Insomnia and Hypersomnia Associated with Depressive Phenomenology and Comorbidity in Childhood Depression

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Study Objectives: To examine sleep disturbance (insomnia and hypersomnia) and associated clinical profiles among depressed children and adolescents in terms of illness history, depressive severity, depressive phenomenology, and psychiatric comorbid disorders.

Design: Clinical profiles from standardized clinical evaluations were compared.

Setting: Twenty-three mental health facilities in Hungary between April 2000 and December 2004.

Patients and Measurements: Five hundred fifty-three children with a current episode of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition major depressive disorder: 55% were boys, mean age was 11.7 years (SD = 2.0, range = 7.3-14.9), and 94% were Caucasian. Sleep and depressive symptoms were assessed with the Interview Schedule for Children and Adolescents-Diagnostic Version.

Interventions: N/A.

Results: Of the total sample, 72.7% had sleep disturbance: 53.5% had insomnia alone, 9.0% had hypersomnia alone, and 10.1% had both disturbances. Depressed girls were more likely to have sleep disturbance than boys (77.0% vs 69.2%, p < .05), but age had no significant effects. Compared with children without sleep disturbance, sleep-disturbed children were more severely depressed and had more depressive symptoms and comorbid anxiety disorders. Across sleep-disturbed children, those with both insomnia and hypersomnia had a longer history of illness, were more severely depressed, and were more likely to have anhedonia, weight loss, psychomotor retardation, and fatigue than were those with either insomnia or hypersomnia.

Conclusion: Clinical profiles differ between depressed children without and with sleep disturbance, with those presenting insomnia plus hypersomnia being most severely depressed. Differentiating depressed children with different sleep disturbances may have important implications for research efforts on the etiology and therapeutics of child depression.

Keywords: Childhood depression, insomnia, hypersomnia, depressive symptoms, comorbidity

Citation: Liu X; Buysse D; Gentzler A et al. Insomnia and hypersomnia associated with depressive phenomenology and comorbidity in childhood depression. *SLEEP* 2007;30(1):83-90.

INTRODUCTION

ACCORDING TO THE DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS, FOURTH EDITION (DSM-IV), INDIVIDUALS MUST HAVE AT LEAST 5 OF 9 criterion depressive symptoms for a major depressive episode, and sleep disturbance is 1 of the 9 symptoms. Although sleep disturbance is not a necessary symptom for the diagnosis of major depressive episode, research has shown that up to 90% of depressed adults have sleep complaints[1,2] and at least two thirds of depressed children and adolescents have significant sleep-onset or sleep-maintenance problems.[3-5] Depressed patients may present with various forms of sleep disturbance, such as difficulty falling asleep (initial insomnia), difficulty maintaining sleep or poor sleep quality (middle insomnia), waking up too early (terminal insomnia), prolonged sleep episodes at night or increased daytime sleep (hypersomnia), and circadian reversal.[2,3,6] Although sleep electroencephalogram changes characterized by impaired sleep efficiency, reduced slow-wave sleep sleep, and disinhibited rapid eye movement sleep have been consistently demonstrated in adult depression,[2,7] findings of polysomnographic studies in child depression are equivocal[3,8] and sleep electroencephalogram abnormalities appear to occur less frequently in child and adolescent depression than in adult depression.[9] Notably, 1 recent study compared subjective sleep complaints and sleep electroencephalogram parameters and found no evidence that depressed children had more disturbed sleep than the controls; paradoxically, depressed children with the greatest subjective sleep disturbance showed the best sleep.[10]

The variability of sleep disturbances from patient to patient and discrepancy between subjective complaints and objective sleep parameters raise several important clinical questions. For example, although sleep disturbance in depression can take various forms, the DSM focuses on whether there has been some deviation in the "quantity" of usual sleep; that is, it specifies insomnia and hypersomnia as 1 criterion symptom. Although insomnia has received much research attention, far less is known about hypersomnia.[10] One epidemiologic study indicated that about half of hypersomnia in young adults occurred in conjunction with insomnia.[11] In some cases, a depressed child may complain about sleep disturbance at night and excessive sleepiness during the day.[9] However, researchers tend to report the rates of insomnia and hypersomnia separately but not their co-occurrence.[5,12] The relationship between sleep disturbance and depression is complex: bidirectional or comorbid.[2,3] However, little is known about whether depressed children without and with sleep disturbance manifest

Disclosure Statement

This was not an industry supported study. Dr. Buysse is a consultant for Actelion, Cephalon, Eli Lilly, GlaxoSmithKline, Merck, Neurocrine, Neurogen, Pfizer, Respironics, Sanofi-Aventis, Servier, Sepracor, and Takeda; and has participated in speaking engagements supported by Neurocrine, Pfizer, Sanofi-Aventis, Sepracor, and Takeda. Drs. Liu, Gentzler, Kiss, Mayer, Kapornai, Vetro, and Kovacs have indicated no financial conflicts of interest.

