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Treatment efficacy in behavioral pediatric sleep medicine

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Abstract

Behavioral interventions have been identified as the treatment of choice for many forms of pediatric sleep disturbance. We adopt criteria established by the Task Force on Promotion and Dissemination of Psychological Procedures (1996) to evaluate the literature base describing behavioral interventions for pediatric sleep disturbance. Three well-established interventions, one promising intervention and one probably efficacious intervention, have emerged for bedtime refusal and frequent nighttime awakenings. Only one intervention for sleep terrors and sleepwalking has sufficient empirical support to be considered promising. Behavioral interventions targeting circadian rhythm disorders (e.g., delayed sleep phase), nightmares and rhythmic movement disorder (RMD) have not been researched sufficiently to be considered empirically supported.

Keywords: Behavior management; Children; Parenting; Pediatric; Sleep; Treatment

Introduction

Disturbed sleep has been identified consistently among the most common concerns presented in clinical settings for children [1–3]. Recent evidence indicates that a good night’s sleep plays a critical role in early brain development, learning, and memory consolidation [4,5], while disrupted sleep has been linked to behavior problems and poor emotional regulation [6,7]. Although some pediatric sleep disorders demand medical attention (e.g., obstructive sleep apnea, narcolepsy), the majority require clinical assessment and intervention skills that specialists in behavioral medicine are ideally suited to provide. The purpose of this article is to evaluate the efficacy of behavioral interventions for common pediatric sleep disturbances, specifically bedtime resistance, night waking, sleep schedule disorders and parasomnias.

In 1996, an American Psychological Association task group developed specific criteria, frequently referred to as the Chambless criteria, to evaluate psychological treatments based on the weight of the empirical support behind an intervention [8]. These criteria have become the ‘gold standard’ for evaluating the efficacy of an intervention. The Chambless criteria outline the type of support necessary for a research study to be considered ‘well-established’ or ‘probably efficacious.’ The primary distinction between these two categories is that a ‘well-established’ intervention has been shown to produce benefits that exceed another treatment or placebo condition that controlled for attention and expectancy variables. We also included a category of ‘promising’ interventions that the Society of Pediatric Psychology Task Force recently added to the Chambless criteria [9]. These interventions have shown some initial empirical support and make sense conceptually, but they lack the methodological rigor necessary to meet the standards of the Chambless criteria.

Bedtime resistance and frequent night waking

Sometimes referred to as pediatric “insomnia,” the hallmark of pediatric sleep disturbance among infants and toddlers involves bedtime resistance and frequent night waking [10]. Like the outdated term “dyslexia,” use of the term “pediatric insomnia” has fallen into recent disfavor. The preferred term, “pediatric sleep disturbance,” avoids potential overlap and confusion with the adult insomnia literature. Pediatric sleep medicine is a distinctive field with unique causal and maintaining variables and different interventions. For example, adults with insomnia complain of difficulty falling asleep despite their best
efforts, while young children are likely to actively resist falling to sleep despite their parents’ best efforts. In this section, we consider bedtime disturbance and frequent night waking together because the two often coexist [11], and treatments that target one symptom often generalize to the other [12]. These findings may be explained by the fact that sleep initiation is required not just at bedtime, but also following brief nighttime awakenings that are part of a child’s normal sleep cycle [13]. Therefore, children who rely on ‘nonadaptive’ sleep associations (e.g., feeding, rocking, parental presence), which the child cannot recreate by him- or herself, will require assistance several times per night [14,15]. Because Mindell [16] recently published a comprehen- sive review of this area, we will keep our coverage brief.

