Stability of Sleep Disorders From Preschool to First Grade and Their Bidirectional Relationship With Psychiatric Symptoms

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ABSTRACT: *Objectives:* To examine the prevalence and stability of DSM-4–defined sleep disorders from preschool to first grade and to explore the bidirectional relationship between sleep disorders and symptoms of psychiatric disorders. *Method:* All children born in 2003 or 2004 in Trondheim, Norway, who attended regular community health checkups for 4-year-olds, were invited to participate (97.2% attendance; 82.0% consent rate, n = 2475) in this study. The authors recruited a screen-stratified subsample of 1250 children and interviewed 994 parents (79.6%) using a structured diagnostic interview (the Preschool Age Psychiatric Assessment). Two years later, 795 of the parents completed the interview. *Results:* There was stability in insomnia (adjusted odds ratio [OR] = 4.03, confidence interval [CI] = 2.83–5.75) and sleepwalking (adjusted OR = 19.28, CI = 4.53–82.10), whereas none of the children with hypersomnia or nightmare disorder at age 4 had the same disorder 2 years later. Insomnia increased the risk for developing symptoms of conduct disorder, major depressive disorder (MDD), and social phobia when the initial levels of insomnia were adjusted for. Symptoms of attention-deficit hyperactivity disorder, oppositional defiant disorder, and MDD at age 4 were statistically linked to insomnia at age 6. Sleepwalking predicted later separation anxiety disorder, whereas hypersomnia was unrelated to symptoms of psychiatric disorders. *Conclusion:* Insomnia is a prevalent and stable disorder in children and is bidirectionally related to psychiatric symptoms.

(J Dev Behav Pediatr 0:1–9, 2015) **Index terms:** sleep disorders, insomnia, psychiatric symptoms, risk, prospective, children.

Although the sleep difficulties of young children tend to decrease with age,[1] sleep problems are persistent from preschool to school age[2] and mid-adolescence.[1] Sleep disorders are more specific and strictly defined and may be more severe compared with sleep problems. Hence, the stability of sleep disorders might differ from that of more broadly defined sleep problems. Defining sleep problems based on diagnostic criteria can contribute to a more uniform conceptualization, and because medical decisions are based on diagnoses, the use of diagnoses in research will conform to medical decision-making processes. Presented with sleep disorders in children, the service provider must determine whether and how to intervene. Knowing whether a specific sleep disorder is likely to remit or exacerbate will aid decisions on whether treatment is required. The *International Classification of Diseases, Tenth Revision*,[3] DSM[4,5] and the *International Classification of Sleep Disorders*[6] provide diagnostic criteria for sleep disorders. However, to the best of our knowledge, no population-based data on sleep disorders are currently available for young children, a population for whom sleep problems are most prevalent. To address this knowledge gap, we examined the stability of DSM-4–defined sleep disorders in a community sample of children from preschool to Grade 1.

Comorbidity between psychiatric disorders is high in children,[7] and sleep difficulties are associated with a range of mental health problems.[8,9] However, the reasons for this comorbidity remain unclear.[7,10] Given the lack of research on sleep disorder comorbidity in children, an initial exploratory step seems necessary before any specific hypotheses are suggested. One possibility for the co-occurrence of sleep disorders and mental health problems is that they act as risk factors for one another. If proven to be the case, this may have implications for prevention and treatment of both conditions. To address this issue, we have conducted the first prospective study of the bidirectional relationship between diagnostically defined sleep disorders and symptoms of psychiatric disorders in children.

A limited number of studies have investigated whether sleep problems in young children are risk factors for later psychiatric symptoms.[11-14] Some investigators have reported that early sleep problems precede the later development of anxiety, depression,[11] and

attention-deficit hyperactivity disorder (ADHD),[13,14] whereas others do not report such findings.[12] Despite their important contributions, these studies have several methodological limitations. First, with one exception,[14] single items were used to measure sleep problems. However, one single item cannot capture the variety of pediatric sleep problems, which might be differentially related to psychiatric problems. Additionally, because symptoms of psychiatric disorders are stable, to some extent, in young children,[15] the initial levels of psychiatric symptoms must be controlled for when studying sleep problems that present as risk factors for later psychiatric symptoms.

