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Psychiatric symptoms in children with insomnia referred to a pediatric sleep medicine center

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Abstract

Background and purpose: To assess the frequency and nature of clinical and psychiatric symptoms in children referred to a pediatric sleep center for evaluation of insomnia.

Patients and methods: A retrospective chart review of all children referred to the pediatric sleep medicine was conducted. Children presenting exclusively with sleep initiation and/or maintenance problems underwent a structured clinical psychiatric interview and their parents completed the behavioral assessment system for children (BASC), pediatric symptom checklist, the clinical attention problem scale and a detailed sleep questionnaire.

Results: Twenty-three of 46 children (50%) with persistent insomnia had a professional diagnosis of another psychiatric disorder. In the remaining 50%, although parents denied any previous psychiatric history, 40% displayed psychiatric symptoms as documented by psychometric measures and clinical interview. A significant positive correlation was observed between depressive BASC score and sleep onset latency and an inverse correlation was present with REM sleep latency.

Conclusion: The vast majority of children presenting with persistent insomnia exhibit clinical symptoms of an accompanying psychiatric disorder, suggesting that comprehensive psychometric assessments are warranted in this population.

Keywords: Insomnia; Psychiatric symptoms; Children

1. Introduction

A growing body of research suggests a strong relationship between sleep and emotional and behavioral development in children [1–5]. Furthermore, the prevalence of sleep complaints has been assessed in the general pediatric population [6,7], as well as in children with special needs, such as pediatric populations with chronic neurodevelopmental [8,9], psychiatric [10–12], and medical disabilities [13]. Population-based surveys on sleep combined with behavioral assessment instruments have also been widely utilized, and have thus far revealed a strong association between sleep problems (e.g. difficulties initiating and maintaining sleep, sleep-disordered breathing, parasomnias, and abnormal involuntary movements) and behavioral and emotional symptoms in children [1,5,14,15].

Despite compelling evidence on the wide prevalence of pediatric insomnia in the primary care setting, this problem is poorly studied and understood. Furthermore, since symptoms of pediatric insomnia greatly overlap with ongoing developmental changes in sleep habits and are reported mainly by the caregivers rather than by the patients themselves, no clear consensus on the definition of insomnia in children exists, even among pediatric sleep experts. A number of behavioral sleep disorders in children present with difficulty settling in bed and delayed sleep onset and are greatly influenced by parent–child interaction and other environmental factors (for reviews see Refs. [16–18]). However, no research evidence is available on the issue of primary or idiopathic insomnia in children, and in fact, insomnia in children is viewed as a symptom rather than as a diagnostic entity. Glaze et al. [18] have recently proposed Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV)-adapted criteria for identification and assessment of insomnia in children. These criteria

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require that the subjective report of sleep disturbance should be accompanied by functional daytime impairment in mood, behavior or learning, and that it does not occur in the presence of another intrinsic sleep disorder, parasomnia, or drug use/abuse [18].

Approximately 35% of adult insomniacs suffer from an underlying psychiatric disorder [19]. Moreover, insomnia serves as an early marker and as a major risk factor for development of depression [20]. A recent study of sleep problems in children indicated that 13.2–28.6% of children who report trouble sleeping exhibit symptoms of anxiety and depression [2]. Taken together, these findings raise the possibility that insomnia is an early sign of emotional distress or that, in susceptible individuals whose sleep homeostasis is poorly preserved by intrinsic biological mechanisms, insomnia is causally implicated in the mood disturbance.

To the best of our knowledge, no studies are available examining psychiatric symptoms in children with insomnia. Thus, the primary goal of this study was to investigate the psychiatric status and clinical characteristics of children referred to a Pediatric Sleep Medicine Center with the chief complaint of sleep initiation and/or maintenance problems.

