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# Sleep Hygiene for Children With Neurodevelopmental Disabilities

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## ABSTRACT

Sleep disturbances in children with neurodevelopmental disabilities are common and have a profound effect on the quality of life of the child, as well as the entire family. Although interventions for sleep problems in these children often involve a combination of behavioral and pharmacologic strategies, the first line of treatment is the promotion of improved sleep habits or “hygiene.” Despite the importance of sleep-hygiene principles, defined as basic optimal environmental, scheduling, sleep-practice, and physiologic sleep-promoting factors, clinicians often lack appropriate knowledge and skills to implement them. In addition, sleep-hygiene practices may need to be modified and adapted for this population of children and are often more challenging to implement compared with their healthy counterparts. This first comprehensive, multidisciplinary review of sleep hygiene for children with disabilities presents the rationale for incorporating these measures in their treatment, outlines both general and specific sleep-promotion practices, and discusses problem-solving strategies for implementing them in a variety of clinical practice settings. *Pediatrics* 2008;122:1343–1350

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### Key Words

children, sleep hygiene, sleep disorders, disabilities, burden of care

### Abbreviation

NDD—neurodevelopmental disability

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**I**N RECENT YEARS, worldwide concerns have been expressed about the increasing number of healthy children and adolescents whose sleep is inadequate or disturbed. An international pediatric task force declared that insufficient sleep in children is a major public health concern.<sup>1</sup> One of the factors contributing to this increasing prevalence of inadequate sleep in children is the gradual erosion of positive sleep habits or “sleep hygiene” that has accompanied the emergence of the “24-hour society” and the increasing complexity of modern life.<sup>2</sup> The impact of poor sleep habits, such as irregular bedtimes and wake times and lack of bedtime routines, may be further compounded in children by the presence of comorbid disorders of sleep; as a result, up to 30% of children may experience sleep deprivation and its consequences.<sup>3</sup>

Because sleep is a complex neurologic function that requires a normal central nervous system, sleep difficulties are even more common among children with neurodevelopmental disabilities (NDDs). NDDs are defined as a collection of a large number of neurologic disorders that start in childhood and have different etiologies. They can be mild, severe, stationary, progressive, congenital, or acquired. Severe chronic sleep difficulties are frequently associated with NDDs, including mental retardation,<sup>4</sup> epilepsy,<sup>5,6</sup> cerebral palsy,<sup>7</sup> visual impairment,<sup>8,9</sup> autism,<sup>10</sup> attention-deficit/hyperactivity disorder,<sup>11</sup> fetal alcohol spectrum disorders,<sup>12</sup> and brain maldevelopment.<sup>13–15</sup> The prevalence rates of sleep disorders may be as high as 75% to 80%<sup>16</sup> in this population of children, although it should be noted that high prevalence rates of sleep disorders described for individual disabilities may be misleading,<sup>9</sup> because disabilities tend to occur in combination.

Impaired sleep not only predisposes children to mood, behavioral, and cognitive impairments but also has an impact on physical health,<sup>17,18</sup> which in turn may further predispose them to sleep difficulties.<sup>19</sup> These effects may be even more pronounced in children with underlying neurodevelopmental vulnerabilities. There is clear evidence that insufficient or inefficient sleep adversely affects learning, memory, cognitive flexibility, verbal creativity, attention, abstract reasoning, and other executive functions that are related to the prefrontal cortex.<sup>20</sup> Sleep loss is known to result in increased irritability, depression, poor affect modulation, impulsivity, hyperactivity, and aggressiveness.<sup>21</sup> Health outcomes of inadequate sleep in children include potential deleterious effects on their cardiovascular,<sup>22</sup> immune, and various metabolic systems,<sup>23</sup> including glucose metabolism and endocrine functions<sup>17,24</sup> as well as impaired coordination and an increase in accidental injuries.<sup>25</sup>

