lower than desirable test-retest reliability. The CSHQ is not designed for use with adolescents or in private practices or school settings. Consequently, Dr Owens has recommended that the CSHQ only be used in research settings by sleep specialists with predominantly Caucasian, English-speaking children. For further information, see Owens and colleagues,²⁸ e-mail owensleep@gmail.com, or visit the Web site www.kidzzzsleep.org.

Pediatric Sleep Questionnaire

The Pediatric Sleep Questionnaire (PSQ) was developed by Chervin and colleagues.²⁹ There were 162 children aged 2 through 18 years in the initial validation: 108 children were patients at 2 general pediatric clinics but did not have sleep disorders (quasi-community sample), and 54 children were diagnosed with a sleep-related breathing disorder (SRBD) (clinical sample). Later validation of a PLMD scale was performed on a sample of 113 children aged 2.8 to 18.0 years; 29 children had PLMD, and 84 did not.³⁰ A further validation of the 22-item SRBD scale was completed on 105 children aged 5.0 to 12.9 years in the Washtenaw County Adenotonsillectomy Cohort in Michigan.³¹ The author did not report specific demographic characteristics for the community and clinical samples.

The PSQ has 22 items completed by parents of children aged 2 through 18 years that are rated on a 3-point scale (“yes,” “no,” or “don’t know”) for all items except the inattention/hyperactivity items that are rated on a 4-point Likert scale. The PSQ provides a total score, which represents the total amount of sleep problems the child has. Exploratory factor analysis has verified that 4 scales exist: (1) SRBD, (2) snoring, (3) sleepiness, and (4) behavior. A fifth scale, PLMD, was later added.

The PSQ was able to identify the children with a diagnosis of SRBD 85% of the time (sensitivity of .85) for Group A and 81% for Group B (the PSQ was validated on 2 separate groups of 116 [Group A] and 154 [Group B] children and adolescents). It had a specificity of .87 for both groups. Most of the subscales had fairly good internal consistency coefficients ranging from .66 to .89, as well as test-retest reliability ranging from .66 to .92. A second validation of the PSQ for SRBD was conducted, resulting in an overall hit rate of 74%, a sensitivity of .78, and a specificity of .72. The overall predictive validity of the PLMD scale was 62%, the sensitivity was 79%, and the specificity was 56%. Internal consistency was .71, and test-retest reliability was .62.

Strengths of the PSQ

It was developed by a leading pediatric sleep specialist, has good structural validity, and is able to predict SRBD with good sensitivity. There is good internal consistency for the SRBD, snoring, and behavior scales. The PSQ’s SRBD scale has been validated in several sleep studies, has clear cut-off scores for referral, and has proven to be a good screener for SRBD.

Limitations of the PSQ

It has not been normed and validated on samples that reflect the 2000 US Census demographics, requiring caution when generalizing its use for universal screenings. Additionally, the sample sizes of young children and older adolescents were too small in the validation studies to accurately investigate differences in age groups, which suggests that more validation studies need to be undertaken specifically on young children and adolescents and from varying ethnic and SES levels. The sleepiness scale has lower internal consistency than desirable, and the sleepiness and PLMD scales had lower test-retest reliability than is desirable. It also has lower than desirable predictive validity for PLMD. If pediatric professionals are going to take the time to screen children or adolescents for sleep disorders, then it would be valuable to add more PSQ items to screen for all of the major pediatric sleep disorders negatively affecting daytime functioning such as BIC, DSPS, and narcolepsy. For more information, contact Ronald D. Chervin, MD, MS, Michael S. Aldrich Sleep Disorders Laboratory, C734 Med Inn Building, 1500 E. Medical Center Drive, Ann Arbor, MI 48109, USA; telephone (734) 647-9064; fax (734) 647-9065.

Sleep Disorders Inventory for Students (SDIS)

The Sleep Disorders Inventory for Students (SDIS) was developed by Marsha Luginbuehl.^{4,9} The SDIS was validated on 821 children and adolescents from 45 schools, 2 psychology private practices, and 7 pediatric sleep centers nationwide, 6 of which were American Academy of Sleep Medicine (AASM)-accredited. There were 602 children in the school/community sample that had not undergone a sleep evaluation of any kind; 219 participants were undergoing a comprehensive sleep evaluation at a sleep center or had already been diagnosed with a sleep disorder at a pediatric sleep center (clinical sample). The main study sample consisted of 595 children, whose family demographics for ethnicity, SES, parents' education, and primary language closely reflected the 2000 US Census.