2. Methods

2.1. Subjects

A retrospective chart review was conducted of all children consecutively referred to Kosair Children's Hospital Sleep Medicine and Apnea Center in Louisville, KY during the years 2002–2003 with a chief complaint of difficulties initiating and/or maintaining sleep. The criteria used for definition of initiation or maintenance insomnia were those recently published by Glaze et al. [18] and included: "the complaint is significant difficulty (defined by frequency, severity, and/or chronicity) initiating or maintaining sleep. The difficulty is viewed as problematic by the child and/or caregiver; the sleep disturbance causes clinically significant impairment in school performance, behavior, mood, learning, or development for the child as reported by the child and/or a caregiver; the sleep disturbance does not occur exclusively in the context of an intrinsic dyssomnia such as narcolepsy, restless legs syndrome, or sleep-related breathing disorders, a circadian rhythm disorder, or a parasomnia; and the sleep disturbance is not attributable to either the direct physiologic effect of a drug or the abuse or misuse of a prescribed medication (page B15, paragraph 3)". Based on this definition of insomnia, 46 children were selected from a larger sample of children evaluated at the Pediatric Sleep Medicine Center.

Children presenting with insomnia underwent a structured psychiatric interview, and their parents completed the Behavior Assessment System for Children (BASC) at the time of consultation. Children were excluded if there was a history of sleep disordered breathing (SDB), abnormal movements during sleep (such as seizures or periodic limb movement disorder), parasomnias, behavioral sleep disturbances, and/or other sleep-related complaints not pertaining to insomnia. The psychiatric and medical profiles of eligible children were reviewed. Subjective information regarding sleep habits was routinely obtained during the initial consultation using a structured problem-based survey completed by the parent. The Pediatric Symptom Checklist (PSC) and the Clinical Attention Problem Scale (CAPS) were also administered to parents at the initial clinical visit. The demographic, clinical, psychiatric, and medical information of all children was collected from the parent-reported histories. All 46 children were subjected to the same psychometric tests and clinical interviews.

2.2. Subjective evaluation

2.2.1. Clinic-based sleep habit questionnaire

Parents of all the patients seen in the Sleep Medicine Center completed at their initial appointment a detailed questionnaire about sleep problems, habits, and sleep practices. Questions pertained to bedtime routines ("Will your child fall asleep alone in bed?" "In order to fall asleep does your child need a special toy or object?" "What do you think that prevents your child from falling asleep?"), as well as sleep disturbances such as daytime sleepiness, restless sleep, nightmares, sleepwalking, nocturnal enuresis, sleep apnea, snoring, and nocturnal awakenings. The majority of questions were dichotomous with 'yes' or 'no' answers; however, some were open-ended or multiple-choice items.

2.3. Psychiatric evaluation

Children underwent a psychiatric interview by a child psychiatrist (Dr Anna Ivanenko) as part of their routine assessment. In addition to this interview, several assessment tools were used, including the BASC, the PSC, and the CAPS.

2.3.1. Behavior-assessment system for children (BASC)

Parents of the children selected completed the BASC, which is a well validated 126–138-item questionnaire with 13 subscales addressing various externalizing, internalizing, and school problems [21]. The BASC is a comprehensive and multidimensional tool that aids in the differentiation of several pediatric emotional and behavioral disorders. A *T*-score ≥ 70 on clinical subscales indicates a clinically significant behavioral problem. For the adaptive subscales, a *T*-score of ≤ 40 is considered to be a marker of a child 'at risk'.

2.3.2. Pediatric symptom checklist (PSC)

The PSC [22] is a parental report scale composed of 35 items that assesses behavioral and emotional problems. The classifications of the PSC are in agreement with the child

behavior checklist (CBCL) and the clinician's global assessment scale (CGAS). It also correlates strongly with the presence of psychiatric disorders. Each item is rated as 'not true', 'often true', or 'very true' by the parent. A score of ≥ 28 is considered to be an indication of significant psychosocial impairment in children aged 6–16 years.

2.3.3. Clinical attention problem scale (CAPS)

The CAPS [23] is a 24-item parental report scale that assesses inattentive and overactive behaviors in children. Parents rate their child's behavior on a three-point scale (not true, often true, or very true) and distinction is made between behaviors present in the morning and afternoon. Scores ≥ 3 for inattention and for hyperactivity are considered clinically significant.

2.4. Polysomnographic evaluation (PSG)

Thirty six (78%) of 46 children underwent overnight polysomnographic (PSG) evaluation to rule out other sleep disorders that could result in difficulty maintaining sleep. Ten children from the selected sample did not require PSG since there was no history of sleep related problems other than insomnia.