Submitted for publication May 9, 2006

Accepted for publication September 25, 2006

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Table 1—Associations of Depressive Symptoms and Sleep Disturbance

Symptom	Insomnia alone	Hypersomnia alone	Insomnia + Hypersomnia
Depressed mood	2.18 (1.28-3.72)[b]	1.00 (0.41-2.42)	1.92 (0.67-5.45)
Irritability	1.60 (0.89-2.89)	1.66 (0.58-4.72)	1.60 (0.55-4.64)
Anhedonia	1.19 (0.75-1.86)	1.49 (0.71-3.12)	3.36 (1.54-7.38)[b]
Weight loss	1.20 (0.76-1.91)	2.38 (1.16-4.92)[a]	2.40 (1.16-4.97)[a]
Weight gain	0.88 (0.53-1.44)	2.18 (1.01-4.68)[a]	1.72 (0.78-3.80)
Diurnal variation	1.63 (1.00-2.63)[a]	1.19 (0.55-2.55)	2.02 (0.97-4.21)
Psychomotor agitation	1.57 (1.00-2.47)[a]	1.32 (0.63-2.79)	2.27 (1.08-4.75)[a]
Retardation	0.75 (0.48-1.19)	1.81 (0.85-3.87)	2.08 (0.97-4.49)
Fatigue	1.13 (0.70-1.83)	2.47 (0.95-6.40)	1.84 (0.70-4.83)
Lack of reactivity	0.75 (0.46-1.22)	0.69 (0.31-1.55)	0.53 (0.25-1.15)
Distinct sadness	1.85 (0.98-3.51)	2.50 (0.98-6.34)	3.29 (1.39-7.77)[b]
Feelings of worthlessness	1.19 (0.75-1.88)	0.35 (0.17-0.74)[b]	0.55 (0.26-1.15)
Inappropriate guilt	1.50 (0.94-2.38)	1.20 (0.55-2.61)	2.38 (1.14-4.97)[a]
Diminished ability to concentrate	1.00 (0.60-1.68)	1.13 (0.47-2.75)	0.64 (0.27-1.51)
Suicidal ideation	1.05 (0.68-1.65)	1.19 (0.57-2.52)	0.91 (0.44-1.90)

Data are presented as adjusted odds ratio and 95% confidence intervals based on multinomial logistic regression with children with no disturbed sleep as the reference adjusted for age, sex, and other symptoms
[a]$p < .05$
[b]$p < .01$

different clinical features, such as age of onset of depression, illness duration, depressive symptom profiles, and psychiatric comorbid disorders. Moreover, research in adult depressed patients has shown some clinical features associated with hypersomnia, such as increased appetite, weight gain, agitation, and earlier age of illness onset.[13] However, whether clinical features of depression vary across different forms of sleep disturbance in children with depression remains unexplored. Answers to such questions may have great implications for research efforts on etiology and therapeutics of childhood depression.

In the current study, we sought to address insomnia and hypersomnia and associated clinical features in a large clinical sample of children with major depressive disorder. Specifically, our first aim was to examine the prevalence rates of insomnia and hypersomnia in depressed children and adolescents. Our second aim was to examine whether sleep-disturbed children differed from sleep-undisturbed children in clinical presentations in terms of age of onset of depression, illness duration, history of medication use, depressive symptom severity, depressive symptom profiles, and psychiatric comorbid disorders. Our third aim was to examine whether clinical features differed across depressed children with insomnia alone, hypersomnia alone, or both insomnia and hypersomnia.

METHODS

Subjects

The subjects in the present study had been participating in an ongoing investigation of psychosocial and genetic risk factors for childhood-onset depression and were recruited from 23 mental health facilities in Hungary starting in April 2000.[14] The 23 clinical sites are estimated to cover about 80% of all referred child psychiatric patients in Hungary. Children referred to participating psychiatric facilities were considered as potential subjects if they met the following eligibility criteria: DSM-IV criteria for major depressive disorder, 7.0 to 14.9 years old, at least 1 biologic parent available, a sibling aged 7 years or older, not mentally retarded, and free of major systemic medical disorders. Before initial evaluation, we obtained signed consent from the parent or parents and assent from the child in accordance with the institutional review boards at the University of Pittsburgh and in Hungary.