The causes of NDDs are varied and include such conditions as hypoxic-ischemic encephalopathy, maldevelopment

of the brain, injury, infection, and metabolic, genetic, and degenerative conditions. Similarly, the etiologies of sleep disorders seen in children with NDDs are also varied and frequently are a consequence of underlying disease-related factors rather than a result of the specific neurologic diagnosis. These factors include the extent and location of brain abnormalities, the severity of developmental delay, associated sensory loss, health problems, and pain.<sup>16</sup> Environmental factors (eg, sleeping space and daytime schedules) and issues related to caregivers (eg, family dynamics, parental stress, maternal depression) also often play important contributory roles. Thus, because these various underlying causes of sleep disorders (eg, pain, infection, sleep-disordered breathing) are addressed very differently, it is vitally important to identify the root causes of sleep problems in these children.

Several parental sleep questionnaires exist for use in primary care settings. The Children's Sleep Habits Questionnaire<sup>26</sup> is a brief parental survey that is a useful clinical screening tool for sleep difficulties and also for sleep studies of the disabled pediatric population. Another simple clinical screening survey is the "BEARS" which is an abbreviation for the key areas of inquiry are bedtime resistance, excessive daytime sleepiness, awakenings during the night, regularity, and snoring.<sup>27</sup> In addition to using screening questionnaires, it is important to question older, verbal children as well, because parents are not always aware of existing sleep difficulties.

When a sleep problem is identified, a comprehensive evaluation should include assessment of current sleep patterns, usual sleep duration, and sleep/wake schedule. A review of sleep habits such as bedtime routines, daily caffeine intake, and sleeping environment (temperature, noise level, etc) may reveal environmental factors that contribute to the sleep problems. Children are often best assessed with a sleep diary, in which parents record daily sleep behaviors for 2 to 4 weeks. Actigraph recordings are commonly used, often simultaneously, with sleep diaries. The actigraph is a small wearable device that is strapped to an arm or leg and measures movements and offers an objective and valid measurement of sleep.<sup>28,29</sup> Video recordings made by the caregiver of unusual nighttime episodes may be useful also. Polysomnographic evaluations are seldom warranted for routine evaluation but may be appropriate if sleep disorders such as obstructive sleep apnea, periodic limb movements, or parasomnias are suspected.

Although there are no ideal hypnotic agents for children, a wide array of medications is available.<sup>1,30,31</sup> The list includes such drugs as benzodiazepines, phenothiazines, barbiturates, antihistamines, tricyclic antidepressants, chloral hydrate,  $\alpha$  agonists, and herbal preparations. All hypnotic drugs may cause significant adverse effects, and they tend to be effective only for short periods of time. Recently, the American Academy of Sleep Medicine endorsed the use of melatonin for circadian rhythm sleep disorders.<sup>32</sup> Although melatonin has mild hypnotic action, it is not considered to be a hyp-

notic drug and is only beneficial when the melatonin secretion is inadequate or inappropriately timed.<sup>33,34</sup>

The use of hypnotic agents seems to be largely based on clinical experience, empirical data derived from adults, and small case series. Currently none of the hypnotic drugs have been approved by the US Food and Drug Administration for use in children. Strict guidelines should be kept in mind when sleep-inducing drugs are felt to be beneficial for children with NDDs. First, drug treatment must be viewed in the context of medical history, developmental age, concurrent medications, and thorough knowledge of the hypnotic agents. The choice of drugs should be determined by specific diagnosis of the sleep disorder and should be prescribed only when appropriately implemented behavioral interventions are not effective. When these guidelines are ignored, the use of sleep-inducing drugs may be suboptimal and even harmful.<sup>35</sup>

The first line of treatment for sleep difficulties in both typically developing children and those with NDDs is to improve their sleep hygiene. The term "sleep hygiene" is well accepted in medicine, but it is often not understood by other professionals and laypeople. Sleep hygiene is defined as a set of sleep-related behaviors that expose persons to activities and cues that prepare them for and promote appropriately timed and effective sleep.<sup>36</sup> Good sleep habits and "sleep health" are alternative terms often used to describe these sleep practices. The sleep-promotion activities and cues are numerous, complex, and interrelated. They may be grouped into 4 categories: (1) environmental (eg, temperature, noise level, ambient light); (2) scheduling (eg, regular sleep/wake schedule); (3) sleep practices (eg, bedtime routine); and (4) physiologic (eg, exercise, timing of meals, caffeine use), all of which may be influenced by neurologic and health conditions.