Children were monitored in the presence of a parent for 10–12 h. The room was quiet and darkened, with an ambient temperature of 24 °C. The PSG ended when children awakened for the day (or approximately 7:00 a.m. if they were still sleeping). This arousal time was maintained for all PSGs on weekends and on school nights; however, no child was awakened from REM sleep. No drugs were used to induce or modify sleep. The following parameters were measured: chest and abdominal wall movement by respiratory impedance or inductance plethysmography; ECG; airflow with an oronasal thermistor/nasal cannula connected to a pressure transducer; and breath-by-breath end-tidal carbon dioxide levels with a sidestream end-tidal capnograph (PETCO2; Pryon SC-300, Menomonee Falls, WI). Arterial oxygen saturation was assessed by pulse oximetry (Nellcor N 100; Nellcor Inc., Hayward, CA) with simultaneous recording of pulse waveform. The left and right electro-oculograms (EOG), eight channels of electroencephalogram (EEG), chin and anterior tibial electromyograms (EMG), and analog output from a body position sensor (Braebon Medical Corporation, NY) were monitored as well. Snoring was monitored with a tracheal microphone positioned over the anterior aspect of the neck (Sleepmate, VA). All signals were digitized using a commercially available PSG system (Rembrandt, Medcare, Buffalo, NY). Digital synchronized video recording was performed for the duration of the study.

2.5. Objective sleep variables

PSG recordings were scored for sleep stages according to the criteria of Rechtschaffen and Kales [24]. Arousals were scored according to the criteria recommended by the American Sleep Disorders Association Task Force Report; and the total arousal index (AI) was recorded. The apnea/hypopnea index (AHI), minimum oxygen saturation (Min% O_2) and mean oxygen saturation (Mean% O_2) were also recorded. Periodic limb movement index (PLMI) was defined as the number of periodic limb movements (at least four movements, between 4 and 90 s apart, lasting for 0.5–5 s each) per hour of sleep. The following measures were collected from the sleep study reports: sleep latency, REM latency, percentage of total sleep time (TST) spent in stages 1–4 of sleep, percentage of REM sleep, percentage of awake time as a proportion of TST after sleep onset, and sleep efficiency (% sleep eff).

2.6. Data analysis

Data were reviewed and analyzed using a statistical software package (SPSS (version 11.5.0, Chicago, IL). Statistical analysis was primarily descriptive in nature, due to the characteristics of the study. Chi square, two-tailed partial correlations, and two-tailed equal variance Student's *t*-tests were performed between data sets. Partial correlations were completed between all continuous variables, adjusting for the influence of a third variable (the presence of a previous psychiatric diagnosis). A P-value < 0.05 was retained as statistically significant.

3. Results

Based on the demographic, medical, and psychiatric information routinely obtained during their initial consultation at the Sleep Clinic, 46 children having no other previously diagnosed sleep disorders were identified as presenting with a complaint of initiation or maintenance insomnia. Patients ranged from 5 to 16 years, with a mean age of 9.2 ± 3.6 years. Thirty-one subjects were male and 37 were Caucasian. Two subgroups became apparent: those with a current or previous history of psychiatric illness (InsP, $n = 23$) and those without any previous psychiatric diagnosis (Ins, $n = 23$). The most common psychiatric illnesses were attention-deficit/hyperactivity disorder (ADHD) ($n = 14$), anxiety ($n = 15$) and mood disorders ($n = 7$). Although none of the subjects in the Ins group had a previously diagnosed disorder, eight were diagnosed by the evaluating psychiatrist as having clinically significant symptoms of anxiety, depression, and aggression. Of the 23 InsP subjects with a psychiatric co-morbidity, 70% were receiving psychopharmacological agents at the time of evaluation compared to none in the Ins subgroup. In the Ins group, an equal proportion of subjects (70%) had an additional medical diagnosis, most commonly asthma and allergies. Their medications therefore primarily included bronchodilators and/or antihistamines compared to five (22%) children in the InsP subgroup (Table 1).

Table 1
Demographic and clinical characteristics of children with insomnia

Characteristic		Ins P, $n = 23$	Ins, $n = 23$
Age (years)		9.78 ± 3.25	8.70 ± 3.97
Gender	Male/female	17/6	14/9
Race (%)	Caucasian	78	83
	African American	17	13
	Other	4	4
Medical diagnosis (%)	Asthma and/or allergies	26	52
	GERD	0	13
	Arnold-Chiari type 1 Malformation	0	4
Psychiatric diagnosis (%)	ADHD	61	0
	Depressive disorder	30	0
	Anxiety disorders	65	0
Medication (%)	Psychostimulants	44	0
	Antidepressants	35	
	Anticonvulsants	9	0
	Antihistamines	9	44
	Bronchodilators	9	22

ADHD, attention-deficit/hyperactivity disorder; GERD, gastroesophageal reflux disease.

