

Differential Associations of Parent-Reported Sleep Difficulties With Teacher-Rated Cognitive Disengagement Syndrome and ADHD Symptom Dimensions in School-Aged Children

Shoou-Lian Hwang-Gu

slhwang@mail.cgu.edu.tw

Chang Gung University

Shu-Wen Chou

Camillian St. Mary's Hospital

Ya-Wen Jan

Chung Yuan Christian University

Liang-Jen Wang

Kaohsiung Chang Gung Memorial Hospital and Chang Gung University College of Medicine

Hsing-Chang Ni

Chang Gung Memorial Hospital Linkou Branch

Research Article

Keywords: cognitive disengagement syndrome, attention-deficit/hyperactivity disorder, daytime sleepiness, parasomnias, sleep problems, children

Posted Date: October 14th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10935592/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Objective: This study examined cross-informant associations between parent-reported sleep difficulties and teacher-rated cognitive disengagement syndrome (CDS) and attention-deficit/hyperactivity disorder (ADHD) symptoms in school-aged children.

Method: Participants were 291 children aged 6–12 years from public elementary schools in Taiwan. Parents completed the Children's Sleep Habits Questionnaire, and teachers rated CDS, ADHD inattention (ADHD-IN), hyperactivity/impulsivity (ADHD-HI), and internalizing/externalizing problems. Hierarchical regressions examined unique associations between sleep domains and symptom dimensions while accounting for age, gender, and overlapping symptoms.

Results: Daytime sleepiness was uniquely associated with CDS ($\beta = .14, p = .002$), whereas parasomnia symptoms were uniquely associated with ADHD-IN ($\beta = .09, p = .040$). No sleep domain was uniquely associated with ADHD-HI.

Conclusions: Findings provide cross-informant evidence of partially differentiated sleep correlates of CDS and ADHD-IN, highlighting the importance of examining specific sleep domains rather than global sleep problems.

Introduction

Cognitive disengagement syndrome (CDS), formerly referred to as sluggish cognitive tempo (SCT), is characterized by excessive daydreaming, mental confusion, slowed behavior, hypoactivity, and difficulties maintaining alertness (Becker et al., 2023). Historically, CDS symptoms were conceptualized as part of the inattentive symptom domain of attention-deficit/hyperactivity disorder (ADHD) and were proposed to characterize a distinct inattentive subtype (Milich et al., 2001). However, accumulating evidence indicates that CDS can be empirically differentiated from both ADHD inattention (ADHD-IN) and hyperactivity/impulsivity (ADHD-HI) symptoms, despite meaningful overlap, particularly between CDS and ADHD-IN (Becker, Leopold, et al., 2016; Becker et al., 2023). Although CDS is moderately associated with ADHD-IN, evidence indicates that CDS shows unique associations with internalizing symptoms, social difficulties, academic impairment, and other areas of functional impairment after accounting for ADHD symptom dimensions (Barkley, 2014; Becker, Leopold, et al., 2016). Identifying clinical and behavioral characteristics that show differential associations with CDS, ADHD-IN, and ADHD-HI may therefore help further clarify the concept boundaries among these related but overlapping symptom dimensions (Becker, Leopold, et al., 2016; Lee et al., 2014). Sleep problems are particularly relevant in this regard because they are associated with both ADHD and CDS (Knouse & Becker, 2025; Koriakin et al., 2015), while emerging evidence suggests that certain sleep-related difficulties, particularly daytime sleepiness and difficulty waking, may be particularly relevant to CDS, although findings vary across sleep measures and informants (Koriakin et al., 2015; Fredrick et al., 2022).

Sleep problems are common during childhood and are associated with difficulties in attention, behavior, cognitive functioning, and academic performance (Astill et al., 2012; Dewald et al., 2010). Importantly, childhood sleep problems are multidimensional rather than reflecting a single, unitary construct (Owens et al., 2000; Mindell & Owens, 2015). Commonly assessed domains include bedtime resistance, sleep-onset delay, short sleep duration, nighttime awakenings, sleep-disordered breathing, and daytime sleepiness, including difficulty waking in the morning and frequently falling asleep during daytime activities (Owens et al., 2000). Distinguishing among these domains may be particularly important when examining CDS and ADHD because different symptom dimensions may show different patterns of association with specific aspects of sleep disturbance (Becker et al., 2014; Knouse & Becker, 2025).