In the present article, we present data on 553 children with a current episode of major depressive disorder who were recruited for the main study between April 2000 and December 2004. Of the 553 currently depressed children, 55.2% were boys, age (mean ± SD) was 11.7 ± 2.0 years (range = 7.3-14.9), and 94.1% were Caucasian. Most of the subjects (78.5%) were in their first depressive episode. The mean age at first onset of major depressive episode was 10.6 years (SD = 2.3). The mean illness duration was 13.8 months (median = 7.0 months), and 19.2% had had the illness more than 2 years; 27.1% had a history of psychiatric hospitalization, and 22.3% and 30.6% had ever taken tricyclic antidepressants and serotonin reuptake inhibitors, respectively. Regarding family demographics of our sample, 38.0% of the biologic parents were not currently married, 79.3% of mothers had received less than 12 years of education, and approximately 31% of parents rated their family financial status worse or much worse than that of other families in general.

Psychiatric Evaluation and Procedure

The assessment procedure was completed at 2 different sessions approximately 6 weeks apart. At the first session, the "mood disorder module" of a clinical diagnostic interview (described below) was administered to the parent and child. Also, the Intake General Information Sheet, which is a comprehensive demographic and anamnestic data form covering demographic, family, developmental, psychosocial history and characteristics, physical diseases, mental health problems, and medical treatment history (e.g., hospitalization, medications for behavior/emotional problems), was given to the parent. Children who met DSM criteria for a mood disorder during the first assessment were scheduled for a second session of the assessment. Depressive symptoms and demographics reported in this article were from

Table 2—Illness History of Depressed Children Without and With Sleep Disturbance

Illness history	No sleep disturbance (n = 151)	Sleep disturbance: Insomnia alone (n = 296)	Sleep disturbance: Hypersomnia alone (n = 50)	Sleep disturbance: Insomnia + hypersomnia (n = 56)	F/χ^2: Disturbed vs undisturbed	F/χ^2: Across sleep disturbances
Age of first episode, y	10.54 ± 2.09	10.60 ± 2.34	10.90 ± 2.45	10.30 ± 2.62	0.06	0.82
Mean illness duration, mo.	13.05 ± 13.14	12.76 ± 15.75	13.71 ± 14.79	21.48 ± 24.44	0.45	6.13[b]
Recurrent depressive episode, %	22.5	19.3	18.0	33.9	0.12	6.42[a]
History of, %						
SSRI use	18.8	35.6	26.5	39.3	13.43[b]	2.04
TCA use	22.1	21.3	24.0	26.8	0.004	0.91
Anxiolytic use	16.1	29.2	16.0	23.2	6.70[c]	4.18
Suicide attempts	8.6	12.8	10.0	14.3	1.78	0.46
Psychiatric hospitalization	22.5	29.7	32.0	21.4	2.23	1.86

Data are presented as mean ± SD unless otherwise indicated. SSRI, serotonin reuptake inhibitors; TCA, tricyclic antidepressants.
[a]$p < .05$
[b]$p < .01$
[c]$p < .001$

this assessment session. The second session included the full diagnostic interview. Results of the assessments and associated documentation were subjected to final consensus diagnostic procedure using pairs of senior child psychiatrists trained as best estimate diagnosticians.[15] Diagnoses of major depressive disorder and comorbid disorders, as well as age of onset of the disorders, were based on best-estimate consensus.

Children were evaluated using a semistructured interview, the Interview Schedule for Children and Adolescents-Diagnostic Version (ISCA-D), which is an extension and modification of the Interview Schedule for Children and Adolescents (ISCA).[16] The ISCA-D includes most DSM-IV Axis-I diagnoses, as well as some DSM-III disorders, and yields ratings for "current" (1 month before the interview) as well as "lifetime" (prior to the last month or, alternatively, prior to the current episode) symptoms and diagnoses. The clinician first interviews the parent about the child's symptoms, then separately interviews the child about himself or herself, and finally assigns an overall rating for each symptom based on information from both the child and the parent. Most symptoms are rated on severity scale as follows: no symptom (0), subthreshold (1), or threshold (2).

Psychiatric evaluations were conducted by child psychiatrists and psychologists, who were required to complete 3 months of training in the semistructured interview technique and reach an average of 85% symptom agreement with "gold standard" ratings (provided by experienced trainers) on 5 consecutive videotaped interviews. Routine follow-up training sessions were held to minimize rater drift. Interrater reliability was estimated from a subset of cases (n = 46) using audiotaped interviews and pairs of clinical raters. For all current depressive symptoms, κ coefficients ranged from .64 to .88, with 80% at or above .70. Similar interrater reliability estimates were found for other DSM-IV disorders.

Assessment of Insomnia and Hypersomnia

ISCA-D includes 2 sets of questions that ask about DSM-IV insomnia and hypersomnia.[16] Insomnia was based on 2 main questions, "During the past month, have you had trouble going to sleep at night?" and "Are you sleeping less than usual?" Following these 2 questions, the subject was then asked about difficulty initiating sleep ("Is it hard to fall asleep even when you want to?"), poor sleep quality ("Once asleep, have you slept well?"), waking up during the night, and waking up early with difficulty going back to sleep ("Do you wake up earlier than you have to? Could you go back to sleep?"). The subject was then asked about the duration of the disturbance ("Was that true every day/many days/once in a while? Longest time?—1 week/2 weeks/etc"). If a subject had a period of at least 2 weeks of troubling falling asleep, staying asleep, or waking up too early with clinical significance nearly every day during the past month, he or she was considered to have insomnia.