Table 2 shows the prevalence of various subjective sleep characteristics in the two subgroups, as reported by the parent when completing the Sleep Habit Questionnaire. Of these, only the initiation insomnia variable was significantly different, with 22 of the InsP subjects complaining of trouble initiating sleep (96%) compared to 15 of the Ins children (65%; $P = 0.022$). Objective sleep variables obtained from the PSG reports showed no significant differences between the InsP and Ins subgroups in any of the analyzed sleep characteristics (Table 3). Three children in the InsP group and two in the Ins group had AHI > 5, i.e. compatible with the diagnosis of obstructive sleep apnea. Two children in the InsP group and three in the Ins group had PLMI > 5. All of these children had AHI and PLMI in the mildly elevated range. Nevertheless, such elevations would unlikely solely account for the severity of sleep initiation and maintenance problems. Of note, children with highly elevated AHI or PLMI were excluded from the study.

Table 2
Prevalence of subjective sleep complaints among children with insomnia (all data are presented as %)

Sleep complaint	Ins P, $n = 23$	Ins, $n = 23$
Initiation insomnia	95.6*	65.2
Nocturnal awakenings	73.9	86.9
Restless sleep	91.3	73.9
Nightmares	65.2	52.2
Noise sensitivity	30.4	47.8
Bedtime fears/worries	43.5	52.2
Daytime somnolence	73.9	65.2
Leg jerks	73.9	78.3
Nocturnal enuresis	43.5	30.4
Snoring	78.3	73.9
Stops breathing	21.7	13.0

*$P < 0.05$.

Table 3
Polysomnographic findings in children with insomnia

PSG variable	Ins P, $n = 23$	Ins, $n = 23$
TST (min)	418.4 ± 74.1	419.7 ± 44.5
Sleep latency (min)	28.9 ± 30.5	25.2 ± 19.3
REM latency (min)	150.3 ± 67.1	132.4 ± 38.0
Stage 1 (%)	7.0 ± 5.8	9.5 ± 9.2
Stage 2 (%)	37.8 ± 11.6	36.2 ± 11.5
Stage 3 (%)	7.7 ± 4.9	9.1 ± 4.5
Stage 4 (%)	20.5 ± 6.9	21.1 ± 6.9
REM (%)	17.9 ± 6.9	16.1 ± 4.8
Sleep eff (%)	85.6 ± 10.8	86.9 ± 6.8
Spont. AI	7.1 ± 6.6	7.7 ± 4.3
Total AI	11.6 ± 6.2	11.9 ± 4.0
PLMI	4.5 ± 5.9	2.4 ± 3.1
AHI	3.6 ± 6.1	2.2 ± 1.9

TST, total sleep time; Sleep eff, sleep efficiency; Spont AI, spontaneous arousal index; PLMI, periodic limb movement index; AHI, apnea hypopnea index.

When evaluated with the BASC, PSC, and CAPS, there were significant differences between the subgroups in psychological measurements. InsP subjects scored higher on the PSC; the mean scores for the adaptabitility, externalizing, internalizing, and BSI composites were in the at risk and/or 'clinically significant' range and were significantly more impaired compared to children in the Ins group ($P \leq 0.03$). Additionally, InsP patients exhibited