ADHD Symptoms and Sleep Problems

Children with ADHD experience higher sleep difficulties than children without ADHD across a range of subjective sleep measures, although findings from objective sleep measures have been less consistent (Cortese et al., 2009; Díaz-Román et al., 2016). Meta-analytic evidence indicates higher levels of bedtime resistance, sleep-onset difficulties, nighttime awakenings, morning awakening difficulties, sleep-disordered breathing, and daytime sleepiness among children with ADHD (Cortese et al., 2009). However, associations between specific ADHD symptom dimensions and particular sleep problems appear less consistent (Becker et al., 2018; Mayes et al., 2009; Wagner & Schlarb, 2012). Mayes et al. (2009) found that children with ADHD combined-type had more overall sleep problems than children with ADHD inattentive type, whereas daytime sleepiness was highest in the inattentive group. Some studies have linked ADHD-HI symptoms with broader nighttime behavioral sleep difficulties, although associations with specific sleep domains have been inconsistent and may be attenuated after accounting for psychiatric comorbidity (Becker et al., 2018; Willoughby et al., 2008). ADHD-IN symptoms have also been associated with daytime sleepiness, although the strength and specificity of this association appear to vary across developmental periods and samples (Willoughby et al., 2008; Langberg et al., 2020). More broadly, reviews and meta-analyses emphasize substantial heterogeneity in sleep functioning among children with ADHD and highlight the importance of considering specific sleep domains, comorbidities, medication status, and assessment methods when interpreting these associations (Cortese et al., 2009; Díaz-Román et al., 2016). Thus, although ADHD symptoms are clearly associated with sleep difficulties, evidence for distinct associations between ADHD-IN or ADHD-HI and particular sleep domains remains mixed.

CDS and Sleep Problems

A growing body of research has linked CDS to sleep-related difficulties, with particularly consistent associations emerging for daytime sleepiness and sleep-related daytime dysfunction (Becker et al., 2014; Becker, Garner, & Byars, 2016; Fredrick et al., 2022; Langberg et al., 2020). In a college student sample, CDS symptoms were associated with poorer sleep functioning even after accounting for ADHD symptom dimensions (Becker et al., 2014). Among children referred to a pediatric sleep disorders center, CDS was associated with sleep problems and daytime sleepiness (Becker, Garner, & Byars, 2016). Sleep-related characteristics, particularly sleeping more than usual, have also been associated with CDS in large clinical samples of children with ADHD and autism spectrum disorder (Mayes et al., 2021). Using multiple sleep assessment methods, Fredrick et al. (2022) found that adolescent CDS symptoms were associated with shorter sleep duration, later sleep onset, poorer overall sleep functioning, sleep/wake problems, and greater daytime sleepiness, with several associations remaining after accounting for ADHD symptoms and other relevant covariates.

The association between CDS and daytime sleepiness is conceptually plausible because several CDS characteristics, including sluggishness, low energy, drowsiness, and mental foggiess, resemble behavioral manifestations of sleepiness (Becker et al., 2023; Langberg et al., 2014). Nevertheless, available evidence indicates that CDS and sleep-related difficulties are associated but distinguishable behavioral problems (Becker, Garner, & Byars, 2016; Langberg et al., 2014; Smith et al., 2019). Smith et al. (2019) used confirmatory factor analyses to demonstrate that CDS is empirically distinct from daytime sleepiness, anxiety, and depressive symptoms, with a four-factor model providing the best fit. Similarly, among children referred for sleep problems, CDS was moderately associated with daytime sleepiness but was not significantly associated with specific sleep disorder diagnoses, such as behavioral insomnia or psychophysiological insomnia (Becker, Garner, & Byars, 2016). Thus, daytime sleepiness may be particularly relevant to the drowsiness, low-energy, and slowed-behavior features of CDS, while remaining conceptually and empirically distinct from the broader CDS construct (Becker, Garner, & Byars, 2016; Langberg et al., 2014; Smith et al., 2019).

Despite growing evidence linking sleep difficulties with CDS or ADHD, many studies in children have relied on the same informant to report both sleep difficulties and attentional symptoms (Becker, Garner, & Byars, 2016; Mayes et al., 2021), raising the possibility that observed associations may be partly influenced by shared-informant variance (De Los Reyes et al., 2013, 2015). Cross-informant studies examining sleep and CDS remain comparatively limited. Koriakin et al. (2015) examined parent-reported sleep difficulties in relation to both parent- and teacher-rated SCT in a large clinically referred sample. Sleep difficulties, measured by only four sleep difficulty items, were more consistently associated with parent-rated SCT, whereas the association with teacher-rated SCT was not significant (Koriakin et al., 2015). The findings raise the possibility that some previously observed associations between sleep difficulties and CDS may be influenced by shared-informant effects and leave unclear whether specific sleep domains are associated with CDS across observational contexts. Hence, more studies are needed to examine the associations between sleep difficulties and CDS symptoms by cross-informant design, which helps clarify the specificity of sleep-related associations across CDS and ADHD symptom dimensions.