‘Well-established’ interventions

Extinction

As applied to pediatric sleep disturbance, extinction involves placing the child in bed and then ignoring inappropriate child behavior (e.g., unreasonable requests, crying) until morning. Exceptions to ignoring are made in the possibility of illness or danger to the child. Extinction has been evaluated in more clinical outcome studies than any other single treatment for pediatric sleep disturbance. The procedure is easy for parents to understand and the under- lying operant theory is well-established. Specifically, ter- mination of the reinforcement contingency that maintains a given response (e.g., crying) will reduce or eliminate the occurrence of that response over time [17]. The earliest reports of using extinction to target bedtime problems consist of uncontrolled case studies [18,19]. These early reports were followed by numerous controlled, within-subject designs [20–22] and larger between-groups experi- mental studies [23–27]. The procedure now has been shown to be efficacious in five large-scale studies by four separate investigatory teams. Consequently, extinction clearly meets criteria as a ‘well-established’ intervention for bedtime disturbance and frequent night waking [16]. The primary drawback of extinction is the potential for postextinction response bursts and spontaneous recovery of the problematic response [17]. France and Blampied [28] present recent evidence suggesting that response bursts may be more frequent in children undergoing extinction (unmodified), compared to graduated extinction or extinction with parental presence. Parents who are unaware of the potential of response bursts may inadvertently resume reinforcing (e.g., attending) the problem behavior, creating an intermit- tent reinforcement schedule and thereby increasing resistance to future extinction procedures [29].

Graduated extinction

Graduated extinction was first described by Douglas and Richman [30], and later popularized by Ferber [31] in his popular self-help book entitled Solve Your Child’s Sleep Problems. Different versions of the checking procedure have been described, but all rely on extinction combined with occasional parental checks that are usually faded over time. Lawton et al. [29] found successful results with decremental graduated extinction [32], in which parents responded immediately but systematically reduced the duration of parental attention by 1/7th every 4 days over the 28-day intervention. The most common version is incremental graduated extinction, which involves ignoring inappropriate child behavior for successively longer periods of time (e.g., 5, 10, 15 min) across successive checks within the same night [12,33] or across successive nights [34].

With the addition of two recent studies, there are now three randomized, well-controlled group experiments to support the efficacy of graduated extinction [25,35,36]. Because these studies were published by three separate investigatory teams, there now is sufficient support to qualify incremental graduated extinction as a ‘well-established’ treatment for bedtime resistance and frequent night waking.

There is some indication that incremental increases between the checks may not be critical to successful outcomes. A slight modification, termed the “quick check” or “minimal check” [32,37] is virtually identical to increment- al gradual extinction, except that the periods between parental checks are maintained at a constant interval (e.g., every 10 min). This version has produced successful outcomes in one uncontrolled clinical outcome study [38], one multiple-baseline study [28] and one group comparison study [39]. Many professionals strongly advocate these checking procedures as a “friendly” alternative to unmodified extinction. Recent data, however, suggest that com- pared with unmodified extinction, checking procedures may result in more, not less, crying and infant distress [28]. This may be because the mere appearance of the parent at regular intervals is sufficient to reinforce the very behavior (i.e., crying) that parents are trying to extinguish.

Early intervention/parent education

Providing early intervention services in an effort to pre- vent sleep disturbances from occurring presents an enticing alternative to treating problems after they are firmly entrenched. A variety of behavioral interventions have been used in an educative manner to promote the early establish- ment of healthy sleep patterns. Strategies typically target sleep routines, parental handling during sleep initiation, and parental response during night awakenings. The one consist- ent recommendation has been to place infants in their cribs sleepy but still awake, to promote independent sleep initiation skills at bedtime which allow infants to return to sleep after waking. One small-scale study [40] and three large-scale studies attest to the efficacy of early intervention [41–43]. After reviewing the empirical data, Mindell [16] aptly concluded that parent education as a prevention strategy meets criteria as a ‘well-established’ intervention. Interestingly, the most impressive prevention study conducted to date is yet to be published. Symon et al. [44] randomly assigned 268 infants to early intervention or control at 2–3 weeks of age.
The intervention required only 45 min of contact time and focused on teaching parental handling skills to promote infant independent sleep achievement skills. By 6 weeks of age, infants in the intervention group averaged nearly 9 h more sleep per week than infants in the control group. Group differences persisted through 12 weeks and collection of long-term data is currently underway. These data may help address the primary weakness of existing studies in this area, which has been failure to collect follow-up data in order to establish the true preventive nature of early intervention.