Table 4
Psychometric findings in children with insomnia

Psychometric tool	Ins P, $n = 23$	Ins, $n = 23$
PSC	37.3 ± 12***	23.1 ± 12
CAPS		
Inatt AM	9.6 ± 4.0	8.5 ± 3.0
Overact AM	6.7 ± 3.0	5.0 ± 2.0
Inatt PM	10.7 ± 3.0	8.6 ± 4.0
Overact PM	7.3 ± 2.0	6.1 ± 3.0
BASC		
Adp	32.5 ± 9.0**	44.4 ± 12.0
Agg	58.9 ± 12	53.0 ± 10.0
Anx	67.4 ± 16.0*	56.3 ± 12.0
Att	71.0 ± 12.0***	59.0 ± 10.0
Con	58.3 ± 11.0	52.3 ± 11.0
Dep	64.8 ± 16.0	57.0 ± 12.0
Hyp	67.4 ± 18.0	57.9 ± 15.0
Som	62.3 ± 14.0	57.7 ± 14.0
Wth	56.0 ± 14.0	53.0 ± 17.0
Adpt	36.5 ± 10.0*	43.8 ± 10.0
BSI	73.0 ± 15.0***	59.0 ± 12.0
Ext	64.0 ± 13.0*	55.3 ± 11.0
Intr	68.4 ± 15.0*	59.0 ± 13.0

Inatt, inattentiveness; overact, overactivity; adp, adaptability; agg, aggression; anx, anxiety; att, attention problems; con, conduct problems; dep, depression; hyp, hyperactivity; som, somatization; wth, withdrawal; ext, externalizing problems; intr, internalizing problems; adpt, adaptive skills; BSI, behavioral symptoms index; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Table 5
Percentage of subjects scoring in the at risk or 'clinically significant' ranges on the BASC-PRS

BASC scale	Ins, P $n = 23$	Ins, $n = 23$
Adp	52	30
Agg	56	26
Anx	69	35
Att	78	39
Con	44	22
Dep	52	30
Hyp	61	34
Som	56	35
Wth	35	30
Ext	56	39
Intr	70	48
Adpt	78	35
BSI	91	44

Adp, adaptability; agg, aggression, anx, anxiety; att, attention problems; con, conduct problems; dep, depression; hyp, hyperactivity; som, somatization; wth, withdrawal; ext, externalizing problems; intr, internalizing problems; adpt, adaptive skills; BSI, behavioral symptoms index.

significantly more impairments on the adaptability, anxiety, and attention subscales of the BASC (Table 4). However, 22–48% of the children in Ins subgroup had elevated *T*-scores within the clinically significant range, particularly on the adaptability, anxiety, attention, depression, hyperactivity, and somatization subscales, and on all composites.

For each subscale and composite score of the BASC, many more children in the InsP group scored within the clinically significant range than in the Ins group (Table 5). Subscales with the highest number of InsP at-risk/clinically significant scores included the attention subscale ($n = 18$; 78%), the adaptability composite ($n = 18$; 78%) and the behavioral symptoms index composite ($n = 21$; 92%).

Significant correlations emerged between some of the PSG-derived measures and the BASC scores. Most notably, there was a negative correlation between adaptability scores on the BASC and sleep latency ($r = -0.62; P = 0.02$). Similarly, a significant correlation was present between depression scores on the BASC and sleep latency ($r = 0.53; P = 0.04$) as well as REM latency ($r = -0.68; P = 0.005$). Additionally, a reduced percentage of stage 4 sleep was associated with increases in reported hyperactivity ($r = -0.60; P = 0.017$).

4. Discussion

This study describes for the first time the psychiatric and clinical characteristics of children, evaluated at a Pediatric Sleep Medicine Center, whose major complaint was insomnia related to sleep initiation and/or maintenance. Due to the lack of consensus on the definition of pediatric insomnia, we adopted the criteria recently proposed by Glaze et al. [18], and only children meeting such criteria were included.

Analysis of the demographic and clinical characteristics revealed that 50% of the 46 patients had a professional diagnosis of a psychiatric disorder previously established by a psychiatrist or clinical psychologist. A high prevalence of psychiatric disorders has been described in adult populations with symptoms of chronic insomnia, with as many as 35% of patients presenting with symptoms of insomnia secondary to psychiatric disorders [19]. Our data indicate that the proportion of insomniac children with psychiatric morbidities is at least as high as that of the adult population.