Current Study

The present study examined the cross-informant associations of parent-reported overall and domain-specific sleep problems with teacher-rated CDS, ADHD-IN, and ADHD-HI symptoms in elementary school children. We were particularly interested in whether specific sleep domains showed unique associations with each symptom dimension after accounting for overlap with the other two teacher-rated symptom dimensions. In addition, because internalizing and externalizing problems are associated with both sleep difficulties and CDS and ADHD symptoms (Stoppelbein et al., 2020), teacher-rated internalizing and externalizing problems were included as additional covariates. This approach allowed a more stringent examination of whether specific sleep domains showed differential associations with CDS, ADHD-IN, and ADHD-HI beyond broader internalizing and externalizing problems. Moreover, children in several East Asian countries have been reported to obtain shorter sleep duration than children in many Western samples (Jeon et al. 2021; Liu et al. 2005). Examining sleep-symptom associations in Taiwanese schoolchildren may therefore provide an informative context for evaluating whether previously reported associations, particularly those involving daytime sleepiness, generalize beyond predominantly Western samples.

Based on prior evidence linking CDS particularly with daytime sleepiness and sleep-related daytime dysfunction, we hypothesized that parent-reported daytime sleepiness would be uniquely associated with teacher-rated CDS symptoms after accounting for teacher-rated ADHD-IN and ADHD-HI symptoms as well as internalizing and externalizing problems. We further examined whether specific sleep domains showed differential associations with teacher-rated ADHD-IN and ADHD-HI after accounting for overlap among the three symptom dimensions and broader behavioral problems. Given the mixed and limited evidence on associations between individual sleep domains and specific ADHD symptom dimensions, we considered these domain-specific analyses exploratory.

Method

Participants

Participants were recruited through purposive sampling from public elementary schools in New Taipei City, Taiwan, between March and June 2022. We initially recruited parents of 306 school-aged children. After excluding invalid responses, 291 valid parent-report questionnaires and teacher-report questionnaires were both retained. One case was further excluded because the child had a history of developmental delay and showed an extreme response pattern. Most parent respondents were mothers (78.6%, $n = 228$).

Table 1 presents the children's demographic characteristics. Girls accounted for 47.9% of the sample and boys for 52.1%. Children ranged in age from 6 years 10 months to 12 years 9 months, with a mean age of 10.03 years ($SD = 1.76$). Approximately half of the children were in the upper grades of elementary school. On average, children slept 8.56 hours ($SD = 0.84$) on school days and 9.53 hours ($SD = 1.34$) on weekends. Based on the Taiwanese children's norms of the SNAP-IV (Gau et al., 2008), six children were classified as possibly meeting criteria for ADHD.

Table 1
Participants Demographics

Parents	Mean (SD)
Father	
age	43.87(5.38)
Education	
Under College	85
College or above	201
Mother	
age	41.48(4.76)
Education	
Under College	66
College or above	218
Teacher	
Education	
College	17
Graduate	25
Behavioral Symptoms	
Cognitive Disengagement Syndrome	1.28(.46)
ADHD-IN	.60(.65)
ADHD-HI	.29(.45)
Internalizing problems	4.47(5.34)
Externalizing problems	3.47(6.07)
C-CSHQ	
Bedtime resistance	1.47(.46)
Sleep anxiety	1.45(.51)
Night waking	1.13(.26)
Parasomnias	1.14(.18)
Sleep breathing problems	1.11(.23)
Daytime sleepiness	1.19(.23)
ADHD: Attention-Deficit/Hyperactivity Disorder	
C-CSHQ: Chinese version of the Children's Sleep Habits Questionnaire	

Procedure

This study was approved by the Institutional Review Board of the Chang Gung Medical Foundation in March 2021 (IRB No. 202002484A3). After approval, the research team contacted cooperating public elementary schools and explained the study to homeroom teachers. Parents were then recruited through classes whose homeroom teachers agreed to participate. The research team provided interested participants with information about the study purpose, procedures, potential risks, and participant rights. Written informed consent was obtained before questionnaire completion. Parents and homeroom teachers were asked to rate the same child's behavioral characteristics within a two-week period. After completing the questionnaire, participants received NT\$200 (approximately US\$6) as compensation.

Measures

The Chinese Version of the Cognitive Disengagement Syndrome Teacher Rating Scale (C-CDS-TRS)

The C-CDS-TRS was 13 items from Penny et al.'s (2009) Sluggish Cognitive Tempo (SCT) Rating Scale and the Kiddie SCT Rating Scale (K-SCT; McBurnett et al., 2014), these items were incorporated to ensure a comprehensive assessment of the CDS symptom domain and enhance content validity, each rated on a 4-point Likert scale (0 = not at all true to 3 = very true). These items showed excellent internal consistency for CDS, ADHD-IA, and ADHD-HI symptoms from the Exploratory Factor Analyses and supported a three-factor structure: CDS, ADHD-IA, and ADHD-HI (factor loadings .61–.89; cumulative variance 64.32%) (Dai & Hwang-Gu, 2026, in press) and showed good internal consistency (Cronbach's $\alpha = .95$).