Only a few studies have explored the opposite direction of the relationship, that is, whether psychiatric symptoms act as risk factors for later sleep problems. Most findings do not support such a relationship.[16,17] However, a specific set of psychiatric symptoms (e.g., separation anxiety) may likely increase the risk of a particular type of sleep disorder (i.e., insomnia) but may reduce the risk of another type of sleep disorder (e.g., hypersomnia). As previous studies have examined broad categories of sleep problems,[1,16,18] the likelihood that actual relationships may have been obscured by this practice should be explored.[8] As stated in a recent review of the bidirectionality of sleep disturbances and mental health problems, sleep and mental health problems are inconclusively defined; the authors of the review call for studies on clearly defined sleep disturbances and mental health problems.[10] Only 2 longitudinal childhood studies were identified in this review, and both captured unidirectional rather than bidirectional relationships between broadly defined childhood sleep problems and anxiety/depression.

In summary, we will study the stability of sleep disorders from preschool to Grade 1 and examine the bidirectional relationship between sleep disorders and symptoms of psychiatric disorders. We hypothesize a moderate stability of DSM-4–defined sleep disorders. Given the broad definitions of sleep problems applied in earlier research and the inconsistency of their findings, specific hypotheses regarding the relationship between different sleep disorders and mental health problems are difficult to make. However, based on adult studies,[10] it is reasonable to assume that insomnia is bidirectionally related to symptoms of depression and anxiety. Difficulties falling asleep and achieving adequate sleep duration are the sleep problems most consistently shown to be associated with ADHD.[19,20] Because some reports indicate that early sleep problems precede ADHD[14,21] and ADHD symptom severity worsens in the presence of sleep problems,[22,23] we expect insomnia to predict an increase in ADHD symptoms. Although there is a lack of evidence, it has been suggested that the link between ADHD and sleep problems is bidirectional[21,24]; therefore, we also hypothesize that ADHD symptoms can prospectively predict insomnia.

METHODS
Participants and Procedure
A letter of invitation and the Strengths and Difficulties Questionnaire (SDQ) 4- to 16-year-olds version[25] were sent to parents of all children living in Trondheim, Norway, and born in 2003 or 2004. The parents brought the completed form when attending the ordinary community health checkup for 4-year-olds. The procedure of this research is described in detail elsewhere.[26,27] To increase variability and statistical power, we oversampled for mental health problems using the SDQ, which has an excellent ability to screen for psychiatric disorders in this age group.[28] The SDQ scores were divided into 4 strata (cutoffs: 0–4, 5–8, 9–11, and 12–40). Using a random number generator, we selected defined proportions of parents in each stratum to participate. The probability of selection increased with increasing SDQ scores (0.37, 0.48, 0.70, and 0.89 in the 4 strata, respectively). We succeeded in interviewing 995 (79.5%) of the 1250 parents invited when the children were 4 years of age. At follow-up 2 years later, we succeeded in interviewing 795 parents. The vast majority of parent informants were mothers (Age 4, 84.8%; Age 6, 81.1%). When the children were 4 years of age, 88.9% of the parents were married or cohabitating; 2 years later, 85.5% had such status. Parents were primarily of Norwegian origin (mothers = 93.0%; fathers = 91.0%). Parental occupation according to the parent with the highest ranking occupation was as follows: leaders (5.7%), higher level professionals (25.7%), lower level professionals (39.0%), formally skilled workers (26.0%), unskilled workers, or farmers/fishermen (3.6%). The mean age of the children was 4.4 years (SD = 0.18) at the first data collection and 6.7 years (SD = 0.25) at the second data collection. Of the 4-year-olds, 50.9% were girls, while 49.9% of the 6-year-olds were girls. Approximately, all children (95.0%) attended official day care centers at age 4, and all were in school at the age of 6.