'Probably efficacious' interventions

Scheduled awakenings

Scheduled awakenings first were used for frequent night waking by McGarr and Hovel [45] in a single-case, reversal design. The procedure since has been evaluated in two multiple-baseline studies [46,47] and one large group comparison study [24]. The procedure calls for establishing a baseline of spontaneous nighttime wakings, then scheduling preemptive awakenings 15–30 min prior to the usual time of the child’s spontaneous wakings. With each parent-induced scheduled awakening, the child is provided with the “usual” responses (e.g., feeding, rocking, soothing) as if the child had awakened spontaneously. The time span between awakenings is increased systematically (e.g., by 30 min) until the awakenings can be eliminated and the child sleeps through the night. Scheduled awakenings appear to systematically increase the duration of children’s sleep periods while eliminating spontaneous waking and excessive crying. Rickert and Johnson [24] compared scheduled awakening with unmodified extinction and found that, while both techniques were effective in reducing night wakings, extinction produced the most rapid results.

'Promising' interventions

Extinction with parental presence

This more recent modification to extinction is based on the assumption that children experience bedtime problems due to separation anxiety [32]. The approach calls for a parent to sleep in the child’s bedroom, but not in the same bed for 1 week while “feigning” sleep and ignoring inappropriate child behaviors (extinction). After 1 week, the parent resumes sleeping in a separate room. The assumption is that the child’s awareness of parental presence will be reassuring and promote quick sleep onset. Parents also may find the procedure more acceptable, leading to better adherence than unmodified extinction. Parental presence has proven efficacious in one large group study, showing comparable results to the quick check procedure in eliminating children’s bedtime disturbance [39]. France and Blampied [28] recently conducted a multiple-baseline evaluation of extinction, extinction with minimal check and extinction with parental presence. They concluded that parental presence produced rapid resolution of night waking and crying with fewer postextinction response bursts, making it the “treatment of choice” [28].

Positive routines/faded bedtime with response cost

Positive routines and faded bedtime are similar strategies that rely heavily on stimulus control as the primary agent of behavior change. Critics of behavioral reductive procedures point out that extinction-based procedures may reduce or eliminate inappropriate behaviors, however, they fail to teach or reinforce adaptive replacement behaviors. Positive bedtime routines can be conceptualized in part as a differential reinforcement procedure designed to teach children appropriate pre-bedtime behaviors and sleep onset skills. The procedure involves temporarily delaying bedtime to ensure rapid sleep initiation, then establishing appropriate cues for sleep onset (e.g., consistent prebedtime routine) that are chained and paired with positive parent–child interactions. Once the behavioral chain is well-established and the child is falling asleep quickly, the bedtime is gradually moved earlier in the evening until reaching the pre-established bedtime goal.

Positive bedtime routines first were used to eliminate bedtime tantrum behaviors of 3 children in a within-subject, A–B–C design [48]. The intervention was effective in gaining voluntary bedtime compliance in all three cases. Like many studies in this area, the authors collected behavioral data (e.g., bedtime resistance) but did not address the children’s actual sleep patterns [48]. Two large group studies also reported beneficial results with positive routines [35,49]. One of these studies [35] used a well-defined protocol and randomized group design, placing positive routines in the ‘promising’ intervention category.

Piazza and Fisher [50,51] used a variation of positive routines to eliminate severe sleep disturbances and increase appropriate sleep in children. Faded bedtime involves first delaying the child’s bedtime by approximately 30 min. If the child does not fall to sleep quickly (e.g., within 15–30 min), a response cost procedure can be added, during which the child is taken out of bed and kept awake for 30–60 min before being allowed to return to bed. This procedure continues until the child falls to sleep quickly. If the child achieves quick sleep onset, the bedtime is set 30 min earlier the next night and continually “faded” according to these criteria until reaching the agreed upon bedtime goal. Sleep is scheduled and restricted, as the child is awakened at the same time each day and is not allowed to sleep outside of prescribed sleep times.