Chinese Version of the SNAP-IV Rating Scale (Swanson, Nolan, and Pelham, Version IV)

The Chinese version of the SNAP-IV Teacher Rating Scale was used to assess the core features of ADHD in children (Gau et al., 2009). The scale is directly based on DSM-IV diagnostic criteria and has established clinical utility. It comprises three subscales: (1) Inattention (Items 1–9), (2) Hyperactivity/Impulsivity (Items 10–18), and (3) Oppositional Defiant Disorder (Items 19–26). Each item is rated on a 4-point Likert scale ranging from 0 (not at all) to 3 (very much). Previous studies support its reliability, with test–retest reliability ranging from 0.60 to 0.84 and internal consistency ranging from $\alpha = 0.88$ to 0.95 (Gau et al., 2009).

Chinese Version of the Teacher's Report Form (TRF/6–18)

The Teacher's Report Form for Ages 6–18 (TRF/6–18; Achenbach & Rescorla, 2001) is a teacher-report measure designed to assess children's adaptive functioning and behavioral and emotional problems in school settings. The Chinese version of the ASEBA school-age forms was adapted for use in Taiwan by Chen et al. (2009). Teachers rate each behavioral and emotional problem item on a 3-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). The TRF yields syndrome scales as well as broadband Internalizing, Externalizing, and Total Problems scores. The Chinese version has demonstrated good reliability, with test–retest correlations for the Internalizing, Externalizing, and Total Problems scales of .86, .89, and .95, respectively, and test–retest correlations for most syndrome scales ranging from .80 to .90 (Chen et al., 2009). The original TRF has also demonstrated extensive evidence of reliability and validity (Achenbach & Rescorla, 2001).

Chinese version of the Children's Sleep Habits Questionnaire (C-CSHQ)

A simplified Chinese version was initially translated and validated by Li et al. (2007), and its psychometric properties were subsequently examined in a large sample of Chinese school-aged children. The traditional Chinese version used in the present study was adapted from the simplified Chinese version.

Parents or primary caregivers complete the questionnaire, which includes 33 scored items and three open-ended questions about sleep schedules. Caregivers rated the frequency of their child's sleep behaviors during a typical recent week using a 3-point scale (1 = rarely [0–1 time per week], 2 = sometimes [2–4 times per week], and 3 = usually [5 or more times per week]). The scored items are conceptually grouped into eight sleep domains: bedtime resistance (6 items), sleep onset delay (1 item), sleep duration (3 items), sleep anxiety (4 items), night wakings (3 items), parasomnias (7 items), sleep-disordered breathing (3 items), and daytime sleepiness (8 items). Higher total scores indicate more severe sleep problems.

The original CSHQ demonstrated good discrimination between children with and without sleep problems, with a recommended clinical cutoff score of 41, a sensitivity of .80, and a specificity of .72 (Owens et al., 2000). The Chinese version demonstrated acceptable internal consistency for the total scale (Cronbach's $\alpha = .73$), with subscale reliabilities ranging from .42 to .69 (Li et al., 2007).

Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics version 27. All statistical tests were two-tailed, and statistical significance was set at $p < .05$.

First, descriptive statistics were calculated for demographic characteristics of the children, parents, and teachers. Second, point-biserial correlations and Pearson correlations were used to examine associations among child age, gender, and the raw scores of the main study variables. Third, hierarchical regression analyses were conducted to examine whether parent-reported sleep problems were uniquely associated with teacher-rated CDS and ADHD symptoms; three hierarchical multiple regression analyses were performed. In each analysis, age and gender were entered as the first step; parent-reported sleep problems included the six individual sleep domains, excluding sleep-onset delay (one item) and sleep duration (internal consistency $< .5$), and were entered as predictors in the second step. In the third step, the

remaining teacher-rated symptom dimensions were entered as covariates to determine whether sleep problems explained unique variance beyond overlapping ADHD/CDS symptoms; the internalizing/externalizing problems were also included as predictors.

Specifically, in the first regression model, teacher-rated CDS was entered as the dependent variable. Parent-reported sleep problems were entered in Step 2, followed by teacher-rated ADHD inattentive (IA) and hyperactive–impulsive (HI) symptoms in Step 3. In the second regression model, teacher-rated ADHD-IA symptoms served as the dependent variable. Parent-reported sleep problems were entered in Step 2, followed by teacher-rated CDS and ADHD-HI symptoms in Step 3. In the third regression model, teacher-rated ADHD-HI symptoms were entered as the dependent variable. Parent-reported sleep problems were entered in Step 2, followed by teacher-rated CDS and ADHD-IN symptoms in Step 3. We reported standardized regression coefficients (β); the other statistics (eg., change in explained variance (ΔR^2) and significance levels) were shown in the tables. Statistical significance was set at $p < .05$.