Hypersomnia was determined by 2 questions, "Have you been sleeping a lot or more than usual during last month?" and "Did you nap in the afternoon/after dinner or have trouble waking up/getting out of bed?" Following these 2 questions, the subject was asked about the duration of the disturbance ("Was that happening every day/many days/once in a while? What was the longest time?—1 week/2 weeks/etc"). If a subject had a period of at least 2 weeks of sleeping too much or increased daytime sleepiness with clinical significance nearly every day, she or he was considered to have hypersomnia.

Statistical Analyses

Sleep disturbance was classified into 3 categories: insomnia alone, hypersomnia alone, and both insomnia and hypersomnia. Insomnia plus hypersomnia encompasses all subjects who had experienced at least 2 weeks of each of the sleep disturbances at any time during the past month. The prevalence rates of the 3 sleep disturbances were estimated according to age and sex.

Depressive symptom severity was computed by adding the "current episode" summary scores on the ISCA-D depressive symptom items, excluding the insomnia and hypersomnia for the purpose of the study (See Table 1 for individual depressive symptoms). A higher summary score represents more-severe depression. Alternately, when examining the prevalence of individual depressive symptoms and their associations with sleep disturbance, each depressive symptom was dichotomized to be clinical-

ly significant (threshold) or not (subthreshold or no symptom).

Analysis of variance was performed to examine the differences in depression severity and illness duration among children without and with various sleep disturbances. χ^2 Tests were conducted to examine differences and similarities in the use of medications, depressive symptoms, and comorbid disorders between children without and with sleep disturbance and across various sleep disturbances. Multinomial logistic regression analysis was performed to examine the associations of each form of sleep disturbance with individual depressive symptoms, adjusting for the effects of other depressive symptoms, medication use, age, and sex. Odds ratios and 95% confidence intervals (CI) were used to present associations of each form of sleep disturbance with depressive symptoms. All statistical tests were 2-tailed. SPSS 13.0 (SPSS, Inc., Chicago, IL) was used for all statistical analyses.

RESULTS

Prevalence of Sleep Disturbance

Based on the ISCA-D clinicians' symptom ratings, 72.7% of the sample had either insomnia or hypersomnia during the past month: 53.5% had insomnia alone, 9.0% had hypersomnia alone, and 10.1% had both. Among children with hypersomnia, 52.8% had insomnia; among children with insomnia, 15.9% also had hypersomnia ($\chi^2 = 6.64$, $p = .010$). The prevalence of either insomnia or hypersomnia was significantly higher in girls than in boys (77.0% vs 69.2%, $\chi^2 = 4.23$, $p = .040$), and the prevalence of combined disturbances was marginally significantly higher in girls than in boys (12.9% vs 7.9%, $\chi^2 = 3.81$, $p = .051$). Insomnia or hypersomnia alone did not significantly differ between boys and girls. Sleep disturbances did not vary significantly by the child's age, maternal marital status, maternal education, family financial status, or race (all p values > .05).

Illness History and Sleep Disturbance

Table 2 presents illness history of depressed children without and with various forms of sleep disturbance. Compared with children without sleep disturbance, sleep-disturbed children were more likely to have taken selective serotonin reuptake inhibitors (SSRI) (35.0% vs 18.8%, $\chi^2 = 13.43$, $p < .001$) and anxiolytics (26.7% vs 16.1%, $\chi^2 = 6.70$, $p = .010$). Further analysis revealed that children with insomnia in particular were more likely to have taken SSRI (35.6% vs 18.8%, $\chi^2 = 13.32$, $p < .001$) and anxiolytics (29.2% vs 16.1%, $\chi^2 = 9.04$, $p = .003$) than were children without sleep disturbance. All other parameters in Table 2 did not differ between children with and without sleep disturbance (all p values > .05).

Across 3 groups of sleep-disturbed children, 2 variables had significant differences. Specifically, children with both insomnia and hypersomnia were more likely to be in a recurrent episode of depression ($\chi^2 = 6.42$, $p = .040$) and have a longer illness duration ($F = 6.13$, $p = .002$) than children with either insomnia or hypersomnia alone.