The reasons why sleep hygiene promotes sleep are still not completely understood. The explanation is likely to be, at least in part, that it works by entraining intrinsic circadian rhythms to the external environment and 24-hour day/night cycle, but this is probably only a small part of a complex process.<sup>37,38</sup> Behavioral conditioning, which results in the association of certain activities and environments with sleep, is likely to play a significant role. Appropriate sleep hygiene also promotes sleep by reducing environmental stimulation and increasing relaxation. The introduction of routine activities before bedtime may even decrease anxiety in some children with NDDs. Whatever the mechanism, it is clear that without appropriate sleep-promoting practices, sleep patterns often deviate from developmentally appropriate norms.

It should be emphasized that, although the institution of positive sleep-hygiene measures by themselves may not be sufficient to adequately treat sleep problems in children with NDDs, other interventions are unlikely to be successful if poor sleep habits are not recognized and addressed. These other interventions include a range of behavioral management strategies used in typically developing children for night wakings and bedtime resistance, such as graduated extinction procedures and pos-

itive reinforcement,<sup>36</sup> pharmacologic interventions such as melatonin<sup>33,34</sup> in conjunction with behavioral techniques,<sup>1,36,30,31</sup> and institution of safety measures, particularly when night wakings or self-injurious behaviors are present. Despite this, sleep-hygiene measures are frequently not included in the treatment package for children with NDDs and sleep complaints. This may be, in part, because sleep-promotion practices often need to be modified and specifically adapted for this population and are often more challenging to implement because of impairments in cognition, physical factors, and an elevated risk for circadian rhythm sleep disorders.<sup>39</sup>

The focus of this article, which to our knowledge is the first comprehensive collaborative review of sleep hygiene for children with NDDs, is on this previously neglected area in an attempt to begin to address these knowledge gaps and inform clinical practice. Wherever possible, empirical evidence for the efficacy of these practices is cited; however, the nearly complete absence of research in many instances creates a necessary relative reliance on clinical expertise rather than data. The multidisciplinary backgrounds of the authors (neurology, neuropsychiatry and child psychiatry, developmental-behavioral pediatrics), all experts in the field of pediatric sleep medicine, were specifically chosen to broaden the perspective and to provide the widest possible range and depth of clinical experience.

Finally, it should also be emphasized that, although the focus of the following discussion is on individual sleep-hygiene practices, the ultimate goal in the clinical setting is to develop a sleep-hygiene program that both incorporates basic sleep-promoting principles and is specifically tailored for the individual patient and family.

## **SLEEP ENVIRONMENT**

### **Sleep Position and Bedding**

Achieving an appropriate level of comfort and safety in the sleeping environment for children with NDDs who have motor disabilities may be challenging for a number of reasons. Immobile patients often require regular turning during the night to avoid pain and bed sores. Involuntary neuromuscular movements may interfere with falling asleep, although these tend to subside during sleep.<sup>40</sup> Esophageal reflux often coexists with NDDs and can cause pain, frequent reflex arousals, arching, and aspiration pneumonia<sup>41</sup>; this common cause of sleep difficulty has been underrecognized.<sup>42</sup>

Sleeping positions in different age groups have been studied in healthy individuals but not in disabled children.<sup>43</sup> Appropriate positioning in bed of children with NDDs and physical disabilities, often with the use of various mechanical devices, can be helpful in sleep promotion; however, this requires experience with motor disabilities and frequently involves a trial-and-error approach and prolonged follow-up to assess the efficacy of the interventions. Elevation of the head of the bed is often beneficial for those with esophageal reflux. Positioning during the night is also important for children with a number of health conditions such as certain types of epilepsy,<sup>44</sup> respiratory disorders,<sup>45</sup> heart disease,<sup>46</sup> car-

ing for pressure sores,<sup>47</sup> and plagiocephaly.<sup>48</sup> It should be noted that although placing infants on their backs for sleep has been shown to reduce the risk of sudden infant death,<sup>49</sup> this practice may not always be possible for infants with NDDs.

