Screening and Evaluation of Sleep Disorders in Children and Adolescents

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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

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

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) *B*edtime problems, (2) *E*xcessive daytime sleepiness, (3) *A*wakenings during the night, (4) *R*egularity of evening sleep time and morning awakenings, and (5) *S*leep-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 have difficulty falling asleep at night?
3. Does the child roll, kick, or move around frequently in sleep?
4. Does the child wake up frequently in the night?
5. Is the child difficult to awaken in the morning?
6. Does the child gasp, choke, or snort in sleep?
7. Does the child stop breathing during sleep?
8. Does the child get enough sleep at night compared with peers of the same age?
9. Does the child have a difficult temperament (irritable or easily frustrated)?
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

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.kidzzz

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, G724 Med Inn Building, 1500 E. Medical Center Drive, Ann Arbor, MI 48109, USA;

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

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 colleagues[9] 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

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, difficultly 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

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 (O_2 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

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.

REFERENCES

1. Rosen RC, Zozula R, Jahn EG, et al. Low rates of recognition of sleep disorders in primary care: comparison of a community-based versus clinical academic setting. Sleep Med 2001;2(1):47–55.
2. Mindell JA, Owens JA. A clinical guide to pediatric sleep: diagnosis and management of sleep problems. Philadelphia: Lippincott Williams & Wilkins; 2003.
3. National Institute of Health Wake up America: a national sleep alert, vol. 1. Washington, DC: Government Printing Office; 2001. p. 1–76.
4. Luginbuehl ML. The initial development and validation study of the Sleep Disorders Inventory for Students. Dissertation abstracts international section A: humanities & soc sc 2004;64(12-A):4376.
5. Chervin RD, Guilleminault C. Obstructive sleep apnea and related disorders. Sleep apnea. Otolaryngol Clin North Am 1996;23:4.
6. Dahl RE, Holttum J, Trubnick L. A clinical picture of child and adolescent narcolepsy. J Am Acad Child Adolesc Psychiatry 1994;33(6):834–41.
7. Tauman R. Sleep and obesity in children. In: Ivanenko A, editor. Sleep and psychiatric disorders in children and adolescents. New York: Informa Health Care; 2008. p. 383–405.
8. National Commission on Sleep Disorders Research In: Wake up America: a national sleep alert, vol. 1. Washington, DC: Government Printing Office; 1993. p. 1–76.
9. Luginbuehl M, Bradley-Klug KL, Ferron J, et al. Pediatric sleep disorders: validation of the Sleep Disorders Inventory for Students. School Psych Rev 2008;37(3): 409–31.
10. Witte R. The relationship between sleep disorders, behaviors, and pre-academic skills in pre-kindergartners. Unpublished educational specialist thesis, University

11. French R. Health and behavioral problems associated with symptoms of pediatric sleep disorders. Unpublished dissertation, University of South Florida, Tampa (FL), 2008.
12. Popkave KM. The relationship between parent identified sleep problems, internalizing behaviors, externalizing behaviors, and adaptive functioning in a pediatric population. Unpublished educational specialist thesis, University of South Florida, Tampa (FL), 2007.
13. Ax EA. Effect of sleep disorders on school behavior, academic performance and quality of life. Unpublished doctoral dissertation, University of South Florida, Tampa (FL), 2006.
14. Ebert CS, Drake AF. The impact of sleep-disordered breathing on cognition and behavior in children: a review and meta-synthesis of the literature. Otolaryngol Head Neck Surg 2004;131:814–26.
15. Montgomery-Downs HE, Crabtree VM, Gozal D. Cognition, sleep and respiration in at-risk children treated for obstructive sleep apnea. Eur Respir J 2005;25: 336–42.
16. Steenari M. Working memory and sleep in 6- to 13-year old children. J Am Acad Child Adolesc Psychiatry 2003;42:85–92.
17. Gozal D. Sleep-disordered breathing and school performance in children. Pediatrics 1998;102:616–20.
18. Mitru G, Millrood D, Mateika J. The impact of sleep on learning and behavior in adolescents. Teach Coll Rec 2002;104:704–26.
19. Chervin RD, Dillon JE, Bassetti C, et al. Symptoms of sleep disorders, inattention, and hyperactivity in children. Sleep 1997;20(12):1185–92.
20. Chervin RD, Archbold KH, Dillon JE, et al. Inattention, hyperactivity, and symptoms of sleep-disordered breathing. Pediatrics 2002;109:449–56.
21. Crabtree V, Ivanenko A, O'Brien L, et al. Periodic limb movement disorder of sleep in children. J Sleep Res 2003;12:73–81.
22. Carroll JL, Loughlin GM. Obstructive sleep apnea syndrome in infants and children: clinical features and pathophysiology. In: Ferber R, Kryger M, editors. Principles and practices of sleep medicine in the child. Philadelphia: WB Saunders Company; 1995. p. 163–91.
23. Picchietti DL, England SJ, Walters AS, et al. Periodic limb movement disorder and restless legs syndrome in children with attention-deficit hyperactivity disorder. J Child Neurol 1998;13:588–94.
24. Picchietti DL, Underwood D, Farris W, et al. Further studies on periodic limb movement disorder and restless legs syndrome in children with attention-deficit hyperactivity disorder. Mov Disord 1999;14:1000–7.
25. Walters AS, Mandelbaum DE, Lewin DS, et al. Dopaminergic therapy in children with restless legs/periodic limb movements in sleep and ADHD. Pediatr Neurol 2000;22:182–6.
26. Owens JA, Dalzell V. Use of the 'BEARS' sleep screening tool in a pediatric residents' continuity clinic: a pilot study. Sleep Med 2005;6:63–9.
27. Crocker L, Algina J. Introduction to classical modern test theory. New York: Holt, Rinehart and Winston; 1976.
28. Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. Sleep 2000;23(8):1043–51.
29. Chervin RC, Hedger K, Dillon JE, et al. Pediatric Sleep Questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness

30. Chervin RD, Hedger KM. Clinical prediction of periodic leg movements during sleep in children. Sleep Med 2001;2:501–10.
31. Chervin RD, Weatherly RA, Garetz SL, et al. Pediatric sleep questionnaire. Arch Otolaryngol Head Neck Surg 2007;133:216–22.
32. Johns MS. A new method of measuring sleepiness: The Epworth sleepiness scale. Sleep 1991;14:540–5.
33. Mallampati S, Gatt S, Gugina L, et al. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J 1985;32(4):429–34.
34. Iber C, Ancoli-Israel S, Chesson A, et al. The AASM manual for the scoring of sleep and associated events: rules, terminology and technical specification. 1st edition. Westchester (IL): American Academy of Sleep Medicine; 2007.
35. Standards of Practice Committee of the American Academy of Sleep Medicine. Practice parameters for clinical use of the multiple sleep latency test and the maintenance of wakefulness test. Sleep 2005;28(1):113–21.
36. Sadeh A, Alster J, Urbach D. Actigraphically-based automatic bedtime sleep-wake scoring: validity and clinical applications. J Amb Monit 1989;2:209–16.
37. Konofal E, Lecendreux M, Arnulf I, et al. Iron deficiency in children with attention-deficit/hyperactivity disorder. Arch Pediatr Adolesc Med 2004;158:1113–5.
38. Konofal E, Cortese S, Lecendreux M, et al. Effectiveness of iron supplementation in a young child with attention-deficit/hyperactivity disorder. Pediatrics 2005;116: 732–4.
39. ICSD—international classification of sleep disorders: diagnostic and coding manual. Diagnostic classification steering committee, Thorpy MJ (Chairman). New York: Marcel Dekker, Inc; 2000.

Classification and Epidemiology of Sleep Disorders

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KEYWORDS
• Sleep disorders • Classification • Prevalence
• Psychiatry • Children

CLASSIFICATION SYSTEMS FOR SLEEP DISORDERS

There are several classification systems available for sleep disorders, including the International Classification for Sleep Disorders, 2nd edition (ICSD-2); the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, Text Revision (DSM-IV-TR); the International Classification of Diseases, 10th edition, Clinical Modification (ICD-10-CM); and the Diagnostic Classification, Zero to Three (DC 0-3R) (Zero to Three 2005).[1–4]

ICSD-2[1] is a comprehensive classification system that includes several nosologic categories, such as insomnias, parasomnias, hypersomnias, sleep-related breathing disorders (SBD), circadian rhythm disorders, sleep-related movement disorders, and other sleep disorders. Behavioral insomnia in childhood was later included as a distinct nosologic category to emphasize a possible etiology of some types of pediatric insomnia.

DSM-IV-TR[2] is a multiaxis classification system that divides sleep disorders into primary sleep disorders, parasomnias, sleep disorders related to another mental disorder, sleep disorders resulting from a general medical condition, and substance-induced sleep disorder. Although DSM-IV-TR reflects most of the sleep disorders seen in adults, it fails to recognize categories of sleep disorders seen in younger children, especially infants, and toddlers.

DC 0-3[4] is a less frequently used multiaxial classification system that was designed to categorize behavioral and emotional disorders in infants, and toddlers. Axis I sleep

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disorder is called sleep behavior disorder and can be used along with other Axis I disorders, such as regulatory disorder, adjustment disorder, or others.

EPIDEMIOLOGY OF SLEEP DISORDERS

Insomnias

Sleep initiation and maintenance problems in children are frequently reported, and these problems may disrupt the sleep of the entire family. Well-designed studies of pediatric insomnia are lacking, in contrast to adult insomnia, because of excessive reliance on the parental reports and variable definitions of "sleep problems" used in research protocols.