Depressive Severity and Sleep Disturbance

The mean depression severity score of this entire sample was 17.17 (SD = 4.44), without significant age ($F = 1.49$, $p > .05$) and sex ($F = 1.57$, $p > .05$) differences. Figure 1 presents mean depression severity scores among children without and with different sleep disturbances ($F = 18.92$, $p < .001$). When history of medication use (SSRI, tricyclic antidepressants, and anxiolytics) was statistically controlled, the difference in depression severity among the 4 groups of children remained significant ($F = 16.28$, $p < .001$). The highest depression severity score was observed in those with both sleep disturbances (mean = 19.93, SD = 3.49), and the lowest score in children without sleep disturbance (mean = 15.28, SD = 5.47). Posthoc tests (LSD) showed that average depression severity scores differed significantly between children without sleep disturbance and children with insomnia alone ($p < .001$), hypersomnia alone ($p < .001$), or insomnia plus hypersomnia ($p < .001$). Children with both sleep disturbances evidenced more severe depression than did children with insomnia ($p < .001$) or hypersomnia alone ($p < .01$). However, no significant difference was found between children with insomnia and hypersomnia alone ($p > .05$).

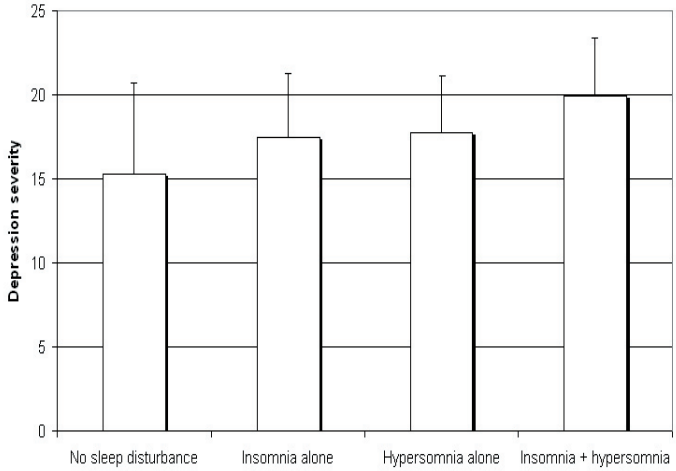

Figure 1—Mean depression severity in depressed children without and with different sleep disturbances. Depression severity was calculated by summarizing scores on the depressive symptoms (excluding insomnia and hypersomnia) as assessed by the Interview Schedule for Children and Adolescents-Diagnostic Version.[16]

Depressive Symptomatology and Sleep Disturbance

Information on the prevalence of individual depressive symptoms by sleep disturbance is presented in Figure 2. Compared with children without sleep disturbance, sleep-disturbed children were more likely to present depressed mood ($\chi^2 = 21.23$, $p < .001$), irritability ($\chi^2 = 10.30$, $p = .001$), distinct sadness ($\chi^2 = 11.42$, $p = .001$), psychomotor agitation ($\chi^2 = 8.60$, $p = .003$), fatigue ($\chi^2 = 8.95$, $p = .003$), anhedonia ($\chi^2 = 7.91$, $p = .005$), inappropriate guilt ($\chi^2 = 7.81$, $p = .005$), weight loss ($\chi^2 = 7.63$, $p = .006$), and diurnal variation ($\chi^2 = 7.16$, $p = .007$). After correction for multiple comparisons,[17] all of the above symptoms remained significant at $p < .05$.

Five symptoms were significantly different among sleep-disturbed children. Specifically, compared with children with insomnia or hypersomnia alone, children with both disturbances manifested more symptoms of anhedonia (76.8% vs 58.0% vs 49.7%, $\chi^2 = 14.26$, $p = .001$), psychomotor retardation (71.4% vs 64.0% vs 40.5%, $\chi^2 = 24.04$, $p < .001$), weight loss (57.1% vs 50.0% vs 35.8%, $\chi^2 = 11.01$, $p = .004$), and fatigue (87.5% vs 86.0% vs 70.9%, $\chi^2 = 10.52$, $p = .005$). However, feelings of

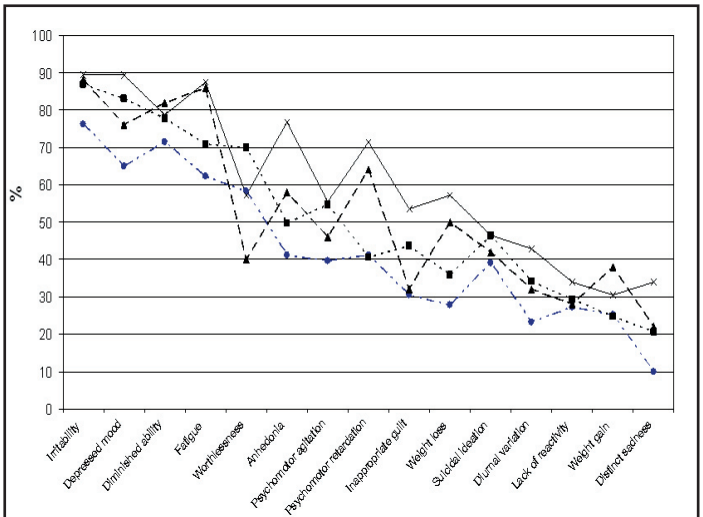

Figure 2—Depressive symptom profiles among depressed children without and with different sleep disturbances. –-●-- refers to no sleep disturbance; ---■---, insomnia alone; ---▲---, hypersomnia alone; –-×–-, both insomnia and hypersomnia.

worthlessness were more prevalent in children with insomnia alone (69.9%) than in children with hypersomnia alone (40.0%) and in children with both sleep disturbances (57.1%) ($\chi^2 = 18.22$, $p < .001$). After correction for multiple comparisons,[21] all of the above symptoms remained significant at $p < .05$.