Outcome Measures
Sleep Disorders
A structured psychiatric interview, the Preschool Age Psychiatric Assessment (PAPA),[29] was completed by parents. A 3-month primary period is used. Diagnoses of insomnia, hypersomnia, and nightmare disorder were generated by computer algorithms implementing the DSM-4[4] criteria, whereas sleepwalking disorder was defined according to the Anders criteria.[30] The PAPA interview only screens for sleep terrors and does not fully cover the diagnostic criteria; thus, sleep terror disorder could not be included. According to DSM-4,[4] insomnia includes difficulties initiating or maintaining sleep or nonrestorative sleep, but it is not specified what the length of time before falling asleep should be to qualify as a symptom of insomnia, and the frequency of symptoms (i.e., times per week) is also not specified. However, based on DSM-4, Gaylor et al[31] have developed

a classification system for dyssomnias in younger children, making a distinction between perturbation, disturbance, and disorder. According to their classification, using more than 20 minutes to fall asleep 5 to 7 times a week for at least one month signifies an insomnia disorder for children older than 24 months. There are few studies on the frequency of insomnia symptoms in children, but Johnsen et al[32] selected 4 times a week as the threshold for a symptom to count as an episode of insomnia. Based on DSM-4 and the work of Gaylor et al[31] and Johnson et al,[32] we thus defined primary insomnia as (1) more than 30 minutes to fall asleep or using sleep medication, or (2) 5 or more night awakenings (duration ≥10 minutes) a week for at least one month, or (3) nonrestorative sleep: being insufficiently rested after sleep or having difficulty waking up at least 3 times a week for at least 1 month.

DSM-4 defines hypersomnia as "excessive sleepiness for at least one month as evidenced by either prolonged sleep episodes or daytime sleep episodes that occur almost daily[4]" (page 609). What constitutes prolonged sleep will of course depend on the usual amount of sleep in different age groups. A meta-analysis reported the upper range (mean + 1.96 × SD) to be 13.9 hours per day among the 4- to 5-year-olds.[33] Daytime sleep episodes are rare in Norwegian 4- to 5-year-olds because there is no scheduled "nap time" for this age group in Norwegian day care centers; thus, it is reasonable to equate data on sleep duration with data on night sleep duration. Therefore, we operationalized hypersomnia as (1) daytime sleep episodes (≥1 hour) at least 5 times a week, (2) daytime sleepiness at least 5 times a week for at least 1 month, or (3) usual night sleep duration exceeding 13.9 hours. A composite category of "any sleep disorder" consisting of insomnia, hypersomnia, nightmare disorder, and sleepwalking was included as well. For all sleep disorders, we use the term "DSM-4–defined" because our diagnostic criteria constitute specifications of the DSM-4 criteria. Sleep terror disorder was not included because the PAPA interview only screens for sleep terrors and does not fully assess the diagnostic criteria.

Interviewers (n = 7) had at least a bachelor's degree in a relevant field and extensive previous experience in working with children and families, and 9% (n = 89) of the interview audio recordings were recoded by blinded raters. The multivariate inter-rater reliabilities were as follows: primary insomnia (*k* = 0.90), primary hypersomnia (*k* = 0.78), nightmare disorder (*k* = 1.0), and any sleep disorder (*k* = 0.83).

Psychiatric Symptoms

DSM-4 symptom counts for the most common psychiatric disorders in young children were generated by the PAPA interview. Symptom counts of psychiatric disorders rather than psychiatric diagnoses were used because the low rate of psychiatric disorders[26] would have resulted in too little statistical power to detect associations with fairly low prevalent sleep disorders.

Symptoms of attention-deficit hyperactivity disorder (Intraclass correlation [ICC] = .96), conduct disorder (ICC = .91), oppositional defiant disorder (ICC = .97), major depressive disorder (ICC = .90), generalized anxiety disorder (ICC = .93), separation anxiety (ICC = .90), social phobia (ICC = .95), and specific phobia (ICC = .80) were included in the analyses.

Statistical Analyses

Bivariate analyses were first performed to obtain the odds ratios (ORs) for the risk of a specific sleep disorder at age 6 given the same sleep disorder at age 4, that is, homotypical continuity. Second, to account for the comorbidity between the different sleep disorders, we explored whether a specific sleep disorder at age 4 was linked to the same sleep disorder at age 6, adjusted for all other sleep disorders at age 4 (adjusted ORs). To examine whether sleep disorders at age 4 predicted symptoms of psychiatric disorders at age 6, General Linear Modeling was applied. Models were developed in a hierarchical fashion, predicting symptoms of one psychiatric condition at a time. First, symptoms of a psychiatric condition at age 6 (e.g., depression) were regressed on each sleep disorder at age 4 (e.g., insomnia). Second, we adjusted for the initial level of the psychiatric symptom in question. We used logistic regression to examine whether psychiatric symptoms at age 4 predicted sleep disorders at age 6, and the same 2-step procedure (above) was applied for one sleep disorder at a time. The sample was screen-stratified; therefore, analyses were conducted using the Horvitz-Thompson estimator with weights proportional to the inverse of the selection probability for each participant (i.e., low screen scores were "weighted up," and high scores were "weighted down") to generate unbiased general population estimates. All analyses were performed in PASW 18, using the Complex Samples option.