The SDIS consists of 2 inventories: (1) the SDIS-Children's Form (SDIS-C) for children aged 2 through 10 years and (2) the SDIS-Adolescent Form (SDIS-A) for youth aged 11 through 18 years. The 25 items on the SDIS-C measure 4 sleep domains: OSAS, PLMD, DSPS, and EDS. The SDIS-A has 30 items constituting the same scales as the SDIS-C, in addition to a narcolepsy scale and a series of RLS questions added to the PLMD scale. Both inventories have 5 items assessing 5 parasomnias (sleepwalking, sleep talking, bruxism, night terrors, and nocturnal enuresis), as well as 11 general health questions written in a 'yes' or 'no' format. Both inventories also yield a total Sleep Disturbance Index and are available in English and Spanish. The items are scored on a sensitive 7-point likert scale, and the reading levels for the items range from third to fifth grade. Quick computer scoring is used for both inventories that produces a comprehensive report and graph with standard T-scores, percentiles, and 3 sleep classifications ("Normal Sleep," "Caution" range, and "High Risk" of a sleep disorder).

The SDIS has a high content validity (0.94), as well as good exploratory factor analysis loadings for the scales. It also has good fit indices for the SDIS-C and SDIS-A confirmatory factor analyses. Predictive validity was .86 for the SDIS-C and .96 for the SDIS-A; sensitivity for the SDIS-C was .82 and .81 for the SDIS-A; specificity for the SDIS-C was .91 and .95 for the SDIS-A; internal consistency for the total SDIS-C was .91 and .92 for the total SDIS-A; test-retest reliability for the total SDIS-C was .97 and .86 for the SDIS-A.

The subscales of the SDIS-C and SDIS-A had good predictive validity coefficients ranging from .72 to 1.0; sensitivity ranged from a low of .50 and .55 for the PLMD/RLS scales to a high of 1.0 for 2 other scales; specificity ranged from .62 to .98; and internal consistency ranged from .71 to .92. Test-retest reliability was only calculated for the overall SDIS-C and SDIS-A, but it was in the mid-.90s.

Strengths of the SDIS

It was developed and validated with the assistance of many leading pediatric sleep specialists on a relatively large sample. The main study samples closely reflected the 2000 US Census demographics. It has a broad, well-defined rating scale, which determines the severity of the various sleep problems. Both the SDIS-C and SDIS-A have good predictive validity, structural validity, and sensitivity for all subscales except the PLMD/RLS scale. However, PLMD is difficult to accurately diagnose using a 1-night sleep study because nighttime leg movements vary in frequency from night to night. The PLMD scale's sensitivity might have been higher for both the PSQ and the SDIS if the hospital cases had been assessed with actigraphy over 4 to 5 nights. The PLMD scales have good specificity. Both inventories have high internal consistency and test-retest reliability and are available in both English and Spanish. Computer scoring is quick, easy, and accurate, and it produces a graph and report that offers

recommendations and interventions when any sleep scale or parasomnia is rated higher than normal. Finally, the SDIS-C and SDIS-A were validated on community, school, private practice, and hospital populations with the intent of using these inventories for any pediatric population in any location, even when the professionals performing the screenings have limited knowledge about sleep disorders.

Limitations of the SDIS

It would be advantageous for more hospital validation studies to be performed on larger populations of children and adolescents, including larger samples of narcolepsy, DSPS, PLMD/RLS, and Spanish-speaking families. For further information, see Luginbuehl and colleagues⁹ or contact: Child Uplift, Inc, PO Box 146; Fairview, WY 83119; telephone: 307-886-9096; e-mail: Childuplift@aol.com. On the Web, visit www.Sleepdisorderhelp.com or Pearson, Inc at www.PsychCorp.com, the national distributor of the SDIS.

REFERRAL PROCESS

Once a child has been through Phase II screening and the practitioner has determined that there is a high probability of a sleep disorder, the child then needs to be referred to a pediatric sleep specialist for a comprehensive sleep evaluation. Practitioners should determine if their local sleep centers are trained to evaluate children. There are different diagnostic criteria for children as compared with adults for some sleep disorders, such as OSAS.

It is important that the practitioner informs the parents of the serious consequences that can occur if some sleep disorders are not identified and treated. Otherwise, many parents may believe that the sleep disorder is trivial or that the child will outgrow it with time, and they will not pursue a referral. The practitioner needs to ask if the child has insurance or Medicaid coverage to pay for a sleep study. If not, the practitioner may need to inform the parents about state insurance that they can acquire. The practitioner should follow up with the parents within a month to determine if the child has completed the recommended sleep evaluation. If not, it should be recommended again, and parent concerns or barriers to completing the evaluation, as well as ways to overcome those barriers, should be discussed.