Compared with children with insomnia alone, children with hypersomnia alone were more likely to have weight gain (38.0% vs 24.7%, $\chi^2 = 3.90$, $p = .048$), psychomotor retardation (64.0% vs 40.5%, $\chi^2 = 9.56$, $p = .002$), and fatigue (86.0% vs 70.9, $\chi^2 = 4.93$, $p = .026$) but were less likely to have worthlessness (40.0% vs 69.9%, $\chi^2 = 16.398$, $p < .001$). After correction for multiple comparisons,[17] only worthlessness and psychomotor retardation remained significant at $p < .05$.

Multinomial logistic regression was conducted to examine independent associations between individual depressive symptoms and each sleep disturbance after controlling for the potential confounding effects of other depressive symptoms and age and sex. As shown in Table 1, compared with children without sleep disturbance, children with insomnia alone demonstrated more frequent depressed mood (OR = 2.18, 95% CI = 1.28 – 3.72), diurnal variation (OR = 1.63, 95% CI = 1.00-2.63), and psychomotor agitation (OR = 1.57, 95% CI = 1.00 – 2.47). Children with hypersomnia alone showed more frequent weight loss (OR = 2.38, 95% CI = 1.16 – 4.92) and weight gain (OR = 2.18, 95% CI = 1.01 – 4.68) but less frequent feelings of worthlessness (OR = 0.35, 95% CI = 0.17 – 0.74). Children with both sleep disturbances evidenced more frequent anhedonia (OR = 3.36, 95% CI = 1.54 – 7.38), weight loss (OR = 2.40, 95% CI = 1.16 – 4.97), psychomotor agitation (OR = 2.27, 95% CI = 1.08 – 4.75), distinct sadness (OR = 3.29, 95% CI = 1.39 – 7.77), and inappropriate guilt (OR = 2.38, 95% CI = 1.14 – 4.97). When the potential effects of history of medication use (SSRI, tricyclic antidepressants, and anxiolytics) were statistically controlled, the associations between sleep disturbances and depressive symptoms showed only minor changes. For example, insomnia was still associated with depressed mood (OR = 1.98, 95% CI = 1.15 – 3.40); hypersomnia was associated with weight loss (OR = 2.34, 95% CI = 1.13 – 4.86), weight gain (OR = 2.23, 95% CI = 1.04 – 4.80), and feelings of worthlessness (OR = 0.38, 95% CI = 0.18 – 0.79); and insomnia plus hypersomnia was associated with anhedonia (OR = 3.55, 95% CI = 1.59 – 7.91), weight loss (OR = 2.45, 95% CI = 1.17 – 5.31), psychomotor agitation (OR = 2.12, 95% CI = 1.01 – 4.47), distinct sadness (OR = 3.33, 95% CI = 1.39 – 7.94), and inappropriate guilt (OR = 2.32, 95% CI = 1.10 – 4.92).

Lifetime Comorbidity and Sleep Disturbances

Table 3 presents the prevalence of lifetime psychiatric comorbid disorders among depressed children without and with different sleep disturbances. Compared with children with no sleep disturbance, sleep-disturbed children showed more anxiety disorders (36.4% vs 25.2%, $\chi^2 = 6.24$, $p = .012$), but no significant differences were detected for specific anxiety disorders, such as separation anxiety, social phobia, panic disorder, generalized anxiety disorder (all p values > .05). In contrast, sleep-disturbed children showed less oppositional defiant disorder than did children without sleep disturbance (4.5% vs 9.3%, $\chi^2 = 4.63$, $p = .031$). Rates for dysthymic disorder, attention-deficit/hyperactivity disorder, and conduct disorder did not significantly differ between children with and without sleep disturbance ($p > .05$). Across 3 groups of sleep-disturbed children, no significant differences were found for any comorbid disorders listed in Table 3.