A generally accepted definition of pediatric insomnia is "a repeated difficulty with sleep initiation, duration, consolidation, or quality that occurs despite age-appropriate time and opportunity for sleep and results in daytime functional impairment for the child and/or family."[5]

The prevalence of pediatric insomnia is estimated to be about 1% to 6% among general pediatric populations, with a much higher prevalence in children with neurodevelopmental and chronic medical and psychiatric conditions.[6,7] When bedtime resistance and disruptive nighttime awakenings are included, the prevalence of sleep-disrupted behavior approaches 25% to 40% in preschool-aged children.[8,9] Jenkins and colleagues[10] reported nighttime awakenings in 23% of children at age 1 year, 24% at 18 months, and 14% at 3 years. According to the Sleep in America poll, 69% of parents reported that their children have problems falling and staying asleep a few times a week, and 51% of adolescents reported difficulties initiating sleep at least once a week.[11,12]

Growing evidence suggests that insomnia is a risk factor for the development of psychiatric conditions, particularly depressive and anxiety disorders later in life.[13] One study found that insomnia during adolescence is a risk factor for major depression, suicidality, and substance abuse during adulthood.[14]

Behavioral insomnia of childhood

Behavioral insomnia was introduced as a separate nosology into the revised ICSD-2 classification with 3 subtypes: Sleep-onset association, limit setting, and combined. Behavioral insomnia is a reflection of maladaptive associations developed by the child or because of poor parental limit setting; either of which may result in an inability to fall asleep in the absence of these behavioral associations, such as rocking, watching television, falling asleep in the parents' bed, holding a favorite stuffed animal, and so on. Most children suffering from behavioral insomnia also have difficulty returning to sleep after normal nocturnal awakenings, which leads to sleep loss.

Sleep-onset association type and limit-setting type are estimated to occur in 10% to 30% of the childhood population, depending on the exact definition used. Infants and toddlers are commonly at a higher risk.[15] The problems tend to diminish as the children grow older, especially after 4 years of age. Sleep complaints, such as bedtime resistance, refusal to sleep alone, increased nighttime fears, and nightmares, are also common in children who have experienced traumatic events, including physical and sexual abuse.[16]

Idiopathic insomnia

Prevalence data for idiopathic insomnia in children are limited. Some evidence may place the presence of this disorder in early childhood. Available information suggests an approximate prevalence of 0.7% in adolescents and 1% in very young adults.[1]

appearance of idiopathic insomnia seems to be unrelated to specific life events, psychological trauma, or medical disorders during childhood.

Sleep-related Breathing Disorders

SBD include obstructive sleep apnea syndrome (OSAS), upper airway resistance syndrome (UARS), and persistent primary snoring (PPS). They occur fairly frequently among the general pediatric population and among children with psychiatric disorders.

Obstructive sleep apnea syndrome

Sleep apnea syndrome is 1 of the most common intrinsic sleep disorders seen in young children. OSAS is characterized by repeated episodes of respiratory obstruction, causing hypoxia, hypercapnia, and/or respiratory arousal.

The prevalence of OSAS in children is estimated at 2% to 3%.[17–22] One community-based study, which used objective criteria for sleep disordered breathing (SDB), estimated the prevalence of SDB in 8- to 11-year olds to be about 2.2%.[20] Untreated OSAS can lead to significant health problems, including growth retardation in more severe cases, neurocognitive deficits, behavioral problems, and cardiovascular morbidity. Common risk factors for OSAS include African American race, obesity, adenotonsillar hypertrophy, sinus problems, allergies, positive family history of OSAS, persistent wheeze, and prematurity.[19]

Prepubertal males are not at higher risk, in contrast to adult males, who are at higher risk for OSAS.[23] Preterm children tend to have a 3- to 5- fold higher risk for developing OSAS when compared with full-term children. African American children have a 4- to 6- fold higher risk for developing SDB when compared with Caucasian children.[20]

Upper airway resistance syndrome

UARS is characterized by brief, recurrent respiratory effort-related arousals during sleep in the absence of overt apnea, hypopnea, or gas exchange abnormalities. The frequency of UARS is much more difficult to discern. However, UARS has been associated with cognitive and behavioral sequelae in children, including learning disabilities, attention-deficit/hyperactivity disorder, and aggressive behavior.[24]

Persistent primary snoring

Primary snoring in children may be associated with an increased respiratory effort, but it is not accompanied by identifiable arousals. Even though primary snoring was previously believed to be a benign condition without polysomnographic changes, evidence suggests that the increased respiratory effort in primary snoring per se may be associated with neurobehavioral deficits.[25,26] Habitual snoring frequently occurs in children with up to 27% reported in some samples.[27] It is estimated that 2% to 3% of children with habitual snoring have clinically significant obstructive sleep apnea.[28]