Faded bedtime and positive routines share the common components of temporarily delaying the bedtime and bedtime fading. However, as Piazza and Fisher [51] point out, positive routines require a wider repertoire of responses from the parent such as instituting a particular routine, praising each component of the routine, and repeatedly returning the child to bed if they come out. Faded bedtime, both with and without response cost, has been evaluated in five treatment outcome studies employing well-controlled,
within-subject designs [50–54]. At this point, bedtime fading with response cost may be the most promising alternative to extinction-based procedures and is a prime target for a randomized large group comparison study. Interestingly, the procedure closely resembles a combination of two behavioral interventions, sleep restriction and stimulus control instructions, which have the strongest treatment efficacy for chronic adult insomnia [55].

Treatment effect sizes

One weakness in using descriptive criteria such as Chambless et al. [8] when evaluating treatment efficacy is the overreliance on statistical significance; to select outcomes. Larger samples usually produce a greater likelihood of statistical significance, however, one cannot use statistical significance to conclude that an intervention yields more powerful, or clinically meaningful results. Consequently, treatment effect sizes have been recommended for inclusion in reviews of empirically supported interventions rather than sole reliance on statistical significance [56].

Compared to research on adult insomnia, the area of pediatric sleep disorders is still in its relative “infancy” [57]. While dozens of published intervention studies exist for insomnia, with relatively consistent outcome variables (e.g., sleep latency, number of awakenings, total sleep time) [58], the pediatric sleep literature consists of only a handful of randomized group studies with little consistency in outcome variables. We were able to identify several randomized or partially randomized treatment outcome studies from the pediatric sleep literature. Effect sizes, however, could not be calculated for several studies due to the use of combined interventions [23,59], pooling of data from more than one intervention group [38,39], or failing to report statistical outcome data [36]. We were able to calculate effect sizes from four randomized group studies [24,25, 27,35] that evaluated the efficacy of four different behavioral interventions (extinction, graduated extinction, scheduled awakenings, positive routines) across six outcome measures (frequency and duration of awakenings, frequency and duration of bedtime tantrums, “good bedtimes,” “good nighttimes”). Effect sizes varied considerably depending on the study, the outcome variables assessed and the time of measurement (see Table 1). Based on direct comparison studies, Extinction, Graduated Extinction and Positive Routines were found to produce comparable results, with combined average effect sizes, $d$, of 1.58, 1.55, and 1.35, respectively. It should be noted that for most outcome variables, all four behavioral interventions surpassed $d = 0.80$ (see Table 1), indicating a large treatment effect [60]. These effect sizes for children with bedtime disturbance compare quite favorably to the effect sizes found for adult insomnia. For example, Morin et al. [55] calculated effect sizes for behavioral interventions combined, including $z = 0.88$ for sleep onset latency, $z = 0.92$ for time awake after sleep onset and $z = 0.53$ for number of nighttime awakenings. Two subsequent meta-analytic reviews found similar results [58,61]. Smith et al. [58] found a mean effect size of 0.96 across five outcome variables for behavioral interventions. Caution must be exercised in comparing the pediatric and adult literatures, however, because few similarities exist in chosen outcome variables. For example, treatment outcome studies for pediatric bedtime resistance and frequent night waking often target bedtime behaviors (e.g., compliance, tantrums, crying) without including sleep-related variables such as sleep onset, number and duration of awakenings, or total sleep time.

Circadian rhythm disorders

Circadian rhythm disorders involve a misalignment between an individual’s sleep pattern and the sleep pattern that is desired or regarded as the societal norm [62]. This review focuses on the three most common circadian sleep disorders encountered in children and adolescents: advanced sleep phase syndrome (ASPS); delayed sleep phase syndrome (DSPS); and irregular sleep–wake pattern. ASPS is believed to be most common in infants, toddlers and elderly individuals [63,64]. In ASPS, the major sleep episode is advanced in relation to the desired clock time, resulting in symptoms of compelling evening sleepiness, early sleep onset and an awakening that is earlier than desired [62]. There are few reports of ASPS in the literature. Although there is one report of phase advance chronotherapy being successful in an older adult [65], we found no published treatment studies targeting children or adolescents.