Results

Table 1 presents the demographic and clinical characteristics of the participants. Table 2 presents the Pearson correlations among the study variables. Bedtime resistance and daytime sleepiness were significantly correlated with teacher-rated CDS ($r = .14, p = .023$; $r = .23, p < .001$) and ADHD-IN ($r = .17, p = .006$; $r = .15, p = .012$), whereas parasomnia symptoms were significantly correlated with teacher-rated CDS ($r = .13, p = .032$), ADHD-IN ($r = .20, p = .001$), and ADHD-HI ($r = .12, p = .041$). Sleep-disordered breathing was significantly correlated with both ADHD symptom dimensions (IA: $r = .17, p = .005$; HI: $r = .20, p = .001$). Teacher-rated externalizing problems were significantly correlated with parent-reported parasomnia symptoms ($r = .13, p = .038$), sleep-disordered breathing ($r = .14, p = .024$), and daytime sleepiness ($r = .15, p = .014$).

Table 2
Correlations Among Demographic Characteristics, Parent-Reported Sleep Difficulties, Teacher-Rated CDS, ADHD Symptoms, and Internalizing/Externalizing Problems

1		1	2	3	4	5	6	7	8	9	10	11	12	13
	Age	-												
2	Gender	-.05	-											
3	CDS ^a	.07	.07	-										
4	ADHD_IN ^a	-.01	.22***	.69***	-									
5	ADHD_HI ^a	-.09	.36***	.25***	.53***	-								
6	Internal problem ^a	.11	-.01	.56***	.50***	.21***	-							
7	External problem ^a	-.05	.28***	.31***	.46***	.69***	.41***	-						
8	Bedtime resistance ^b	-.31***	.02	.14*	.17**	.08	.09	.09	-					
9	Sleep anxiety ^b	-.26***	-.01	.02	.04	.02	.07	.04	.80***	-				
10	Night waking ^b	-.15**	-.06	.08	.02	-.06	.01	-.03	.24***	.30***	-			
11	Parasomnias ^b	-.11	-.10	.13*	.20**	.12*	.03	.13*	.32***	.28***	.31***	-		
12	Sleep breath ^b	-.02	.21***	.11	.17**	.20**	.01	.14*	.19**	.14*	.10	.22***	-	
13	Daytime sleepiness ^b	-.08	-.03	.23***	.15*	.10	.01	.15*	.28***	.13*	.10	.25***	.16**	-
CDS: Cognitive Disengagement Syndrome; ADHD: Attention Deficit/Hyperactivity Disorder; ADHD-IN: ADHD Inattention; ADHD-HI: ADHD Hyperactivity Impulsivity;														
a: assessed by the teacher; b: from parent report														
* $p < .05$; ** $P < .01$; *** $P < .001$														

Table 3 presents the hierarchical regression analyses examining the associations between parent-reported sleep difficulties and teacher-rated CDS after controlling for age, gender, teacher-rated ADHD-IN and ADHD-HI symptoms, and internalizing and externalizing problems. The final

model accounted for 56.5% of the variance in CDS ($F(12,251) = 29.41, p < .001$). Parent-reported daytime sleepiness was the only sleep domain that remained significantly associated with teacher-rated CDS ($\beta = .14, p = .002$). Table 4 presents the hierarchical regression analyses examining the associations between parent-reported sleep difficulties and teacher-rated ADHD-IN after controlling for age, gender, teacher-rated CDS, ADHD-HI, and internalizing and externalizing problems. The final model accounted for 64.7% of the variance in ADHD-IN ($F(12,251) = 38.32, p < .001$). Parent-reported parasomnia symptoms were the only sleep domain that remained significantly associated with teacher-rated ADHD-IN ($\beta = .09, p = .040$). Table 5 presents the hierarchical regression analyses examining the associations between parent-reported sleep difficulties and teacher-rated ADHD-HI after controlling for age, gender, teacher-rated CDS, ADHD-IN, and internalizing and externalizing problems. The final model accounted for 58.1% of the variance in ADHD-HI ($F(12,251) = 31.55, p < .001$). In the final model, none of the parent-reported sleep domains remained significantly associated with teacher-rated ADHD-HI ($ps > .05$).

Table 3
Regression Model for Sleep Difficulties, ADHD Symptoms, and Internalizing/Externalizing Problems Predicting CDS^a