RESULTS

Prevalence and Stability of Sleep Disorders

Table 1 presents the prevalence of sleep disorders at ages 4 and 6 years for all participants and for each gender specifically. At age 4, the rate of nightmare disorder was higher in girls than boys, whereas at age 6, more boys than girls had this disorder.

At age 4, 1.0% had more than one sleep disorder, whereas 1.5% had more than one disorder 2 years later. The values in the diagonal from the upper left corner in Table 2 show the odds ratio (OR) for having the same sleep disorder at age 6 as at age 4. Primary insomnia and sleepwalking were stable over time. As none of the children with primary hypersomnia or nightmare disorder at age 4 had these disorders at age 6, we could not estimate the ORs. Because of the low prevalence of nightmare disorder at age 6, we did not include nightmare disorder in additional analyses.

Table 1. Prevalence of Sleep Disorders at Age 4 and Age 6

Sleep Disorders	Age 4 (N = 995) % (95% CI)	Gender Differences at Age 4 t	df	p	Age 6 (N = 795) % (95% CI)	Gender Differences at Age 6 t	df	p	Children with the Same Disorder at Both Ages % (96% CI)
Primary insomnia	16.6 (15.0, 18.4)	−1.47	992	.14	21.2 (19.2, 23.3)	−1.46	788	.15	43 (37.0, 49.1)
Girls	18.0 (15.7, 20.6)				22.9 (20.1, 26.1)				49.3 (39.0, 59.7)
Boys	15.3 (13.2, 17.6)				19.4 (16.7, 22.3)				35.6 (26.2, 46.3)
Primary hypersomnia	0.8 (0.5, 1.3)	1.48	985	.14	7.7 (6.4, 9.2)	0.01	785	.99	0
Girls	0.5 (0.2, 1.0)				7.7 (5.9, 10.0)				0
Boys	1.1 (0.6, 2.0)				7.7 (6.0, 9.8)				0
Nightmare disorder	2.2 (1.7, 2.9)	−2.03	990	.04	1.6 (1.0, 2.4)	2.02	788	.04	0
Girls	2.9 (2.0, 4.2)				0.8 (0.4, 1.4)				0
Boys	1.5 (1.1, 2.1)				2.4 (1.4, 4.0)				0
Sleepwalking	0.7 (0.5, 1.2)	0.13	989	.90	3.5 (2.6, 4.6)	0.57	788	.57	44.9 (21.5, 70.8)
Girls	0.7 (0.4, 1.4)				3.2 (2.1, 4.8)				56.1 (19.1, 87.4)
Boys	0.8 (0.4, 1.6)				3.8 (2.6, 5.6)				32.0 (5.2, 80.3)
Any sleep disorder	19.2 (17.5, 21.1)	−1.91	992	.06	31.4 (29.0, 33.8)	−0.19	788	.85	47.2 (41.5, 53.0)
Girls	21.1 (18.6, 23.9)				31.6 (28.3, 35.2)				50.8 (41.2, 60.2)
Boys	17.4 (15.1, 19.8)				31.1 (27.8, 34.6)				42.7 (33.0, 52.9)

CI, confidence interval.

Sleep Disorders as Predictors of Psychiatric Symptoms

As presented in Table 3, primary insomnia at age 4 was associated with increased risk for symptoms of attention-deficit hyperactivity disorder (ADHD), conduct disorder (CD), oppositional defiant disorder (ODD), major depressive disorder (MDD), generalized anxiety disorder (GAD), separation anxiety, and social phobia at age 6. When the initial levels of psychiatric symptoms were adjusted for, insomnia positively predicted symptoms of CD, ODD, MDD, GAD, and social phobia. Primary hypersomnia increased the risk for ODD in the adjusted analyses, and sleepwalking predicted symptoms of separation anxiety.