Hypersomnias of Central Origin

Narcolepsy

Narcolepsy is a rare rapid eye movement (REM) sleep hypersomnia attributed to dysfunction of the hypocretin (orexin) system in the brain and is characterized by a tetrad of sudden sleep attacks, hypnagogic hallucination, cataplexy, and sleep paralysis. Narcolepsy is typically a disorder with onset during adolescence, with some rare reported cases of childhood onset. Genetic and environmental factors have been suggested as possible etiologies.[29] Narcolepsy is more difficult to diagnose in younger

Narcolepsy with cataplexy

Narcolepsy with cataplexy has a prevalence of 0.02% to 0.18% in the United States and western European nations. Japan has a prevalence ranging from 0.16% to 0.18%. Males seem to be more commonly affected than females. Human leukocyte antigen (HLA) subtypes DR2/DRB1*1501 and DQB1*0602 are associated with the disorder in Caucasians and Asians, whereas DQB1*0602 alone is more specifically associated with the disorder in African Americans. Some HLA subtypes are protective against narcolepsy in the presence of DQB1*0602, such as DQB*0501 and DQB1*0601, whereas DQB1*0301 increases the susceptibility. A study in monozygotic twins showed a concordance rate of 29% for narcolepsy with cataplexy. Environmental triggers may include head trauma, viral illness, an abrupt change in sleep-wake patterns, or sustained sleep deprivation. First-degree relatives of patients with narcolepsy with cataplexy have a 10- to 50- fold increased risk of developing the disorder.[29,30]

Narcolepsy without cataplexy

Narcolepsy without cataplexy is thought to represent about 10% to 50% of the narcoleptic patients, but the exact prevalence remains unknown. Both males and females can be affected at any age, though it seems to more commonly set on in adolescence. A small percentage of patients demonstrate hypocretin deficiency in their cerebrospinal fluid. Environmental triggers identified in case reports, although largely unproven, point toward head trauma and viral illnesses.

Kleine-Levin syndrome

Kleine-Levin Syndrome is characterized by periodic hypersomnia associated with increased appetite, hypersexuality, and behavioral problems.[31] About 200 cases have been reported so far, with a male to female ratio of 4:1. It is thought to occur during early adolescence; females typically have a somewhat later onset than males. HLA DQB1*02 is found in increased frequency in patients. Environmental factors, such as infections, alcohol consumption, head trauma, or exposure to anesthetics, are thought to be possible triggers. About 3 families with 2 cases each have been reported to date, indicating that a familial pattern is likely rare. Some family members have been noted to have mood disorders.

Idiopathic hypersomnia with long sleep time

The pediatric population is rarely affected by idiopathic hypersomnia. It generally occurs before the age of 25 years and has an equal male to female ratio. Other demographic information is not known at this time. There may be an increased predisposition to hypersomnia and psychiatric disorders, which might be genetic in nature. An autosomal dominant mode of inheritance has been suggested.

Behaviorally induced insufficient sleep syndrome

Sleep loss resulting from behavioral sleep problems seems to occur more commonly in adolescents, though it can affect all ages and both genders. Children with psychiatric and neurodevelopmental disorders are at higher risk for insufficient sleep because of their disruptive behaviors or increased anxiety associated with transition to sleep.

Circadian Rhythm Sleep Disorders

Delayed sleep phase disorder

Though the exact prevalence remains unknown, delayed sleep phase disorder (DSP) is more common in adolescents and young adults, with a reported prevalence ranging

a diagnosis of DSP. It has been associated with psychiatric disorders, such as depression and personality disorders (eg, schizoid and avoidant). Genetic factors associated with the disorder include polymorphisms in hPer3, arylalkylamine *N*-acetyletransferase, HLA, and clock genes. DSP may be familial in up to 50% of the cases, with 1 pedigree showing an autosomal dominant trait.[33]

Advanced sleep phase disorder

Though advanced sleep phase disorder has been reported in childhood, it is largely considered a disorder beginning in middle-aged men and women with a prevalence of 1%, which increases with age. Familial cases have been identified with the possibility of an autosomal dominant mode of inheritance. A mutation in the circadian clock gene hPer2 was localized in 1 instance. Some pedigrees suggest genetic heterogeneity.

Free-running type or nonentrained type

Free-running or nonentrained circadian rhythm disorder is commonly seen in totally blind individuals (about 50%), including children with congenital blindness. There is no sex difference in the prevalence of the disorder. It may rarely affect sighted individuals, after chronotherapy for DSP or after isolating the individual from normal time cues.

Jet lag disorder

This disorder affects all age groups, with younger individuals typically recovering faster than the elderly.

Sleep-related Movement Disorders

Restless legs syndrome

There is increasing recognition of the prevalence of restless legs syndrome (RLS) in children, which was previously viewed as a disorder only in adults. Picchietti and colleagues[34] conducted the largest-ever study to assess RLS in children using the National Institues of Health criteria. The investigators screened children between ages 8 and 17 years from a research panel of more than 10,000 volunteers in the United States and United Kingdom. This study found a prevalence of 1.9% in 8- to 11-year olds, and 2% in 12- to 17-year olds. The prevalence of RLS in non-European countries is mostly unknown, but some studies point toward a lower prevalence in Asian populations. RLS is 1.5 to 2 times more prevalent in females than in males.