	Step 1 model summary				Step 2 model summary				Step 3 model summary			
	Adjusted $R^2 = .07$				Adjusted $R^2 = .51, \Delta R^2 = .42$				Adjusted $R^2 = .57, \Delta R^2 = .06$			
	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>
Age	.41	.21	.12	1.61	.28	.16	.08	1.73	.17	.15	.05	1.12
Gender	.82	.74	.07	1.11	-.57	.58	-.05	-.99	-.20	.55	-.02	-.36
Bedtime resistance ^b	3.20	1.37	.24	2.33*	.52	1.02	.04	.51	.61	.96	.05	.64
Sleep anxiety ^b	-2.18	1.20	-.18	-1.82	-.59	.89	-.05	-.67	-.97	.83	-.08	-1.16
Night waking ^b	1.87	1.52	.08	1.23	1.91	1.12	.08	1.71	1.86	1.05	.08	1.78
Parasomnias ^b	2.43	2.28	.07	1.07	-1.43	1.70	-.04	-.84	-.65	1.60	-.02	-.41
Sleep breath ^b	.32	1.61	.01	.20	.14	1.18	.01	.12	.38	1.11	.02	.34
Daytime sleepiness ^b	4.30	1.65	.17	2.61**	3.29	1.21	.13	2.73**	3.60	1.14	.14	3.15**
ADHD_IN ^a					.78	.06	.76	14.11***	.61	.06	.59	10.21***
ADHD_HI ^a					-.20	.08	-.14	-2.49*	-.22	.09	-.15	-2.32*
Internalizing problem ^a									.32	.06	.29	5.52***
Externalizing problem ^a									.03	.06	.03	.53
CDS: Cognitive Disengagement Syndrome; ADHD: Attention Deficit/Hyperactivity Disorder; ADHD-IN: ADHD Inattention; ADHD-HI: ADHD Hyperactivity Impulsivity;												
a: assessed by the teacher; b: from parent report												
* $p < .05$; ** $P < .01$; *** $P < .001$												

Table 4

Regression Model for Sleep Difficulties, ADHD-HI, CDS, and Internalizing/Externalizing Problems Predicting ADHD-IN^a

	Step 1 model summary				Step 2 model summary				Step 3 model summary			
	Adjusted $R^2 = .11$				Adjusted $R^2 = .62$, $\Delta R^2 = .50$				Adjusted $R^2 = .63$, $\Delta R^2 = .02$			
	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>
Age	.14	.20	.04	.68	-.02	.14	-.01	-.15	-.06	.13	-.02	-.43
Gender	2.47	.70	.21	3.53***	.62	.49	.05	1.26	.79	.48	.07	1.64
Bedtime resistance ^b	3.48	1.30	.27	2.69**	1.57	.86	.12	1.84	1.57	.84	.12	1.86
Sleep anxiety ^b	-2.13	1.14	-.19	-1.87	-.71	.75	-.06	-.95	-.89	.74	-.08	-1.21
Night waking ^b	-.43	1.43	-.02	-.30	-.72	.95	-.03	-.76	-.62	.93	-.03	-.66
Parasomnias ^b	5.85	2.16	.18	2.71**	2.64	1.43	.08	1.85	2.90	1.41	.09	2.06*
Sleep breath ^b	.65	1.52	.03	.43	-.37	1.00	-.02	-.37	-.28	.98	-.01	-.28
Daytime sleepiness ^b	1.54	1.56	.06	.99	-1.38	1.03	-.06	-1.34	-.84	1.03	-.03	-.81
ADHD-HI ^a					.51	.06	.36	8.35***	.54	.08	.38	6.99***
CDS ^a					.56	.04	.58	14.11***	.48	.05	.50	10.21***
Internalizing problem ^a									.17	.05	.16	3.24*
Externalizing problem ^a									-.06	.05	-.06	-1.09
CDS: Cognitive Disengagement Syndrome; ADHD: Attention Deficit/Hyperactivity Disorder; ADHD-IN: ADHD Inattention; ADHD-HI: ADHD Hyperactivity Impulsivity;												
a: assessed by the teacher; b: from parent report												
* $p < .05$; ** $p < .01$; *** $p < .001$												

Table 5
Regression Model for Sleep Difficulties, ADHD-IA^a, CDS, and Internalizing/Externalizing Problems Predicting ADHD-HI^a

	Step 1 model summary				Step 2 model summary				Step 3 model summary			
	Adjusted $R^2 = .15$				Adjusted $R^2 = .37$, $\Delta R^2 = .21$				Adjusted $R^2 = .58$, $\Delta R^2 = .21$			
	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>B</i>	<i>SE</i>	β	<i>t</i>
Age	-.14	.14	-.06	-.99	-.15	.12	-.06	-1.22	-.08	.10	-.04	-.82
Gender	2.73	.48	.34	5.67***	1.78	.43	.22	4.16***	.87	.36	.11	2.43*
Bedtime resistance ^b	.21	.89	.02	.24	-.88	.78	-.10	-1.12	-.48	.64	-.05	-.76
Sleep anxiety ^b	-.38	.78	-.05	-.48	.26	.68	.03	.39	.15	.56	.02	.27
Night waking ^b	-1.48	.99	-.09	-1.50	-1.07	.86	-.07	-1.25	-.60	.70	-.04	-.86
Parasomnias ^b	3.61	1.48	.15	2.43*	1.43	1.30	.06	1.09	.47	1.06	.02	.44
Sleep breath ^b	1.62	1.04	.09	1.56	1.39	.90	.08	1.54	1.14	.73	.07	1.55
Daytime sleepiness ^b	.99	1.07	.06	.93	.86	.94	.05	.91	-.19	.77	-.01	-.24
CDS ^a					-.12	.05	-.18	-2.49*	-.10	.04	-.14	-2.32*
ADHD-IN ^a					.42	.05	.60	8.35***	.30	.04	.43	6.99***
Internalizing problem ^a									-.10	.04	-.14	-2.59*
Externalizing problem ^a									.38	.03	.55	11.54***
CDS: Cognitive Disengagement Syndrome; ADHD: Attention Deficit/Hyperactivity Disorder; ADHD-IN: ADHD Inattention; ADHD-HI: ADHD Hyperactivity Impulsivity;												
a: assessed by the teacher; b: from parent report												
* $p < .05$; ** $P < .01$; *** $P < .001$												