Psychiatric Symptoms as Predictors of Sleep Disorders

Primary insomnia at age 6 was statistically predicted by symptoms of ADHD, ODD, MDD, GAD, and separation anxiety at age 4 in the unadjusted analyses (Table 4). When adjusted for insomnia at age 4, symptoms of ADHD, ODD, and MDD were associated with increased risk for insomnia at age 6. Sleepwalking and hypersomnia at age 6 were unrelated to all of the psychiatric symptoms examined at age 4.

DISCUSSION

The first aim of this article was to study the stability of diagnosable sleep disorders from preschool to first grade in a large and representative community sample. We hypothesized a moderate stability of sleep disorders and

found that the stability of insomnia and sleepwalking was fairly high, whereas no stability was found for hypersomnia and nightmare disorder. Second, we aimed to explore the bidirectional relationship between sleep disorders and symptoms of psychiatric disorders. Although the current knowledge base does not permit the development of specific hypotheses regarding most disorders, the results of adult studies led us to expect insomnia to be bidirectionally related to symptoms of depression and anxiety and to hypothesize a reciprocal relationship between insomnia and attention-deficit hyperactivity disorder (ADHD) symptoms. Our findings partly support these hypotheses, showing a reciprocal relationship between insomnia and major depressive disorder (MDD). However, when we adjusted for initial symptom levels, anxiety (generalized anxiety disorder, social phobia) was statistically predicted by, but did not statistically predict, insomnia; consequently, the findings did not support a reciprocal relationship between insomnia and anxiety. As expected, ADHD symptoms were associated with increased risk of insomnia, but the findings did not confirm our hypothesis of a bidirectional relationship between insomnia and ADHD symptoms. Furthermore, adding to the current knowledge base, we found that insomnia was bidirectionally related to oppositional defiant disorder (ODD), and conduct disorder was unidirectionally related to insomnia.

Earlier studies have reported on the stability of sleep problems within the preschool[34] and school age period[17] as well as from preschool to school age.[2] This study extends previous research by reporting the stability of diagnosable sleep disorders; however, earlier

Table 2. Stability of Sleep Disorders from Age 4 to Age 6

	Primary insomnia at Age 6		Primary Hypersomnia at Age 6	
	OR (95% CI)	Adjusted OR (95% CI)	OR (95% CI)	Adjusted OR (95% CI)
Primary insomnia at age 4	3.90*** (2.75, 5.52)	4.03*** (2.83, 5.75)	0.45* (0.21, 0.95)	0.47* (0.22, 1.0)
Primary hypersomnia at age 4	0.57 (0.10, 3.18)	0.44 (0.06, 3.29)	b	b
Nightmare disorder at age 4	0.50 (0.19, 1.36)	0.63 (0.23, 1.75)	2.05 (0.64, 6.55)	2.48 (0.76, 8.10)
Sleepwalking at age 4	d	d	d	d

	Nightmare Disorder at Age 6		Sleepwalking at Age 6	
	OR (95% CI)	Adjusted OR (95% CI)	OR (95% CI)	Adjusted OR (95% CI)
Primary insomnia at age 4	a	a	1.06 (0.44, 2.59)	0.92 (0.36, 2.38)
Primary hypersomnia at age 4	b	b	4.02 (0.70, 23.22)	3.79 (0.55, 26.05)
Nightmare disorder at age 4	c	c	4.75** (1.61, 13.99)	2.41 (0.63, 9.20)
Sleepwalking at age 4	d	d	23.82*** (6.34, 89.57)	19.28*** (4.53, 82.10)

[a]None of those with insomnia at Time 1 had nightmare disorder at Time 2; thus, it was not possible to estimate the ORs. [b]None of those with hypersomnia at Time 1 had hypersomnia or nightmare disorder at Time 2; thus, it was not possible to estimate the ORs. [c]None of those with nightmare disorder at Time 1 had nightmare disorder at Time 2; thus, it was not possible to estimate the ORs. [d]None of those with sleepwalking at age 4 had insomnia, hypersomnia, or nightmare disorder at age 7; thus, it was not possible to estimate the ORs. ***$p < .001$; *$p < .05$; **$p < .01$. Adjusted OR, ORs adjusted for all other sleep disorders at Time 1; OR, odds ratio; CI, confidence interval.