Primary RLS usually occurs in isolation of other disorders. Secondary RLS manifests as a result of underlying disorders, such as iron deficiency, peripheral neuropathy, medications, and so forth. Secondary RLS tends to resolve upon treatment of the underlying condition.

RLS seems to follow a familial pattern of inheritance, with up to 50% of patients with primary RLS reporting a familial association. First-degree relatives of patients with RLS tend to have a 3- to 6- fold increase in the risk for developing RLS, when compared with the general population. An autosomal dominant mode of inheritance has also been observed in some families. RLS may occur at anytime during the lifetime of an individual, with an earlier onset indicating a higher familial risk. There is great interest in understanding the association between RLS/periodic limb movement disorder (PLMD) and ADHD.[35] The prevalence of RLS in children diagnosed with ADHD ranges from 10.5% to 44% depending on the sample.[36,37]

Periodic limb movement disorder

PLMD is characterized by episodic limb movements during sleep, generally involving

tend to be worse during resting states and immobility and tend to alleviate with movement and stretching. Prevalence data for PLMD are still unknown, with no gender differences reported. However, the prevalence of PLMD seems to increase with age, with 34% of people being affected by the age of 60 years. About 80% of the patients diagnosed with RLS are also found on polysomnography to have PLMD.[38] PLMD commonly co-occurs with RLS, REM sleep behavior disorder, and narcolepsy.

New data suggest that PLMD may precede the onset of sensory symptoms required for diagnosing RLS in children by a significant period of time. There is also a grèater association of periodic limb movements with insomnia and sleep-related eating disorder, the later of which is responsive to dopaminergic therapy. Precipitating factors for PLMD include medications, such as selective serotonin reuptake inhibitors, tricyclic antidepressants, and dopamine-receptor antagonists, and low serum ferritin levels. Family studies have been largely inconclusive to date. However, several families with a high occurrence of RLS also have members with PLMD, suggesting strong biologic link between PLMD and RLS. PLMD does occur in children, but the age of onset is largely unknown.

Parasomnias

Parasomnias are the third most common category of sleep disorders during childhood, after insomnia and frequent nocturnal awakenings.[39] Common parasomnias in children include night terrors, sleepwalking, sleeptalking, nocturnal bruxism, nocturnal enuresis, and rhythmic movement disorder.

Childhood parasomnias are primarily due to genetic and developmental factors, unlike adult parasomnias, which are more closely linked to psychopathology.[40] A large survey of school-aged children found that approximately 50% of them have an episode of sleeptalking at least once a year, and fewer than 10% experience sleeptalking every night.[41]

A study of 212 Swedish children between the ages of 6 and 16 years showed the prevalence of sleepwalking to be 16.7% in children aged 12 years.[42] Nocturnal enuresis occurs in about 30% of 4-year olds, 10% of 6-year olds, 5% of 10-year olds, and 3% of 12-year olds.[43–46] Another study found a 12-month prevalence of enuresis of 4.45% among children in the United States, along with a strong association with ADHD.[47]

A large survey of university students reported a childhood history of nocturnal bruxism in 15.1% of participants.[48] The prevalence of bruxism progressively decreases from childhood through preadolescence.[49,50]

Rhythmic movement disorder, such as body rocking, was reported in 19.1% of children aged 3 months to 6 years.[51] Body rocking is primarily a disorder of early childhood, which disappears in approximately 70% of the cases by age 10 years.[50]

PREVALENCE OF SLEEP DISTURBANCES IN CHILDREN WITH PSYCHIATRIC DISORDERS

Sleep disorders are far more frequently reported among children and adolescents with coexisting psychiatric morbidities. Only a handful of studies, however, address the prevalence of sleep problems in psychiatric cohorts of children. In a 1982 study, sleep complaints in children evaluated at a mental health clinic were compared with sleep symptoms reported by parents of children from the general population.[52] This study found a significantly greater prevalence of nightmares and restless sleep in children with anxiety and depression, and a significantly higher prevalence of snoring, head banging, nocturnal awakenings, and restlessness among children with ADHD. In a later

more frequently reported in children with psychiatric disorders than in children without a psychiatric history.[53] Among those with psychiatric disorders, a high rate of nocturnal awakenings and nightmares was documented in children with ADHD and comorbid mood and anxiety disorders and in those with mood or anxiety disorders alone. Sleep duration and sleep latency strongly correlated with aggression, hyperactivity, and depression, whereas restless sleep highly correlated with all psychiatric symptoms.