Discussion

This cross-informant study examined the associations of parent-reported domain-specific sleep difficulties with teacher-rated CDS, ADHD-IN, and ADHD-HI symptoms in elementary school children while accounting for overlap among ADHD symptoms and broader internal/external problems. The findings revealed partially differentiated patterns of association between specific sleep difficulties and CDS and ADHD symptom dimensions. Most notably, parent-reported daytime sleepiness remained uniquely associated with teacher-rated CDS after controlling for ADHD-IN, ADHD-HI, and internalizing/externalizing problems. In contrast, parent-reported parasomnia was uniquely associated with teacher-rated ADHD-IN, whereas no sleep difficulties domain remained uniquely associated with ADHD-HI after adjustment for overlapping attentional symptoms and broader psychopathology.

These findings provide preliminary evidence of potentially differentiated patterns of association between specific sleep domains and CDS and ADHD symptom dimensions, despite the shared variance among these symptom constructs. Because the associations were observed between parent-reported sleep difficulties and teacher-rated symptoms, they are unlikely to be attributable solely to shared-informant variance. Nevertheless, although the cross-informant design reduces shared-rater bias, it also introduces context specificity: parents primarily observe sleep-related behaviors and daytime functioning at home, whereas teachers observe attention, alertness, and task engagement under the cognitive and behavioral demands of the classroom.

Daytime sleepiness and CDS

Parent-reported daytime sleepiness remained uniquely associated with teacher-rated CDS symptoms after accounting for ADHD-IN and ADHD-HI symptoms as well as internalizing/externalizing problems. This finding extends previous research demonstrating consistent associations

between CDS symptoms and daytime sleepiness (Becker, Garner, & Byars, 2016; Fredrick et al., 2022). More specifically, daytime drowsiness observed by parents may correspond to several behavioral features of CDS evident in the classroom, including appearing sleepy or drowsy, slowed thinking or behavior, mental foggiess, and difficulty maintaining alertness (Becker et al., 2023). One possibility is that this cross-informant association reflects a partially shared dimension of reduced daytime alertness that is manifested somewhat differently across contexts: parents may observe drowsiness or difficulty staying alert at home, whereas teachers may observe slowed, disengaged, or mentally foggy behavior under the cognitive demands of the classroom. This interpretation is consistent with evidence that CDS ratings show some cross-informant correspondence despite generally modest parent–teacher agreement (Becker, Leopold, et al., 2016; Burns et al., 2017; Mayes et al., 2023). The cross-informant association suggests that reduced daytime alertness observed in one context may be related to CDS-like behaviors observed independently in another context.

Notably, in the fully adjusted model, daytime sleepiness was the only sleep domain uniquely associated with CDS, whereas the nighttime sleep domains were not. This pattern suggests that, in the present sample, daytime sleepiness showed a more proximal cross-sectional association with CDS than did the assessed nighttime sleep domains.

Parasomnia Symptoms in Relation to ADHD-IN

Teacher-rated ADHD-IN showed a unique positive association with parent-reported parasomnia symptoms after accounting for ADHD-HI, CDS, and internalizing/externalizing problems. Previous research has documented associations between parasomnia-related symptoms and ADHD symptoms more broadly, although the direction and mechanisms of these associations remain unclear (Vélez-Galarraga et al., 2016). Notably, daytime sleepiness was not associated with teacher-rated ADHD-IN even when the sleep domains were considered before including CDS and other symptom dimensions. Together with the unique association between daytime sleepiness and CDS, this finding suggests a partially differentiated pattern of sleep correlates across CDS and ADHD-IN rather than a nonspecific association between sleep difficulties and attention-related symptoms. This pattern broadly aligns with separate literatures linking daytime sleepiness with CDS (Becker, Garner, & Byars, 2016; Fredrick et al., 2022) and parasomnia-related symptoms with ADHD symptoms (Vélez-Galarraga et al., 2016), although previous studies have not directly established this differential specificity.

The association with ADHD-IN should also be interpreted cautiously given the heterogeneous content of the CSHQ parasomnias subscale, which encompasses behaviors such as sleep talking, restless sleep, sleepwalking, nocturnal enuresis, bruxism, night terrors, and nightmares. These behaviors do not necessarily reflect a common underlying sleep mechanism, and the subscale should not be interpreted as an indicator of clinically diagnosed parasomnia or sleep fragmentation. Rather, it may capture a range of parent-observed nighttime behaviors or sleep-related disturbances. Accordingly, the present findings do not clarify why these behaviors were associated with teacher-rated ADHD-IN.