findings were only replicated for insomnia and sleepwalking.[35]

Our results indicate that specific sleep disorders in preschoolers represent a risk factor for developing specific psychiatric symptoms in first grade, thus extending existing literature reporting more broadly defined sleep problems to predict later difficulties.[8,11,13,14,36] This study also extends previous research by showing that longitudinal relationships exist between insomnia and symptoms of several psychiatric disorders even when initial levels of psychiatric symptoms are adjusted for. The link between sleepwalking and separation anxiety has been previously reported.[37] High arousal is involved in both disorders,[38] and studies show a genetic overlap between sleep quality and anxiety symptoms,[39] likely explaining the current finding. Surprisingly, primary hypersomnia predicted symptoms of ODD in the adjusted, but not unadjusted, analyses. There is no evident explanation for this counterintuitive finding; before any substantial conclusion can be made, this finding should be replicated.

We further found symptoms of ADHD, ODD, and MDD at age 4 to be statistically linked to primary insomnia at age 6, even when the initial level of insomnia was controlled for. Overall, this result contradicts earlier research.[1,11,17] The discrepancy in findings might

be attributed to the fact that earlier studies have examined broad categories of sleep problems,[1,16,18] a practice that may have obscured the actual relationships between specific psychiatric disorders and specific sleep disorders.[8] By studying diagnosable sleep disorders and psychiatric symptoms of specific disorders, we were better positioned to detect such prospective relationships. The comorbidity between ADHD, ODD, and MDD is high in young children[40]; it is therefore not surprising that symptoms of all 3 of these disorders predicted insomnia 2 years later. ADHD might be related to insomnia through a shared origin of arousal dysfunction.[41] Symptoms of ADHD and ODD, which are categorized as disruptive disorders, might also increase the risk for insomnia through coercive circles of bedtime resistance; problematic behavior at bedtime might trigger more inconsistent parental bedtime rules, and such inconsistency may cause persisting bedtime resistance in the child through intermittent reinforcement, thus contributing to an increased risk for insomnia. This pattern of parent-child interactions might also be evident regarding night awakenings. MDD symptoms might increase the risk for insomnia through elevated levels of rumination; depression is associated with rumination in children,[42] and rumination has shown to predict reduced sleep quality.[43]

Table 3. Sleep Disorders at Age 4 as Predictors of Symptoms of Psychiatric Disorders at Age 6

	Attention-deficit Hyperactivity Disorder at Age 6			Conduct Disorder at Age 6			Oppositional Defiant Disorder at Age 6			Major Depressive Disorder at Age 6			Generalized Anxiety Disorder at Age 6			Separation Anxiety Disorder at Age 6			Social Phobia at Age 6			Specific Phobia at Age 6		
Mean no. of psychiatric symptoms at Age 6 (95% CI)	1.43 (1.31, 1.55)			0.23 (0.20, 0.26)			1.00 (0.93, 1.07)			0.55 (0.49, 0.60)			0.48 (0.43, 0.53)			0.30 (0.27, 0.34)			0.01 (0.00, 0.02)			0.08 (0.06, 0.10)		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Primary insomnia																								
Unadjusted model	.47*	0.19	.18	.12**	0.04	.22	.41***	0.11	.31	.26***	0.07	.28	.21**	0.08	.24	.15*	0.07	.22	.05*	0.02	.32	.05	0.03	.15
Adjusted model	.18	0.19	.07	.09*	0.04	.17	.27*	0.11	.21	.14*	0.07	.15	.14	0.07	.17	.10	0.07	.15	.05*	0.02	.32	.05	0.03	.15
Primary hypersomnia																								
Unadjusted model	−.17	0.79	−.06	−.09	0.10	−.17	.79	0.42	.60	−.03	0.18	−.03	−.15	0.16	−.18	−.05	0.18	−.08	NA[a]			NA[a]		
Adjusted model	.10	0.70	.04	−.06	0.10	−.10	.95*	0.41	.72	−.26	0.15	−.29	−.12	0.16	−.14	−.04	0.19	−.06	NA[a]			NA[a]		
Sleepwalking																								
Unadjusted model	.57	0.80	.21	−.15*	0.06	−.27	−.22	0.36	−.17	−.09	0.24	−.10	.31*	0.13	.36	.47***	0.13	.70	−.01**	0.00	−.08	.03	0.08	.11
Adjusted model	.49	0.63	.18	−.08	0.06	−.15	−.11	0.28	−.08	−.13	0.21	−.14	.28	0.15	.33	.47***	0.14	.70	−.01**	0.01	−.08	.04	0.09	.13

Adjusted model: adjusted for symptoms of the same psychiatric disorder at age 4. *p < .05, **p < .01, ***p < .001 by the Wald F test. [a]Because the design-based covariance matrix was singular, these values could not be estimated. CI, confidence interval; NA, not applicable.