<table>
<thead>
<tr>
<th>Study/outcome variables</th>
<th>Intervention</th>
<th>Graduated</th>
<th>Scheduled</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Awakenings</td>
<td>$d = 2.31$</td>
<td>$d = 1.11$</td>
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<tr>
<td>Frequency Bedtime Tantrums</td>
<td>$d = 0.75$</td>
<td>$d = 0.88$</td>
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<td>Duration Bedtime Tantrums</td>
<td>$d = 1.50$</td>
<td>$d = 1.83$</td>
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<tr>
<td>Number of Awakenings</td>
<td>$d = 0.68$</td>
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<td>Minutes Awake</td>
<td>$d = 1.00$</td>
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<tr>
<td>Good Bedtimes</td>
<td>$d = 2.63$</td>
<td>$d = 1.93$</td>
<td></td>
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<tr>
<td>Good Nighttimes</td>
<td>$d = 1.29$</td>
<td>$d = 2.03$</td>
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All studies employed a RTC design, therefore, between-groups effect sizes were computed on posttreatment scores.

- a Six weeks posttreatment.
- b Four weeks posttreatment.
- c Three weeks posttreatment.
- d Settled alone in less than 10 min.
- e Slept through night without sleeping with or waking the parents.
The most common circadian sleep disturbance among older children and adolescents is DSPS [66,67]. In DSPS, the major sleep episode is delayed in relation to the desired clock time that results in symptoms of sleep-onset insomnia and/or difficulty in awakening at the desired time [62]. DSPS initially was described with reference to adults; however, most adults report that their difficulties originated in childhood or adolescence [68–70].

Behavioral treatments for DSPS typically include one or more of three primary components: stabilization of the sleep schedule; gradual realignment to a desired sleep schedule through either phase advance or phase delay chronotherapy; and rewards or behavioral contracts to facilitate maintenance of treatment effects. Unfortunately, there are few data to support these treatment components for children. In fact, at the time of this writing, there is not a single behavioral intervention for DSPS that has sufficient empirical support to be classified by the Chambless criteria. In order to facilitate additional research in the area, we will briefly describe those interventions that have received attention in the literature.

Behavioral treatment of DSPS primarily has focused on either advancing or systematically delaying the child’s sleep phase until the desired sleep–wake schedule is achieved. Ferber and Boyle [71] have advocated using phase advance with younger children with DSPS, which involves gradually advancing the waking time followed by a gradual advance of the child’s bedtime, although there has been no research evaluating this approach with children. Attempts to phase advance with adolescents and adults with DSPS have not been successful [67,72,73].

Phase delay chronotherapy [74] involves first stabilizing the child’s sleep schedule, then “lengthening” the day by delaying both bedtime and wake time by 3 h each day over successive days until the desired sleep phase is reached. Once the desired sleep–wake schedule is achieved, bedtimes and wake times must be closely adhered to throughout the week or children will drift back to their previous sleep–wake schedule. Although chronotherapy has been used primarily with adults [75], there are a few published studies that have targeted child participants [76–78]. Dahl et al. [76] used chronotherapy and a behavioral intervention (extinction) to treat the sleep problems of a 10-year-old girl diagnosed with DSPS and Attention Deficit Hyperactivity Disorder (ADHD). The intervention package, which took 1 week to implement, produced an increase in total sleep time from 7.2 to 9.0 h per night. Pre- and post-intervention behavioral measures and teacher ratings indicated significant improvement in peer interactions, increased productivity on a timed arithmetic task and increased completion of academic seatwork. Although ADHD symptomatology persisted, the improvement in sleep reportedly produced a significant reduction in the severity of symptoms and clinical impairment. Despite the fact that chronotherapy has received widespread billing as a treatment for DSPS, there has been surprisingly little research on the procedure since it was first introduced in 1981.

Thorpy et al. [67] devised an interesting alternative to daily progressive chronotherapy that reportedly was less disruptive to participants’ weekly school schedule. Sleep deprivation with phase advance (SDPA) involves keeping a regular sleep schedule for 6 days, followed by one night of total sleep deprivation on the weekend. Bedtime on the following night is advanced 90 min earlier than the previous 6 days, and the new sleep schedule is maintained for the next 6 days. The process is repeated on successive weekends until the desired schedule is attained. SDPA “appeared to be helpful” for the group of adolescents described, however, the protocol still awaits formal empirical evaluation.