There have been growing numbers of studies indicating a high prevalence of insomnias, parasomnias, and disorders of excessive daytime sleepiness in children with ADHD, mood and anxiety disorders, and autism spectrum disorders (ASD). For example, sleep complaints have been reported by 25% to 50% of parents of children with ADHD.[54] Symptoms such as bedtime resistance, delayed sleep onset, and frequent nighttime awakenings have been most frequently reported in patients with ADHD. Other intrinsic sleep disorders have also been associated with ADHD.[35] SDB has increasingly been reported in patients with ADHD and appears to be implicated in the pathophysiology of neurocognitive and behavioral deficits seen in affected children.[55]

A study based on clinician and parent reports found that about 85% of children and adolescents with anxiety disorders have transient sleep problems, and up to 50% have chronic sleep disturbance.[56] The prevalence of parasomnias may increase with anxiety, and another longitudinal study found the same association, except in the case of enuresis and sleepwalking.[57] Rorschach tests in children who sleepwalk have shown an increase in inhibited aggression and a more developed mental defense against anxiety.[42]

Significant life events, where children feel a loss of control (eg, divorce, separation, and relocation), may cause them to react in the form of night terrors.[58] Some studies have suggested that parasomnias, especially enuresis, are associated with socioeconomic factors, such as low social class, low parental education, and family disruption.[43,59]

Children with ASD have a high prevalence rate of sleep problems. It has been reported that 44% to 83% of children with ASD have sleep initiation and maintenance difficulties and suffer from irregular sleep-wake patterns, early morning awakenings, and poor sleep routines.[60]

Early onset depression has been associated with symptoms of sleep initiation and maintenance insomnia and early morning awakenings. A study of depressed children and adolescents revealed that 72.7% had sleep disturbance, 53.5% had insomnia alone, 9% had hypersomnia, and 10.1% had insomnia and hypersomnia. Children with more severe depression had more disturbed sleep, with the most severely affected ones having insomnia and hypersomnia.[61]

SUMMARY

Sleep disorders are highly prevalent in children and adolescents and have significant impact on their neurocognitive, emotional, and behavioral development. Children with medical, neurodevelopmental, and psychiatric disorders have a significantly higher rate of reported sleep-related problems that can persist with time, if not properly treated at the time of their occurrence. Disrupted and/or insufficient sleep contributes to performance deficits, daytime fatigue, sleepiness, inattention, poor impulse control, and emotional dysregulation. Several classification systems of sleep disorders are currently available and can be used to define clinical conditions seen across the

REFERENCES

1. American Academy of Sleep Medicine. The international classification of sleep disorders. 2nd edition. Westchester (IL): American Academy of Sleep Medicine; 2005.
2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th edition. Washington, DC: American Psychiatric Association; 1994.
3. International classification of diseases, tenth revision, clinical modification (ICD-10-CM). Available at: http://www.cms.hhs.gov/ICD10/02m_2009_ICD_10_CM.asp#TopOfPage. Accessed June 8, 2009.
4. Zero to Three. Diagnostic classification, 0–3R: diagnostic classification of mental health and developmental disorders of infancy and early childhood. revised edition. Arlington (VA): Zero To Three; 2005.
5. Mindell JA, Emslie G, Blumer J, et al. Pharmacological management of insomnia in children and adolescents: consensus statement. Pediatrics 2006;117(6): e1223–32.
6. Stein MA, Mendelsohn J, Obermeyer WH, et al. Sleep and behavior problems in school-aged children. Pediatrics 2001;107(4):E60.
7. Ivanenko A, Crabtree VM, Gozal D. Sleep in children with psychiatric disorders. Pediatr Clin North Am 2004;51(1):51–68.
8. Meltzer LJ, Mindell JA. Sleep and sleep disorders in children and adolescents. Psychiatr Clin North Am 2006;29:1059–76.
9. Owens J. Classification and epidemiology of childhood sleep disorders. Sleep Med Clin 2007;2(3):353–61.
10. Jenkins S, Bax MCO, Hart H. Behavior problems in preschool children. J Child Psychol Psychiatry 1980;21:5–17.
11. National Sleep Foundation. Children and sleep. Sleep in America poll 2004. Available at: http://www.sleepfoundation.org. Accessed June 8, 2009.
12. National Sleep Foundation. Adolescents and sleep. Sleep in America poll 2006. Available at: http://www.sleepfoundation.org. Accessed June 8, 2009.
13. Dahl RE, Ryan ND, Matty MK, et al. Sleep onset abnormalities in depressed adolescents. Biol Psychiatry 1996;39(6):400–10.
14. Roane BM, Taylor DJ. Adolescent insomnia as a risk factor for early adult depression and substance abuse. Sleep 2008;31(10):1351–6.
15. Pillar G, Sadeh A, Peled N, et al. Insomnia in infancy and childhood—causes, significance, assessment and approach to treatment. Harefuah 1996;130(4): 255–9.
16. Sadeh A. Sleep, trauma, and sleep in children. Child Adolesc Psychiatr Clin N Am 1996;5(3):685–700.
17. Ali NJ, Pitson DJ, Stradling JR. Snoring, sleep disturbance, and behavior in 4–5 year olds. Arch Dis Child 1993;68(3):360–6.
18. Gislason T, Benediktsdottir B. Snoring, apneic episodes, and nocturnal hypoxemia among children 6 months to 6 years old: an epidemiologic study of lower limit of prevalence. Chest 1995;107(4):963–6.
19. Redline S, Tishler PV, Schluchter M, et al. Risk factors for sleep-disordered breathing in children: associations with obesity, race, and respiratory problems. Am J Respir Crit Care Med 1999;159(5 Pt 1):1527–32.
20. Rosen C, Larkin E, Kirchner H, et al. Prevalence and risk factors for sleep-disordered breathing in 8- to 11-year-old children: association with race and prematurity. J Pediatr 2003;142(4):383–9.