It is somewhat surprising that there has been a virtual absence of evidence-based research regarding the impact of the sleeping surface and bedding on sleep quality in children with NDDs. Nevertheless, the choice of mattress, pillow, or blanket may be important for some children with disabilities. For example, mattresses that are overly hard or soft may cause discomfort. Many children with NDDs also have a specific preference for either light or heavy blankets. Some infants sleep better when they are tightly bundled or swaddled. For restless, low-functioning children, light sleeping bags (available in certain countries) that are anchored to the mattress for safety reasons but still allow freedom of movement may be helpful. Other devices used in occupational therapy settings, such as weighted blankets and vests, may be particularly helpful for children with sensory integration issues.

Nonmobile children with brain damage may have lower-than-normal skin temperature,<sup>50</sup> whereas others with autonomic nervous system dysfunction sweat excessively during sleep.<sup>51</sup> Hyperhidrosis or impaired sweating may be associated with severe brain disorders.<sup>52</sup> Although the impact of temperature dysregulation on sleep in children with NDDs has not been investigated adequately, the use of sleep products such as Supracor sheets, which are flexible, breathable, honeycomb-like, and absorbent, thus potentially minimizing the need to change pajamas, may result in less sleep disruption for both the child and caregivers.

### **Sleeping Space and Physical Environment**

During the night, low-functioning children may wander around the house, disrupting their own sleep and that of family members and potentially posing significant safety concerns. In response, some parents create "fortified cribs" with safety netting or stronger and higher side rails or remove all the furniture from the room. These are generally constructed by the caregiver in secret because of fear of professional disapproval. Alarm systems may provide an additional measure of safety, because they alert caregivers when the child has left the bedroom during the night. Children with NDDs often sleep better in their own home environments, because their sleep and behavior may deteriorate in a strange place where the bed, visual environment, voices, sounds, and smells are unfamiliar.

Exposure to even low levels of light inhibits melatonin secretion by the pineal gland, disrupting circadian-mediated sleep onset; therefore, it is generally recommended that the bedroom be totally dark. However, some anxious children with fears of the dark might benefit from a dim night light. This practice is not suitable for children with cortical visual impairment, however, because they tend to stare into a light source for self-stimulation, and this light-gazing keeps them in an alert state.<sup>53</sup> Encouraging physical activity during day-



light hours may help children with NDDs sleep better at night, because bright daylight aids the nocturnal melatonin rise and may promote better sleep and mood<sup>54,55</sup>; however, there have been no studies to show that this technique is equally effective for nonmobile children with NDDs.

Varying degrees of thalamocortical dissociation and impaired “gating” of incoming and outgoing sensory stimuli during sleep may be seen in children with brain damage.<sup>56,57</sup> Such children may be overly sensitive to visual and auditory as well as tactile and olfactory stimuli that are part of the normal environment and, thus, may be awakened by the slightest noise or changes in sensory stimuli. Thus, surrounding these infants’ cribs with many colorful, high-contrast objects may excite those with severe NDDs. Similarly, certain colors in the bedroom can have a stimulating effect.<sup>58</sup> On the basis of clinical experience “white-noise machines,” which produce a mixture of all frequencies and can mask sounds, may be useful. Therefore, the bedroom environment needs to be made unexciting for these children.