THE CLINICAL INTERVIEW OF A PEDIATRIC SLEEP PATIENT

Once the child has been referred to a sleep specialist, a detailed questionnaire and sleep log are usually sent to the patient's family to complete before the clinic visit. At the time of the clinic visit, a detailed evaluation occurs focused on the patient's chief sleep complaints. All knowledgeable family members should provide input about the patient's sleep behaviors.

The sleep specialist must ask many questions to determine if the patient is exhibiting any characteristics of a major sleep disorder. Sleep-disordered breathing (SDB) and OSAS are evaluated by asking questions relating to the presence of possible snoring. There are many other conditions that can cause, or result from, nighttime breathing problems. To this end, the sleep specialist should inquire about any evidence of heart burn (acid reflux including gastroesophageal reflux disease), persistent ear infections, nasal congestion, and difficulty swallowing. In addition, if the patient awakens in the morning with a headache, thirst, or a dry mouth, or if he or she has experienced any changes in cognitive functioning or behavior, these symptoms may signal sleep pathology. Questions about sleep movement disorders, such as RLS and PLMD (eg, uncomfortable creepy, crawling feelings in the legs or evidence

of nocturnal myoclonus, such as frequent limb-jerking movements during sleep) and parasomnias (eg, nocturnal enuresis, sleepwalking, nightmares, night terrors, night sweats, sleep talking, and bruxism) should also be addressed. Finally, the possibility of narcolepsy should also be explored (eg, cataplexy, sleep paralysis, hypnagogic hallucinations, and evidence of dream enactment).

If any of the aforementioned sleep disorder symptoms are present, the sleep specialist will ask when the symptoms first began, what time of day or night they typically occur, and how frequent or severe they are. Depending on the severity and frequency, the sleep specialist will determine if a sleep study needs to be scheduled to determine with certainty if the patient has a sleep disorder.

It is important to determine if the patient experiences EDS, which could be an indication of several major sleep disorders, such as narcolepsy, severe OSAS, or insufficient sleep. Is the patient tired during the daytime? Does he fall asleep in school? Is there abnormal behavior, such as hyperactivity, difficulty focusing, or cognitive problems? The Epworth sleepiness scale or the SDIS's excessive daytime sleepiness scale may also be useful here.³²

The sleep specialist must also rule out environmental factors and poor sleep habits that disrupt sleep or cause some forms of insomnia, such as DSPS in adolescents or BIC in younger children. Environmental questions address these factors: Does the patient sleep in a comfortable bed? Are there other people or pets in the room or bed with the patient who might disrupt sleep? What body position does the patient usually sleep in? Is the room dark and quiet, with a comfortable temperature? Does the patient watch TV, use a computer, or read in the bedroom? If so, how late at night does he do these things?

Other important variables to explore are the patient's sleep habits: What time does the patient go to bed? What is his bedtime routine? Does he have adequate opportunity to calm down or settle before getting into bed? How long does it take the patient to fall asleep? How many times does he awaken during the night? Does he have difficulty falling back asleep after awakening? Does he go to the bathroom during the night? What time does he get up in the morning? Is the patient alert or tired upon awakening in the morning? Does he take a nap during the day, and if so, how long does it last and is the nap refreshing? Do the patient's bedtime and awakening times vary significantly between weekdays and weekends? Caffeine use, including chocolate, and tobacco, alcohol, and drug use should also be explored. If the child has poor sleep habits causing BIC or DSPS, corrections can often be made by teaching the parents and child better sleep hygiene and by helping the parents learn strategies to consistently enforce these good habits.

A detailed medical history also is elicited. Information concerning possible allergies, particularly to medications, is important to know. A list of medications, including doses and time of use, is obtained. Is there a history of infections, diseases, hospitalizations, or surgery? Queries about previous head injuries or nasal fractures are important. A detailed review of systems, including any history of anemia, hypertension, diabetes mellitus, thyroid dysfunction, or cardiac, pulmonary, or renal dysfunction, is obtained. Is there any evidence of depression, anxiety, syncope, or seizure-like activity? Are there any cutaneous problems? A thorough growth and developmental history is obtained, including birth weight, potential gestational complications, perinatal complications, and developmental milestones. School grades and performance are also important to know, because some major sleep disorders negatively impact school performance.