21. Anuntaseree W, Rookkapan K, Kuasirikul S, et al. Snoring and obstructive sleep apnea in Thai school-age children: prevalence and predisposing factors. Pediatr Pulmonol 2001;32(3):222–7.
22. Brunetti L, Rana S, Lospalluti ML, et al. Prevalence of obstructive sleep apnea syndrome in a cohort of 1,207 children of southern Italy. Chest 2001;120(6): 1930–5.
23. Marcus CL. Sleep-disordered breathing in children. Am J Respir Crit Care Med 2001;164(1):16–30.
24. Guilleminault C, Korobkin R, Wenkel R. A review of 50 children with obstructive sleep apnea syndrome. Lung 1981;159:275–87.
25. Urschitz MS, Guenther A, Eggebrecht E, et al. Snoring, intermittent hypoxia and academic performance in primary school children. Am J Respir Crit Care Med 2003;168:464–8.
26. O'Brien LM, Mervis CB, Hollbrook CR, et al. Neurobehavioral implications of habitual snoring in children. Pediatrics 2004;114:44–9.
27. Dayyat E, Kheirandish-Gozal L, Gozal D. Childhood obstructive sleep apnea: one or two distinct disease entities? Sleep Med Clin 2007;2(3):433–44.
28. Tang JP, Rosen CL, Larkin EK, et al. Identification of sleep-disordered breathing in children: variation with event definition. Sleep 2002;25:72–9.
29. Guilleminault C, Zvonkina V, Tantrakul V, et al. Advances in narcolepsy syndrome and challenges in the pediatric population. Sleep Med Clin 2007;2(3):397–404.
30. Kotagal S. Narcolepsy and idiopathic hypersomnia in childhood. In: Ivanenko A, editor. Sleep and psychiatric disorders in children and adolescents. New York/London: Informa Healthcare; 2008. p. 163–73.
31. Pillar G, Ravid S. Klein- Levin syndrome. In: Ivanenko A, editor. Sleep and psychiatric disorders in children and adolescents. New York/London: Informa Healthcare; 2008. p. 175–84.
32. Wyatt JK. Circadian rhythms sleep disorders in children and adolescents. Sleep Med Clin 2007;2:387–96.
33. Ancoli-Israel S, Schnierow B, Kelsoe J, et al. A pedigree of one family with delayed sleep phase syndrome. Chronobiol Int 2001;18(5):831–40.
34. Picchietti D, Allen RP, Walters AS, et al. Restless legs syndrome: prevalence and impact in children and adolescents—the Peds REST study. Pediatrics 2007; 120(2):253–66.
35. Cortese S, Konofal E, Yateman N, et al. Sleep and alertness in children with attention-deficit/hyperactivity disorder: a systematic review of the literature. Sleep 2006;29(4):504–11.
36. Walter AS. Simple sleep-related movement disorders of childhood including benign sleep myoclonus of infancy, rhythmic movement disorder, and childhood restless legs syndrome and periodic limb movements in sleep. Sleep Med Clin 2007;2(3):419–32.
37. Picchietti MA, Picchietti DL. Restless legs syndrome and periodic limb movement disorder in children and adolescents. Semin Pediatr Neurol 2008;15(2):91–9.
38. Montplaisir J, Boucher S, Poirier G, et al. Clinical, polysomnographic, and genetic characteristics of restless legs syndrome: a study of 133 patients diagnosed with new standard criteria. Mov Disord 1997;12(1):61–5.
39. Dollinger SJ. On the varieties of childhood sleep disturbance. J Clin Child Psychol 1982;1:107–15.
40. Kales JD, Kales A, Soldatos CR, et al. Night terrors. Arch Gen Psychiatry 1980; 37:1413–7.