### SLEEP SCHEDULING

Normally, scheduling of sleep and wake periods in children, including the duration of daytime naps and bedtimes, is done in accordance with developmental, health, social, cultural, and economic considerations, as well in response to individual needs of families.<sup>59–62</sup> Although regular bedtimes and wake-up times should be enforced for all children, the institution of a consistent sleep/wake schedule may be particularly important for children with NDDs, because they are uniquely vulnerable to both sleep and circadian rhythm disruptions. For example, factors such as epilepsy, use of anticonvulsants,<sup>6</sup> and melatonin abnormality<sup>39</sup> may significantly alter the timing and duration of sleep in these children and can present considerable challenges to maintaining regular sleep patterns. Early-morning awakening is also common in children with advanced sleep onset related to inadequate melatonin secretion or shifting of the sleep patterns.

Despite these challenges, every attempt should be made to both maintain sleep/wake regularity and adapt sleep schedules to individual needs. For example, there should not be more than an hour’s difference in bedtimes and wake-up times during the week and weekends. On the other hand, children with disabilities may require extra naps or longer nocturnal sleep than do their healthy counterparts, because they fatigue more easily<sup>63</sup> and may fall asleep several hours before their regular bedtimes. Additional interventions may be helpful; for example, for children with NDDs who have impaired sleep maintenance and early awakening caused by melatonin abnormality, sustained-release melatonin formulations given at bedtime can be useful.<sup>33</sup> Light therapy,<sup>64</sup> behavioral modification,<sup>65</sup> and long-acting hypnotic agents that have minimal hangover effect may have to be used in some cases.<sup>31</sup>

### SLEEP PRACTICES

A review of presleep-hygiene practices for children with NDDs leads to some key observations. Children with NDDs may be easily overstimulated because their brain has difficulties processing extra information, resulting in an overload state.<sup>58</sup> Therefore, bedtime activities must be planned carefully, and choosing them should be based on their relative stimulating or calming influence. Clinical experience suggests that stimulation occurs in response to new and unexpected events, anxiety, excessive noise, cold or heat, vigorous exercise, hunger, large meals, pain, seizures, and certain drugs. During a bath before bedtime, when the light is too bright or too many toys are in the water, bathing may become exciting rather than calming for children with NDDs. Playing together with siblings is often overly exciting. Storytelling should have a calming influence, but unfamiliar stories or books with the sounds of animals may be stimulating. A favorite television show or video after dinner may be calming for some, but it could also result in overstimulation for others.<sup>58,66</sup>

Alternatively, calming activities include well-structured routine behaviors, quiet baths, listening to stories or lullabies, prayers, small snacks, the presence of small toys or a familiar blanket, and a comfortable bed within a secure, quiet environment. Rhythmic, repetitive, low-frequency movements, quiet sounds, soft music,<sup>67</sup> and gentle touching seem to have a calming influence for all young children.<sup>68</sup> Playing tapes of heart beats can also be calming to small infants.

Many children with NDDs learn to fall asleep only under certain conditions or in the presence of specific sleep associations, such as being rocked or fed, which may readily be available at bedtime. During the night, when these children experience the type of brief arousal that normally occurs at the end of each sleep cycle (every 60–90 minutes) or awaken for other reasons, they are not able to get back to sleep (“self-soothe”) unless those same conditions are available to them. The children then signal the caregiver by crying (or coming into the parents’ bedroom if they are no longer in a crib) until the necessary associations are provided. This scenario often results in prolonged night wakings; thus, in general, the use of sleep associations that require caregiver participation is to be discouraged. However, on the basis of clinical experience, many children with profound brain damage only respond to primitive, somatic sleep-promoting cues such as light massaging,<sup>69</sup> brushing, gentle rhythmic movements, vibrating pillows and beds, tight bundling, or swaddling; thus, caregivers may need to provide these sleep-onset associations at bedtime.

Sleep-promotion practices are usually aimed at influencing sleep onset, but for those with NDDs, the planning of daily activities may be equally important. Regular daily routines and structure assist in reinforcing circadian rhythms by serving as *zeitgebers* (time cues). These children also often benefit from well-balanced patterns of both stimulation and rest during the day and night. Sensory or cognitive overload can result in high levels of stress and anxiety, leading to an abnormal physiologic

state of prolonged brain excitation, which could, in turn, lead to delayed sleep phase syndrome, impaired sleep maintenance, persistent early awakenings, and changes in behavior and even to self-injurious behaviors. Recognizing the contribution of daytime activities to sleep promotion is important, because discussions with the teachers may be required to improve the children's sleep. Because so many disabled children cannot express their complaints, caregivers and therapists need to function at times somewhat like detectives.