Table 4. Psychiatric Symptoms at Age 4 as Predictors of Sleep Disorders at Age 6

No. of DSM-4 symptoms at Age 4 (Possible Range)	Mean no. of symptoms	Primary insomnia at Age 6	
	Mean (95% CI)	OR (95% CI)	Adjusted OR (95% CI)
Attention-deficit hyperactivity disorder (0–18)	1.22 (1.14, 1.29)	1.11*** (1.05, 1.18)	1.08** (1.02, 1.15)
Conduct disorder (0–9)	0.33 (0.30, 0.36)	1.17 (0.95, 1.43)	1.08 (0.89, 1.33)
Oppositional defiant disorder (0–8)	0.74 (0.69, 0.79)	1.22*** (1.09, 1.36)	1.15* (1.03, 1.29)
Major depressive disorder (0–9)	0.47 (0.44, 0.51)	1.50*** (1.27, 1.78)	1.28** (1.07, 1.52)
Generalized anxiety disorder (0–6)	0.47 (0.43, 0.50)	1.44*** (1.20, 1.72)	1.18 (0.97, 1.42)
Separation anxiety disorder (0–8)	0.31 (0.28, 0.33)	1.33** (1.09, 1.61)	1.19 (0.98, 1.46)
Social phobia (0–2)	0.02 (0.01, 0.02)	1.22 (0.60, 2.51)	1.15 (0.49, 2.72)
Specific phobia (0–7)	0.09 (0.07, 0.11)	0.72 (0.46, 1.12)	0.71 (0.47, 1.08)

No. of DSM-4 symptoms at Age 4 (Possible Range)	Primary Hypersomnia at Age 6		Sleepwalking at Age 6	
	OR (95% CI)	Adjusted OR (95% CI)	OR (95% CI)	Adjusted OR (95% CI)
Attention-deficit hyperactivity disorder (0–18)	0.94 (0.83, 1.05)	0.93 (0.88, 1.05)	0.91 (0.74, 1.12)	0.90 (0.71, 1.14)
Conduct disorder (0–9)	1.06 (0.76, 1.46)	1.04 (0.75, 1.45)	1.19 (0.77, 1.82)	1.23 (0.85, 1.99)
Oppositional defiant disorder (0–8)	1.07 (0.90, 1.27)	1.07 (0.89, 1.29)	0.82 (0.65, 1.04)	0.84 (0.66, 1.07)
Major depressive disorder (0–9)	0.84 (0.64, 1.11)	0.85 (0.64, 1.14)	1.04 (0.72, 1.51)	1.02 (0.71, 1.47)
Generalized anxiety disorder (0–6)	0.86 (0.64, 1.15)	0.85 (0.63, 1.15)	1.24 (0.91, 1.70)	1.21 (0.89, 1.66)
Separation anxiety disorder (0–8)	0.91 (0.66, 1.27)	0.93 (0.69, 1.28)	0.83 (0.48, 1.44)	0.82 (0.47, 1.45)
Social phobia (0–2)	NA[a]	1.00 (1.00, 1.00)	2.31 (0.88, 6.05)	2.46 (0.94–6.46)
Specific phobia (0–7)	0.81 (0.40, 1.60)	0.81 (0.41, 1.62)	0.54 (0.20, 1.46)	0.59 (0.22, 1.61)

OR: ORs between the number of symptoms of a specific psychiatric disorder at age 4 and a specific sleep disorder at age 6; Adjusted OR: ORs between the number of symptoms of a specific psychiatric disorder at age 4 and a specific sleep disorder at age 6 adjusted for the same sleep disorder at age 4. ***$p < .001$; **$p < .01$; *$p < .05$ by the Wald F test. [a]Because the design-based covariance matrix was singular, this value could not be estimated. OR, odds ratio; CI, confidence interval; NA, not applicable.