41. Reimão RN, Lefévre AB. Prevalence of sleep-talking in childhood. Brain Dev 1980;2:353–7.
42. Klackenberg G. Somnambulism in childhood-prevalence, course and behavioral correlations. Acta Paediatr 1982;71:495–9.
43. Essen J, Peckham C. Nocturnal enuresis in childhood. Dev Med Child Neurol 1976;18:577–89.
44. Klackenberg G. Nocturnal enuresis in a longitudinal perspective. Acta Paediatr 1981;70:453–7.
45. Feehan M, McGee R, Stanton W, et al. A 6-year follow-up of childhood enuresis: prevalence in adolescence and consequences for mental health. J Paediatr Child Health 1990;26:75–9.
46. Byrd RS, Weitzman M, Lanphear NE, et al. Bed-wetting in U.S. children: epidemiology and related behavior problems. Pediatrics 1996;98:414–9.
47. Shreeram S, He JP, Kalaydjian A, et al. Prevalence of enuresis and its association with attention-deficit/hypersctivity disorder among U.S. children: results from nationally representative study. J Am Acad Child Adolesc Psychiatry 2009; 48(1):35–41.
48. Reding GR, Zepelin H, Monroe LJ. Incidence of bruxism. J Dent Res 1966;45: 1198–204.
49. Fisher BE, Wilson AE. Selected sleep disturbances in school children reported by parents: prevalence, interrelationships, behavioral correlates and parental attributions. Percept Mot Skills 1987;64:1147–57.
50. Laberge L, Tremblay RE, Vitaro F, et al. Development of parasomnias from childhood to early adolescence. Pediatrics 2000;106:67–74.
51. Sallustro F, Atwell CW. Body rocking, head banging, and head rolling in normal children. J Pediatr 1978;93:704–8.
52. Simonds JF, Parraga H. Prevalence of sleep disorders and sleep behaviors in children and adolescents. J Am Acad Child Adolesc Psychiatry 1982;21:383–8.
53. Ivanenko A, Crabtree VM, O'Brien LM, et al. Sleep complaints and psychiatric symptoms in children evaluated at a pediatric mental health clinic. J Clin Sleep Med 2006;2(1):42–8.
54. Corkum P, Tannock R, Moldofsky H. Sleep disturbances in children with attention-deficit/hyperactivity disorder. J Am Acad Child Adolesc Psychiatry 1998;37: 637–46.
55. O'Brien LM, Gozal D. Neurocognitive dysfunction and sleep in children: from to rodent. Pediatr Clin North Am 2004;51:187–202.
56. Alfano CA, Ginsburg GS, Kingery JN. Sleep-related problems among children and adolescents with anxiety disorders. J Am Acad Child Adolesc Psychiatry 2007;46:224–32.
57. Parkes JD. The parasomnias. Lancet 1986;2:1021–5.
58. Rosen G, Mahowald MW, Ferber R. Sleepwalking, confusional arousals, and sleep terrors in the child. In: Ferber R, Kryger M, editors. Principles and practice of sleep disorders in the child. Philadelphia: WB Saunders Co; 1995. p. 45–53.
59. Rona RJ, Li L, Chinn S. Determinants of nocturnal enuresis in England and Scotland in the '90s. Dev Med Child Neurol 1997;39:677–81.
60. Ivanenko A, Johnson K. Sleep disturbances in children with psychiatric disorders. Semin Pediatr Neurol 2008;15(2):70–8.
61. Liu X, Buysse DJ, Gentzler AL, et al. Insomnia and hypersomnia associated with depressive phenomenology and comorbidity in childhood depression. Sleep 2007;30:83–90.

Family and Cultural Influences on Sleep Development

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Sleep is a biopsychosocial process that is influenced by complex biologic rhythms. Homeostatic mechanisms, chronobiological factors, parenting, temperament, cultural beliefs, and family values all contribute to the development of sleep patterns, but the influence of each individual factor is difficult to discern.[1–4]

Although individual characteristics impacts sleep patterns, there is increasing evidence that parental factors play an important role as well.[5–7] Thus, parental characteristics, such as personality, psychopathology, employment, and education, have been repeatedly associated with sleep in early childhood.[7–11] The development of the sleep–wake system has been considered a marker for behavioral organization and adaptation, and parents must actively encourage the development of self-regulation, particularly as it is not an innate part of the developmental process.[1] Clearly, for optimal interactions to occur, a highly developed sensitivity to and understanding of the cues children display are required.

Psychologically mature parents have been described as being empathetic with their child,[12] having the capacity of coping flexibly with life's challenges, and providing an optimal environment for the development of self-regulation.[13] In contrast, family stress, marital conflicts, and poor parent–child relationships can have negative effects on children's sleep.[14,15] In a recent study on sleep behavior of preschool children, Johnson and McMahon[10] found that parents' sleep-related cognitions associated with doubts about parenting competence, anger, and difficulties with limit setting were associated with more problematic sleep in their children. These cognitions predicted more parental interaction at children's bedtime and during the night, which contributed to their sleep problems. Interestingly, in a longitudinal study of preschool sleep disturbance, Simard and colleagues[11] found that maladaptive parental behaviors, such as a parent's presence at sleep onset or giving food or drink after the child awakens, typically develop in reaction to pre-existing sleep difficulties. Notably,

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