### PHYSIOLOGIC FACTORS

A number of intrinsic neurologic and physiologic factors can strongly influence the sleep behavior of children with NDDs. For example, children with disabilities and a strong family history of bipolar disorder may develop regularly recurring episodes characterized by several days of hypersomnolence, lethargy, withdrawal, behavioral regression, and irritability alternating with a manic, euphoric state during which they sleep very little, demonstrate improved mental capacities, and are hyperactive.<sup>70</sup> Other children with NDDs may experience repetitive "sleep starts," or persistent body jerks just before entering sleep, which may prevent them from falling asleep, sometimes for several hours.<sup>71,72</sup> Alternatively, some children with specific neurologic deficits<sup>73</sup> such as autism or fetal alcohol spectrum disorders have uncontrollable crying episodes during the night that may continue for several hours, disrupting sleep, and even progress to vomiting or self-injurious behavior.

Children with progressive neurologic diseases such as Sanfilippo syndrome may gradually develop severe sleep difficulties to such a degree that, in the latter stages of the progression of the syndrome, there is a complete loss of sleep/wake rhythms.<sup>15,74</sup> The resulting irregular sleep/wake rhythm is a result of the destruction of the supra-chiasmatic nuclei and their neurologic network by the pathologic process, which renders the child's sleep difficulties refractory to treatment.<sup>75</sup>

The influence of common externally mediated physiologic factors should also be considered when designing sleep-hygiene programs. For example, although heavy meals before bedtime may disrupt sleep maintenance and, thus, should be avoided, a light bedtime snack consisting of carbohydrates is useful, because hunger is one of the causes of impaired sleep in children. The impact of food on children's sleep has not been studied, although meals, especially those with a high carbohydrate content, have been shown to shorten sleep onset in healthy adults.<sup>76</sup> Other potentially sleep-interfering behaviors, such as television viewing in close proximity to bedtime,<sup>77</sup> consumption of beverages containing caffeine, and vigorous physical exercise within a few hours of sleep onset should be curtailed. Finally, it should be noted that when there are clinical suspicions for melatonin abnormality in delayed sleep phase disorder or impaired sleep maintenance, melatonin supplementation may be advisable, because without the correction of the underlying physiologic abnormality, sleep-hygiene measures and behavioral interventions are not only less effective but frequently fail.<sup>33</sup>

### SLEEP HYGIENE FOR THE CAREGIVERS

When children do not sleep, caregivers are also frequently sleep deprived.<sup>65,78</sup> There are many reasons why caregivers' sleep may be interrupted or reduced. During the night, some parents repeatedly check their children to find out if they are covered, having seizures, or are safe.<sup>79</sup> Parents of children with NDDs, motor disabilities, and epilepsy may be particularly anxious, because these children more readily get into potentially unsafe sleeping positions.<sup>44</sup> During the night, when children have seizures, infections, or aspiration, they may need to be taken to emergency units, further disrupting family sleep. However, sleep hygiene is more likely to be effective when it provides for the sleep needs of both the child and the parents.<sup>80</sup> For example, using a Webcam in the bedroom may reassure the parents and reduce nighttime anxiety. Caregivers can be taught to discriminate between normal noises made by their children and those that indicate distress or potentially medically compromising situations and to which they need to respond.<sup>81</sup>

A child with disabilities who cries before bedtime and repeatedly during the night may disturb the entire family and even the neighbors. As a result, parents may walk with their children or take them for car rides during the night, which places a greater burden on them. Some parents feel compelled to take their children into their own beds or lie next to them, either in response to a sleep problem or to ensure their safety. The practice of cosleeping may be an attempt to increase the likelihood that both the child and the parents will sleep, to avert exhaustion, or to assuage the child's increasing anxiety about middle-of-the-night sleep disturbances. Parents may not tell their doctors about cosleeping, because they become aware that this is perceived as problematic. However, to many parents, cosleeping may seem preferable to dealing with the challenge of an overtired child and sleepless nights.