DISCUSSION

To our knowledge, this represents the first investigation to examine whether depressed children with insomnia, hypersomnia, or both insomnia and hypersomnia manifest different clinical features—in terms of illness history, depressive symptoms, and psychiatric comorbidity—compared with those with no sleep disturbance. The major findings of this study are summarized as follows. First, close to 73% of depressed children evidenced either insomnia or hypersomnia, with a ratio of 3.4:1.0 for insomnia and hypersomnia. Second, sleep-disturbed children were more severely depressed than children without sleep disturbance, with those who had insomnia plus hypersomnia being most severely depressed. Third, children with different sleep disturbances demonstrated different depressive symptom profiles. Finally, compared with children with no sleep disturbance, sleep-disturbed children were more likely to have comorbid anxiety disorders.

As expected, sleep disturbances in depressed children are very common. Our findings indicate that about 73% of depressed children had either insomnia or hypersomnia, 64% had insomnia, and 19% had hypersomnia. The rates of sleep disturbance are comparable to those reported in previous studies of depressed children[3,5,12] and are in the range of those reported in depressed adults.[2,13] The relationship between sleep disturbances and depression has been suggested to be bidirectional.[18] Dysfunction of circadian regulation, reduced regular exposure to bright light, and reduced social schedule as a result of illness may contribute to the high risk of sleep disturbance in depressed children.[19] Sleep disturbance may also result from side effects of antidepressants, hypnotics or both. For example, SSRI may worsen insomnia and hypnotics may increase the risk for excessive daytime sleepiness due to next day residual effects.[20] Conversely, sleep disturbance is associated with an increased risk for subsequent depression. Longitudinal studies have demonstrated the causal relationship between disturbed sleep and the development of depression in adults.[11,21] Furthermore, sleep disturbance and depression may share similar neurobiologic mechanisms or genetic roots.[2,8,22] It

Table 3—Lifetime Prevalence of Comorbid Disorders in Depressed Children by Sleep Disturbance

Comorbid disorder	No sleep disturbance (n = 151)	Sleep disturbance: Insomnia alone (n = 296)	Sleep disturbance: Hypersomnia alone (n = 50)	Sleep disturbance: Insomnia + hypersomnia (n = 56)	χ^2: Disturbed vs undisturbed	χ^2: Across sleep disturbances
Anxiety disorders[a]	25.2	35.6	36.0	41.1	6.24[c]	0.61
Dysthymic disorder	14.6	10.5	20.0	12.5	0.69	3.71
Attention-deficit/hyperactivity disorder	22.5	16.9	10.0	16.1	3.28	1.52
Oppositional defiant disorder	9.3	4.4	0	8.9	4.63[b]	4.68
Conduct disorder	4.0	3.7	2.0	1.8	0.18	0.84

[a]Anxiety disorders include separation anxiety, social phobia, agoraphobia, specific phobia, panic disorder, generalized anxiety disorder, overanxious disorder, posttraumatic stress disorder, and obsessive-compulsive disorder
[b]$p < .05$
[c]$p < .01$

has been speculated that abnormal serotoninergic and cholinergic neurotransmission may be a neurobiologic bases for the relationship between sleep and depression.[3,23]

Little is known about the relationship between insomnia and hypersomnia in childhood depression. In the current study, we found that approximately 10% of depressed children had insomnia plus hypersomnia during the past month. The prevalence of insomnia plus hypersomnia was very close to the rate of hypersomnia only. This is in agreement with an epidemiologic study of young adults.[11] Our finding also indicated that more than half of depressed children with hypersomnia occurred in conjunction with insomnia. There are 2 potential explanations for the co-occurrence of insomnia and hypersomnia. First, insomnia and hypersomnia might occur in the same patients across different time intervals. That is, some depressed children might have insomnia for 1 to 2 weeks followed by hypersomnia or vice versa. Second, insomnia and hypersomnia might occur in the same patient during the same time period. For example, some depressed children might have difficulty falling asleep or maintaining sleep at night and also report excessive daytime sleepiness or prolonged nocturnal sleep the following day as a result of prior sleep loss.[9] When both insomnia and excessive daytime sleepiness (a major form of hypersomnia) coexist, a circadian rhythm sleep disorder has been proposed.[24] Evidence from published studies supports the contention that childhood depression may be associated with disturbed circadian rhythms.[25-28.]

It is notable that children with both insomnia and hypersomnia were most severely depressed, and children with either sleep disturbance were more severely depressed than children with no sleep disturbance. Numerous studies have shown adverse effects of sleep loss or disturbed sleep on daytime functioning, behavior, and emotion in children and adolescents.[29-31] The contribution of sleep disturbances to other depressive symptoms has been noted by Szuba.[32] Sleep disturbance has been suggested to be a marker of altered regional brain activity that impacts upon frontal–limbic interactions and thus may be linked to depression.[33] Furthermore, depressed children with both sleep disturbances may represent a subtype of depression with circadian rhythm disorders or sleep-wake cycle abnormalities, which may cause or worsen other depressive symptoms.[8,19] For example, the sleep-wake cycle and circadian phase have interactive effects on mood regulation in healthy subjects.[34] Aronen et al[35] reported that reduced levels of activity correlate significantly with clinical ratings of depressive severity. Their analysis of depressive symptoms revealed that activity measures correlated with clinical ratings of sadness, low self-esteem, anhedonia, and physical complaints and, to a lesser degree, with ratings of hypoactivity, fatigue, and slow speech. Thus, insomnia or hypersomnia not only may be associated with depression, but may also increase its severity, and having both disturbances may further worsen the illness.