Irregular sleep–wake patterns consist of temporally disorganized and variable episodes of sleeping and waking behavior [62]. Irregular sleep schedules appear to occur more often in young children with inconsistent bedtimes and wake times and adolescents who demonstrate large discrepancies between their weekday and weekend sleep schedule [79]. Mindell et al. [80] successfully treated a 2-year-old blind child with an irregular sleep schedule. A strict sleeping and feeding schedule was introduced to increase the likelihood the child would be tired at bedtime and fall asleep quickly. Although this procedure did not systematically advance the bedtime, the same effect was achieved. This report was an uncontrolled pre-/posttreatment study, but observable effects of the schedule were immediate and lasting. The authors postulated that imposing strict schedule changes is likely to be more successful in young children who still have polyphasic sleep patterns. Piazza et al. [78] used chronotherapy to effectively treat an 8-year-old female with developmental disabilities and a disrupted sleep–wake schedule characterized by irregular sleep onset times, variable wake times, inappropriate day sleep and reduced total sleep time. Immediate improvements in the child’s sleep pattern were observed after chronotherapy was introduced, achieving an age-appropriate bedtime within 11 days. Four months of follow-up data indicated that the improvements were maintained. These results suggest that the utility of phase delay chronotherapy may extend beyond DSPS to other sleep schedule disturbances.

**Parasomnias**

The term parasomnia is used to describe a group of undesirable behaviors that occur during sleep or are exacerbated by sleep [62]. Common forms include sleepwalking, sleep terrors, nightmares and rhythmic movement disorder (RMD). Because there is limited research attesting to the efficacy of behavioral interventions for most parasomnias in children, this section will outline clinical approaches that need to be subjected to empirical study.
Scheduled awakenings

Scheduled awakenings involve the parent waking the child 15–30 min prior to an expected partial arousal event. Although initially used to treat nighttime awakenings, scheduled awakenings gained popularity as an intervention for parasomnias after the publication of uncontrolled reports proclaiming the elimination of sleepwalking [85] and sleep terrors [86]. The recent publication of two successful multiple-baseline studies [87,88] places scheduled awakenings within the classification of a ‘promising’ intervention.

The mechanism underlying scheduled awakening’s utility in decreasing partial arousal parasomnias in children is unclear. One possibility is that the awakenings alter the child’s sleep patterns so as to eliminate the disruption in slow-wave sleep [85,87]. Alternatively, scheduled awakenings may condition the child for self-arousal just prior to an event, thereby avoiding it altogether. Finally, it could be that scheduled awakenings indirectly reduce partial arousal events by increasing the child’s total sleep time. As mentioned previously, scheduled awakenings are used for children with frequent nighttime awakenings and have been found to systematically increase the length of children's sleep periods. Durand and Mindell [87] noted an unexpected and unexplained increase in total sleep time for all 3 of their participants after implementing scheduled awakenings, which presents a confound of the independent variable.

Nightmares

Nightmares are frightening dreams that usually awaken the sleeper from REM sleep [62]. They typically involve an episode of sudden awakening from sleep with intense anxiety or fear of harm. One way nightmares can be distinguished from sleep terrors is that upon awakening, the child is usually alert with little confusion or disorientation. Furthermore, most children seek parental reassurance, describe vivid details of the frightening images and have difficulty returning to sleep. The timing of events is important, because in contrast to sleep terrors, which occur during slow-wave N-REM sleep, nightmares take place during REM sleep, which is more prominent during the last half of the night.

The clinical approach for children who experience occasional nightmares usually involves nothing more than education that nightmares are an unavoidable part of growing up and reassurance that they do not necessarily signify emotional disturbance. Nightmares that occur frequently or contain extremely disturbing content may warrant professional attention.