Children with persistent insomnia, but without a reported history of behavioral and/or emotional disturbances, also had elevated scores on a number of behavioral scales. Indeed, as many as 40% scored in a clinically significant range on at least one subscale of the BASC. Although elevated *T*-scores on the BASC do not conclusively establish a psychiatric diagnosis, they indicate the presence of disturbances in particular domains of psychological functioning as perceived by the parent. Our findings are similar to those in an earlier study in which Dixon et al. [25] uncovered greater emotional disturbances among children with insomnia. Prospective studies of sleep difficulties among the general pediatric population have also suggested that sleep problems early in life are predictive for the development of anxiety and depression in later years [3]. Thorough evaluations at a sleep medicine center of adults with psychophysiologic insomnia revealed that approximately 40% had sustained childhood sleep disturbances [26]. When compared with adult-onset insomniacs, those with childhood-onset symptoms had more frequent nightmares, longer sleep latencies, and more 'fear of dark', indicating the presence of persistent hyper-arousal symptoms that have been previously described among primary insomniac patients [27–29].

The medical and medication history of the children in our study revealed that over 60% with only insomnia had concurrent diagnoses of asthma and/or environmental allergies and received antihistamines and/or bronchodilators. This is in contrast with a prevalence of 6% asthma and 21% allergic disease in the general pediatric population in Louisville (Gozal D, unpublished survey results among 5–7-year-old children in Louisville, 2003). Snoring was highly prevalent in both groups of children, even though the majority did not meet the diagnostic criteria for obstructive sleep apnea when polysomnographically evaluated. However, the possibility that snoring, and perhaps upper airway resistance syndrome, may be potential contributing factors in the development of insomnia cannot be completely excluded, especially in children with asthma and allergies. Allergies are known to be associated with congestion, nasal discharge and wheezing, resulting in increased breathing effort and respiratory resistances during sleep.

The higher prevalence of immune system dysfunction in the population of insomniac children highlights the possibility of immune system respiratory-related disorders as either precipitating or perpetuating factors in

the pathophysiology of the hyperarousal associated with idiopathic insomnia, and merits further study.

Anxiety may be associated with many chronic medical conditions including asthma and environmental allergies. Subjective complaints of sleep initiation and maintenance insomnia are common in children with elevated anxiety levels. Feelings of danger or threat interfere with the normal ability to initiate and maintain sleep and may result in transient or chronic insomnia. Other environmental and family factors associated with chronic illness in the child may impair family dynamics. Feelings of guilt, anger and self-doubt are common parental responses to a child's diagnosis of chronic illness and can translate into increased worry or even depression in the child, contributing to symptoms of insomnia.

Our study design did not allow us to establish causal relationships between elevated psychopathology scores and symptoms of insomnia. However, insomnia could induce symptoms of psychophysiological distress due to chronic sleep deprivation, resulting in behavioral and emotional dysfunction. Alternatively, insomnia may represent a symptom of an underlying or developing psychiatric disorder. Larger prospective long-term follow-up studies are needed to further explore these relationships.

Only subjective parental report of delayed sleep onset differentiated insomniac children with or without co-morbid psychiatric disorders; children with psychiatric diagnosis had significantly more difficulties initiating sleep than those with insomnia alone. Subsequent analysis of PSG variables did not confirm differences in sleep latency or any other sleep characteristic among subgroups, but revealed a high positive correlation between sleep latency and depressive scores and a strong negative correlation between REM sleep latency and scores on the BASC depressive subscale, which is similar to sleep findings in adult depression (for review see Ref. [30]). Thus, minor changes in neurophysiological organization of sleep occurring in early-onset insomnia may place children at a higher risk for development of future depressive symptoms.

The current findings should be viewed within the limitations imposed by the relatively small sample of children in our study, the wide age range and the variety of medications being used at the time of their clinical evaluation. Our data are also biased by the selection and reference criteria. Children referred to a specialized Pediatric Sleep Medicine Center have significantly more medical and/or behavioral comorbidities, as well as more severe symptoms of insomnia.

Despite these limitations, which could make our findings less relevant to groups of children with chronic insomnia seen in various clinical settings, our study represents an initial attempt to characterize one such group in whom other sleep disorders, including behavioral sleep disturbances, were ruled out by a sleep medicine professional. The results of our study have potential clinical implications. Clinicians should be alert to signs of attendant psychiatric disorders in children exhibiting symptoms of persistent insomnia, and use additional psychometric assessments and clinical interviews to evaluate underlying or co-existing symptoms of psychological distress in children with sleep initiation and maintenance problems. Furthermore, the impact of psychiatric and medical illnesses on the development of chronic insomnia, and vice versa, should be assessed in future studies to enable formulation of optimal management strategies for children with insomnia.

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