A surprising finding of the study was the relationship between different sleep disturbances and specific depressive symptoms. When other depressive symptoms and age and sex were statistically controlled, insomnia alone independently correlated with depressed mood, diurnal variation, and agitation; hypersomnia alone correlated with weight loss, weight gain, and worthlessness; and insomnia plus hypersomnia correlated with anhedonia, weight loss, agitation, distinct sadness, and guilt. These results suggest that 3 groups of sleep-disturbed children are distinguishable from each other in the presentation of depressive symptoms. Given that the mechanism between sleep disturbance and depression is unclear, it is not possible to explain why the 3 groups of sleep-disturbed children were related to different depressive symptoms. However, these results suggest that differentiating insomnia and hypersomnia may be important in the treatment of depression and in the research studies of the neurobiologic mechanisms between sleep and depression.

In contrast with previous studies,[12,36] we found that children with hypersomnia were more likely to have not only weight gain but also weight loss. This suggests that the relationship between hypersomnia and weight change is complex.

In agreement with previous studies,[37] we found that sleep-disturbed children were more likely to have comorbid anxiety disorders. In contrast with the literature,[38] however, we did not find significant associations between attention-deficit/hyperactivity disorder and either insomnia or hypersomnia. The negative association between oppositional defiant disorder and sleep disturbance deserves further investigation.

Our results indicated that children with insomnia were more likely to have a history of use of SSRI and anxiolytic drugs. The association between insomnia and SSRI may be due to the side effects of SSRIs on sleep but could also be due to SSRI being prescribed in more-severe cases.[39] Likewise, anxiolytic drugs were more frequently used by children with insomnia, which is most likely related to a therapeutic intent of improving sleep and reducing agitation and anxiety due to insomnia.

In interpreting the results of these analyses, however, several important limitations need to be born in mind. First, the clinical interview from which these data were gathered was not designed with the assessment of sleep patterns and disorders as a primary goal. As a consequence, we did not have data on bedtime, morning rise time, and sleep duration and were not able to distinguish subtypes of insomnia, such as sleep-onset insomnia and sleep-maintenance insomnia. Second, no objective measures of sleep were used in the study, such as nocturnal polysomnography, actigraphy, and Multiple Sleep Latency Test. Ideal studies of sleep in depressed children should assess both subjective and objective measures of sleep disturbance.[8] Third, although the potential effects of medications were statistically controlled when we examined the associations between sleep disturbances and depression severity and individual depressive symptoms, we could not determine the effects of specific medications because we did not collect specific data on the starting date, dose, and duration of individual medications used by subjects. Fourth, the age range of our sample was 7.3 to 14.9 years. Although our analyses had adjusted for the potential effects of age as appropriate, we did not collect data on puberty status and were not able to look at the effects of pubertal developmental status on sleep disturbance and depressive features.[40] Fifth, although our sample size was large (n = 553) and was recruited from multiple clinical sites, 79% of mothers of the sample received less than 12 years of education and 31% of parents rated their family financial status worse or much worse than that of other families. Further research needs to examine whether our findings could be generalized to others samples of depressed children and adolescents. Finally, no causal relationships can be concluded based on the current cross-sectional analysis. For example, the relationship between sleep disturbance and depressive symptoms and comorbid anxiety disorders may be bidirectional.

In conclusion, insomnia and hypersomnia are prominent conditions associated with childhood depression that deserve clinical attention. Our findings indicate that children with both insomnia and hypersomnia were most severely depressed and children with insomnia or hypersomnia were more depressed than those without either sleep disturbance. Children without and with different sleep disturbances were found to manifest different features of clinical depression. Clinical trials and longitudinal studies are needed to address whether depressed children with no sleep disturbance, insomnia alone, hypersomnia alone, or both insomnia and hypersomnia are associated with a specific treatment response or clinical course. Further research is also needed to investigate whether depressed children with insomnia are distinct from those with hypersomnia or with both sleep disturbances in genetic and neurobiologic mechanisms.

ACKNOWLEDGMENTS

We thank all participating physicians across various research sites in Hungary; Ping Tepper, PhD, for preparation of the dataset; and Charles J. George, MS, for his statistical comments on an earlier version of this manuscript. This work was supported by National Institute of Mental Health Program Project grant, MH 56193, HHSA, Washington, DC, USA

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