Limitations

Although the present work has several strengths, including the study of diagnosable disorders, a large population sample, and prospective analyses, the findings should be considered in the context of several limitations. The prevalence of psychiatric disorders is lower in Norway compared with other countries (e.g., the United States),[26] which may affect the generalizability of our findings to countries with higher rates of childhood mental health problems. Although the sample was large, the low rate of disorders in the present sample required that we use symptom counts rather than psychiatric diagnoses for power reasons. Although the majority of studies do not empirically support a categorical view of disorders,[44,45] we cannot rule out that different processes might be involved regarding symptoms compared with disorders.[17] Thus, the current results may not generalize to diagnosable psychiatric disorders where impairment, duration, and exclusion criteria are used. The

clinical applicability of our results might also have been improved by the use of DSM-5, rather than DSM-4 criteria. However, the interview schedule (the Preschool Age Psychiatric Assessment [PAPA]) was constructed before DSM-5 was launched. A new feature of the DSM-5[5] is that insomnia, that is, difficulty initiating or maintaining sleep, may manifest as difficulty initiating or maintaining sleep without caregiver intervention. We have not assessed whether parents intervene and, thus, cannot take this criterion into consideration. As a third criterion of insomnia, the DSM-5 lists "early morning awakening with inability to return to sleep[5]" (page 362). Because this criterion differs from that in the DSM-4 (nonrestorative sleep), which informed the psychiatric interview that was used to assess sleep disorder in this study, we do not have data to include this criterion in the analyses. However, we have assessed nonrestorative sleep, which might accord to this new DSM-5 criterion of insomnia. Hence, it is unlikely that the inclusion of the

new DSM-5 insomnia criterion would extensively affect the results. It should also be noted that we have applied a stricter criterion regarding frequency of insomnia and hypersomnia symptoms compared with that defined in the DSM-5. The DSM-5 states that the sleep difficulty must have occurred at least 3 nights per week, whereas we have used at least 4 (insomnia) or 5 (hypersomnia) times per week as a criterion. Thus, it is reasonable to assume that we have not overestimated the prevalence of these 2 sleep disorders. In accordance with the DSM-5, a 3-month criterion has been used for all sleep disorders examined. Overall, it could be assumed that the results would not have substantially differed if the DSM-5 criteria were applied rather than the DSM-4 criteria.

Another limitation is the reliance on parental reports. Parents reported both sleep and psychiatric symptoms; thus, common method variance may account for some of the comorbidity. However, the PAPA is a semi-structured interviewer-based measure, which implies that the interviewer decides whether the symptoms are present and probes until she or he can make a decision. Of course, objective measures of sleep, such as the use of video recordings, actigraphy, or polysomnography would have been ideal; however, these methods are time-consuming and costly. Notably, most large-scale community studies have applied parent-completed sleep questionnaires. Diagnostically defined sleep disorders conform with clinical practice; therefore, the use of clinical diagnostic methods is a strength of this study.

Finally, it should be noted that etiological bidirectionality cannot be determined from observational studies such as the present one because of an inability to adjust for all potential confounders,[10] including a range of parent and child factors such as parenting practices, parent-child interaction, child temperament, and genetics.

Summary and Conclusion

This study is the first to examine the prevalence and stability of diagnosable sleep disorders in young children and to explore the bidirectional relationship between sleep disorders and symptoms of psychiatric disorders. On the individual level, there is homotypical continuity of insomnia and sleepwalking, whereas hypersomnia and nightmare disorder seem to be transient conditions. A clinical implication of this finding is that young children with insomnia may be in need of treatment, whereas because hypersomnia and nightmare disorder are transient, interventions might not be required. The difference in stability between sleep disorders and, thus, the difference in the need for treatment underscore the importance of thorough diagnostics. Furthermore, insomnia at age 4 is linked to an increased risk of psychiatric symptoms at age 6, and specific psychiatric symptoms increase the risk of later insomnia, thus adding to our knowledge about the etiological relation between sleep disorders and mental health problems. Such a finding might indicate that treatment of psychiatric symptoms may prevent later

sleep disorder, although treatment studies are needed to support such an assumption.

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