A sleep-deprived parent often experiences helplessness, frustration, anxiety, anger, self-blame, negative self-evaluation, and depression.<sup>65</sup> Maternal emotional problems, in turn, can also adversely influence a child's sleep.<sup>82</sup> The parents may lack a social life and may develop marital and health problems.<sup>83</sup> When caring for a child with severe NDDs, parental stress is marked.<sup>84</sup> It is often incorrectly assumed that stresses associated with providing care for a child with NDDs result in an increased rate of divorce or separation. However, marriages are affected both positively and negatively by the type of disability; therefore, the divorce rate is about the same among caregivers of children with NDDs as in the general population.<sup>85,86</sup> The increased stress also adversely influences the sexual activities of caregivers, especially when they are sleep deprived.<sup>87</sup> This fact is often unrecognized or ignored.

The effect of sleep problems on mothers and fathers are often different.<sup>88</sup> Fathers who come home late from work would like to have close contact with their children but may not be able to, because playing is too exciting for the children. They feel alone with these difficulties. The burden placed on families by the sleep difficulties is often not appreciated. The needs of the

parents must always be considered; otherwise, alternative care is commonly requested.<sup>9</sup> Professionals should listen to the parents and inform them honestly about medical issues, prognosis, and interventions. Cultural attitudes to sleep hygiene<sup>61,62</sup> and the economic costs of impaired sleep and health on the families must be considered also.<sup>89-91</sup>

### COLLABORATIVE MANAGEMENT

Even the most experienced pediatric sleep specialists are not fully familiar with the impact of all the neurodevelopmental disorders and various health problems on sleep hygiene. Recent awareness of the need for better assessment and treatment of sleep disorders has led to the emergence of pediatric clinic teams in tertiary settings and associations for exchanging information. A collaborative approach is more efficient for helping families and can prevent the frequent burnout facing both the caregivers and therapists.<sup>92</sup> It is evident from the previous discussions that the type and severity of disabilities influence therapeutic approaches. For instance, children with autism spectrum disorders require different sleep-promotion techniques than those with severe sensory impairments. A trial-and-error approach to therapy is strongly influenced by clinical experience. Therapists from various specialty programs for children with disabilities and chronic health problems should work closely with sleep clinics. It would be ideal if the case managers of these specialty programs could accompany the children to sleep appointments.

The education of parents is vital. An appropriate understanding of the disabilities and their impact on sleep are important. For example, parents may wrongly assume that a child must be supervised throughout the night to be sure that seizures do not occur, because they assume that each seizure will result in irreversible brain damage.<sup>93</sup> This puts the parents in the position of choosing between exhaustion and guilt. Because most books for parents do not discuss the specific difficulties of children with NDDs, the caregivers who are sleep deprived should receive both verbal and written instructions from health care providers, and compliance with recommendations should be tracked. Ideally, structured sleep-promotion techniques should be instituted soon after the medical diagnosis is made. Sleep disorders should be treated early to avoid the resultant harmful effects on children and their caregivers.

### CONCLUSIONS

This collaborative review of sleep hygiene for children with NDDs is based more on clinical experience than on evidence-based trials, which are almost nonexistent in this field. Rich clinical experience must not be discarded, but future evidence-based studies should be built on it. This review illustrates that persistent sleep disturbances represent one of the most severe disabilities in children with NDDs. They are more common, and their causes are frequently different and more varied in this group of children compared with those of typically developing children. The diagnoses and treatment of sleep disorders

in children with NDDs and their management, including sleep hygiene, are grossly neglected. The emerging field of pediatric sleep medicine has the potential to provide the high-quality clinical therapy, research, and teaching needed to address the specific needs of this population of children and represents an important opportunity for the future.

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