Surprisingly, there is no solid research to guide professionals in their efforts to assist children who experience frequent or disturbing nightmares. To date, the empirical literature on behavioral interventions for children with nightmares consists of two nonrandomized group studies [89,90], one quasi-experimental case report [91], and a handful of nonexperimental case descriptions [92–95]. Consequently, the current state of the empirical research fails to support a single intervention as ‘promising’ according to our adopted criteria.

Wile [89] published the largest, albeit uncontrolled, group study with 25 children between the ages of 6 and 14 years. Group 1 comprised 11 children who were taught to “think of positive dreams in the place of nightmares,” while Group 3 included 3 children who were encouraged to engage in dream-relevant content coping tasks during the day. Although termed “indirect suggestion,” this intervention obviously consisted of in vivo exposure. For example, a child who had nightmares of horses after seeing a dead horse was taken to visit horses and encouraged to learn about them, while another child whose nightmare content involved skeletons was taken to a museum of natural history to see numerous skeletons. The median time for the nightmares to “disappear” was 3 months for Group 1, 5 months for Group 2 and 2 months for Group 3. Although the work of Wile [89] comprises the largest study to date, the method of subject assignment was not described, statistical tests were not used, a control group was not included, and only 3 children participated in the third group. Nonetheless, the study pioneered systematic evaluation of focused interventions to reduce nightmares in children, which was a radical departure from the Freudian
era in which dreams were considered symbolic discharges of repressed sexual conflict.

The first and only controlled group study to date was published recently by Krakow et al. [90], who are well-known for their work with adult nightmare sufferers [96,97]. Nineteen adolescent females (aged 13–18 years) with chronic nightmares were assigned to waitlist control or to active intervention consisting of a 6-h workshop on imagery rehearsal therapy (IRT). The IRT intervention consisted of three steps: (a) self-selecting a nightmare; (b) changing the nightmare “anyway you wish”; and (c) rehearsing the new version 5–20 min each day. At 3 months, retrospective report indicated that nightmare frequency decreased significantly in the treatment group with no change in the control group. The authors recognized the limitations of their study, including small sample size, nonrandomized subject assignment, a selective population (residential facility) and instruments not standardized for use with adolescents. In addition, nightmare frequency was measured via retrospective report, which has been shown to be less reliable than daily logs [98].

Researchers interested in pediatric sleep should find the treatment of nightmares a ripe area to make one’s “mark.” There are several important points to take into account. First, accurate identification and measurement of nightmares in young children is challenging. Unlike the behavioral manifestations of sleepwalking, night terrors and enuresis, nightmare episodes may not be accompanied by external manifestations that are readily apparent to parents sleeping in another room [99]. Second, the existing literature contains differences in the operational definition of nightmares, which leads to uncertainty regarding the epidemiology, etiology, diagnosis, and treatment of nightmares in children [100]. The pediatric sleep literature is fraught with confusion regarding nightmares and sleep terrors, often using the terms interchangeably [101–104]. Finally, nightmares as “frightening dreams that awaken the child from REM sleep” must be clearly distinguished from a child’s verbal report of a “nightmare” following a normal nighttime awakening that is selectively reinforced (e.g., serves as the child’s admission ticket into the parents’ bed).

In summary, there is surprisingly little quality research supporting clinical intervention for children who experience frequent or disturbing nightmares. The empirical support that does exist suggests that exposure-based therapies may be a fertile area for future research.

**Rhythmic movement disorder**

RMD is a sleep–wake transition disorder that comprises a group of stereotyped, repetitive movements involving large muscles, usually of the head and neck [62]. These movements typically occur prior to sleep initiation and into light sleep, then again during the night as the child returns to sleep following normal awakenings. The topography of the movements varies along a broad spectrum (e.g., head banging, head rolling and body rocking) [105]. Head banging (jactatio capitis nocturna) is the most commonly recognized form, characterized by repeated lifting of the head or upper torso and forcible banging of the head into the pillow, mattress, headboard or wall.