A detailed family and social history is taken, including the age and health of the parents and siblings, parents' occupations, and any unusual medical problems or

environmental conditions that might exist. Is there a family history of sleep problems like OSAS, narcolepsy, RLS, or other sleep problems similar to those of the patient?

Finally, a physical examination is conducted, including general appearance, blood pressure, height, weight, head circumference, and neck circumference. The eyes, lungs, heart, abdomen, extremities, neck, and throat are examined. The posterior pharynx is evaluated with particular attention to the size of the tonsils, uvula, and tongue base. A Mallampati score is given, which measures the size of the tongue in comparison to the airway opening.³³ Nasal airflow is also evaluated. A neurologic evaluation is performed, including memory, cranial nerves, muscle strength, cerebellar function, sensation, and reflexes.

A diagnostic impression is arrived at after gathering this extensive information, and it is discussed along with appropriate treatment and/or further diagnostic tests with the patient and family. Written information explaining the diagnosis is given to the patient and family.

AN OVERNIGHT SLEEP STUDY OR OTHER DIAGNOSTIC TESTING

If a major sleep disorder is probable, the sleep specialist usually asks the patient or the parents to complete a 2-week sleep log to gather more information about the patient's sleep habits and sleep-wake cycles. A sleep log documents bedtime, length of time to get to sleep, hour of awakening, the number and duration of awakenings during the night, daytime naps, comments, and any unusual events occurring during the night or the day.

If SDB or OSAS is suspected, an overnight polysomnogram (PSG) is scheduled. A PSG consists of continuous and simultaneous nighttime monitoring and recording of the electroencephalogram (EEG), electrooculogram (EOG), and submental electromyogram (EMG) to determine sleep staging.³⁴ Additional parameters are recorded, including electrocardiogram (ECG), airflow, ventilation and respiratory effort, oximetry (O₂ saturation), extremity muscle movement, and snoring severity. Video monitoring is recorded throughout the testing. A sleep technologist is present throughout the entire night to monitor the PSG recordings and the patient.

If narcolepsy is a consideration, an overnight PSG followed by a multiple sleep latency test (MSLT) is scheduled to determine the sleepiness level of a patient. An MSLT consists of 5 nap opportunities performed at 2-hour intervals after an overnight PSG.³⁵ The initial nap opportunity begins 1.5 to 3 hours after termination of the nocturnal recordings. A nap session is terminated after 20 minutes if sleep does not occur. If sleep occurs, the nap is continued for 15 minutes from the first epoch of sleep. Stimulants, stimulant-like medications, and rapid eye movement-suppressing medications should be stopped 2 weeks before the MSLT. Drug screening may be indicated to ensure that sleepiness on the MSLT is not pharmacologically induced.

If parasomnias are a consideration, a video recording of the patient's sleep by the family may be acquired as well as actigraphy. Actigraphy consists of monitoring movement of the arms or legs with a device that is strapped onto the extremity (often the child's leg or wrist).³⁶ The data can be recorded for weeks and then downloaded onto a computer. Sleep and wake times are estimated by analyzing the movement data. If the child is diagnosed with RLS or PLMD, total iron binding capacity (TIBC) and ferritin levels should be obtained. Research shows that low TIBC or ferritin levels may be associated with RLS and PLMD and are treatable with iron supplements.^{37,38}

If DSPS or BIC is considered after a 2-week sleep log is obtained, actigraphy may be requested. As mentioned earlier, these sleep disorders are often corrected with behavioral interventions in the form of teaching the child and parents better sleep hygiene.

Although there are 84 diagnosable sleep disorders,³⁹ most affected children and adolescents have only 1 or 2 of the sleep disorders discussed in this article. Because these other sleep disorders seldom occur, a discussion of their evaluation is not warranted here.

SUMMARY

A nationwide, systematic screening process for sleep disorders would help identify children early in the development of a sleep disorder, and if treated successfully, reduce academic, behavioral, health, and safety problems associated with some of these disorders. Having the right tools to screen for sleep disorders is only one part of the process of identifying and correcting pediatric sleep disorders. If the screening results indicate a high probability of a sleep disorder, then interdisciplinary collaboration between professionals is essential. Communication between all individuals involved, including the child, the parents, the pediatrician or sleep specialist, the school psychologist, teachers, and other professionals, is required. The treatment team must work together to teach the parents about the serious educational, behavioral, and health consequences for their child if a major sleep disorder is not corrected. Parents otherwise often do not pursue a comprehensive sleep evaluation. If the child's sleep disorder is corrected by a pediatric sleep specialist, it could mean the difference between a lifetime of failure or success, and in severe cases the difference between life and death.

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