The etiology of RMD is unknown. It most likely represents the final common pathway derived from multiple etiologies. The diagnosis of RMD can be challenging in certain cases, yet relatively straightforward in others. For most children, RMD represents a stereotypic movement/habit disorder with the essential feature involving “motor behavior that is repetitive, often seemingly driven and non-functional” [106]. Habit behaviors like RMD can often be distinguished from organically based movements because the former can be produced voluntarily, can be temporarily suppressed, and can be modified by distractions or special attention [107]. Medical etiology should always be ruled out, especially when RMD presents for the first time after early childhood [108]. Accurate diagnosis can be greatly aided by having parents videotape the nocturnal events or through split-screen video-polysomnographic analysis [109].

Upon reviewing the treatment literature, one quickly discovers considerable confusion regarding the definition of RMD. Many studies cited to have targeted RMD instead addressed daytime self-injurious behavior, usually in individuals with mental disabilities [110–112]. Using a consistent definition and diagnostic criteria of RMD, such as the one used by the International Classification of Sleep Disorders [62], will be a critical step toward advancing the scientific literature in this area.

To date, there have been no randomized group treatment studies published. In addition, no two studies have evaluated the same treatment protocol, leaving the area without a single ‘promising’ intervention. The entire literature on behavioral interventions for RMD in children consists of eight published articles that base their results on anecdotal reports, uncontrolled (e.g., A–B design) single-subject studies and quasi-experimental single-subject designs. Although the state of the empirical literature cannot be construed to provide strong support for using behavioral interventions, the case for using psychopharmacological agents is even weaker. The medication literature consists of a few uncontrolled anecdotal reports, with no measurement of RMD activity at pre- or posttreatment. In contrast, there is a handful of quasi-experimental studies with pre- and posttreatment frequency data to show that behavioral interventions can produce rapid and substantial reductions in RMD, with durable and lasting effects [113–117].

Several studies have incorporated immediate detection and feedback for the presence of rhythmic behavior, by using verbal prompts from all night observers, a contingent light signal or audible alarms attached to the bed [113,115–118]. Because rhythmic movement is often highly conditioned to the sleep onset process, teaching replacement behaviors has been a primary goal. Some intervention packages explicitly taught alternative sleep initiation...
behaviors, while children in other studies appeared to develop replacement behaviors on their own, such as learning to sleep on one’s back rather than front, mild rocking from side to side as opposed to violent head banging or “grinding” one’s head into the pillow rather than banging it [113,116,118]. Mild punishments such as response cost also have been used, including waking the child or having the child walk around for a brief time before being allowed to return to bed [114,115]. A couple of studies used professionals to deliver the intervention within a hospital setting before teaching parents to utilize the protocol at home [114,118].

Conclusions

The past decade has witnessed heightened interest and increased recognition of the impact that sleep has on children’s development, learning, mood and behavior. The field of pediatric sleep medicine has witnessed a proliferation of recent activity including the publication of review articles [10,16,32,120], clinical practice guidelines [121,122] and self-help books [123,124]. With the exception of bedtime refusal and night waking, however, there are surprisingly few empirically supported interventions for pediatric sleep problems. Uncontrolled case reports far outnumber experimental studies, and the majority of the randomized studies have recruited subjects through newspaper advertisements, limiting the external validity of the findings to clinical populations. Sample sizes have been small with short-term data collection, and there has been little agreement on relevant outcome variables. Some studies included behavioral outcome variables (e.g., duration of crying, frequency out of bedroom), while others used sleep-related variables (e.g., sleep latency, frequency/duration of awakenings, total sleep time). A select number of studies incorporated both behavioral and sleep-related variables, but some major studies included neither. Confusion surrounding the definition of certain disorders (e.g., nightmares vs. sleep terrors, RMD vs. self-injurious behavior) may be resolved by adopting formal diagnostic criteria, such as those published by the American Academy of Sleep Medicine (formerly the American Sleep Disorders Association) [62].

In conclusion, we hope that this review will provide guidance to clinicians working with families, and encouragement and direction to researchers in the field. While some readers may view the glass as “half empty,” we perceive a rapidly developing field with abundant opportunities to forge an empirical foundation for novel or promising interventions. Treatment outcome studies are desperately needed to allow professionals to adopt a consumer-driven model that allows parents to make informed decisions after learning about various treatment options, their efficacy, advantages, disadvantages and potential side effects [28].

References