Nevertheless, there is broader evidence that sleep and daytime attention can be related. Vélez-Galarraga et al. (2016) reported an association between shorter sleep duration and omission errors on a sustained-attention task in an ADHD subgroup receiving pharmacological treatment ADHD, and experimental sleep restriction has been shown to increase parent-rated inattention in adolescents with ADHD (Becker et al., 2019). These findings provide a broader context for the observed association but do not establish that the CSHQ parasomnia symptoms in the present study affected attention through disrupted sleep. If sleep-related attentional difficulties are expressed during the school day, they may become particularly salient in classroom settings that place sustained demands on attention, following instructions, and task completion. However, this contextual interpretation remains speculative because the present study did not assess objective sleep disruption, daytime attention, or classroom task engagement. Furthermore, these findings should be considered preliminary and require replication using longitudinal designs and multi-method sleep assessments, including actigraphy or polysomnography where appropriate.

Sleep Difficulties and ADHD-HI

The pattern of findings differed for teacher-rated ADHD-HI. Although some sleep difficulties may have shown associations with ADHD-HI before overlapping symptom dimensions were considered, no sleep domain remained uniquely associated with ADHD-HI in the fully adjusted model. This pattern suggests that sleep-related associations with ADHD-HI may be better accounted for by their overlap with inattentive symptoms and broader behavioral problems than by sleep difficulties uniquely related to ADHD-HI. However, previous findings regarding associations between ADHD-HI symptoms and specific sleep domains have been mixed (Chiang et al., 2010; Gau, 2006). Some studies have reported associations between ADHD-HI symptoms and nighttime behavioral sleep difficulties, including night wakings and parasomnias, even after accounting for co-occurring symptom dimensions (Becker et al., 2018; Chiang et al., 2010). In contrast, Willoughby et al. (2008) found that associations of hyperactive–impulsive symptoms with parasomnias, dyssomnias, and sleep-assistance problems were attenuated to non-significance after psychiatric comorbidity was taken into account. Thus, the absence of a unique sleep correlate of ADHD-HI in the present study is consistent with the possibility that some sleep–ADHD-HI associations partly reflect broader behavioral or psychiatric overlap rather than a sleep domain specifically associated with ADHD-HI.

Cross-Informant Sleep–Symptom Associations in a Taiwanese Community Sample

The present findings extend the literature by demonstrating differentiated sleep–symptom associations in a community sample of Taiwanese school-aged children. Children in East Asian societies have been reported to obtain less nocturnal sleep than children in many Western countries (Jeon et al., 2021; Liu et al., 2005). Consistent with prior literature, mean school-night sleep duration in the present sample (8.56 hours) was below the recommended 9–12 hours of sleep per 24 hours for children aged 6–12 years (Paruthi et al., 2016). Importantly, adding sleep duration to the regression models did not alter the main findings: parent-reported daytime sleepiness remained uniquely associated with teacher-rated CDS, and parent-reported parasomnia symptoms remained uniquely associated with teacher-rated ADHD-IN (Supplementary Table 1, 2, and 3). These results suggest that the observed symptom-specific associations cannot be explained simply by shorter sleep duration and that specific sleep difficulties may provide information beyond sleep quantity.

Study Limitations

Although the present study had several strengths, it also had some limitations. First, the cross-sectional design does not allow conclusions about the direction of the associations between sleep difficulties and CDS or ADHD symptoms. Longitudinal studies are needed to clarify how these relationships develop over time. Second, sleep difficulties were assessed by parent report rather than objective measures. Future studies using actigraphy, polysomnography, or other sleep measures would provide a more comprehensive assessment of children's sleep. Third, because the sample was predominantly nonclinical, the findings should be interpreted as dimensional associations and may not generalize directly to children with diagnosed ADHD. Finally, the unique associations of daytime sleepiness with CDS and parasomnia symptoms with ADHD-IN were relatively small and should be interpreted cautiously. Future studies using larger and more clinically diverse samples, longitudinal designs, and multiple methods of sleep assessment are needed to replicate and extend these findings.

Conclusion

The present study provides cross-informant evidence of partially differentiated associations between specific sleep difficulties and CDS and ADHD symptom dimensions in school-aged children. Parent-reported daytime sleepiness was uniquely associated with teacher-rated CDS, whereas parasomnia symptoms were uniquely associated with ADHD-IN; no sleep domain was uniquely associated with ADHD-HI. Although these findings require replication, they suggest that assessment of attention-related difficulties may benefit from considering specific sleep domains rather than sleep problems as a single global construct. In particular, daytime sleepiness may warrant attention when children present with CDS symptoms such as drowsiness, slowed thinking, or reduced alertness, whereas parasomnia symptoms may provide complementary information when inattentive symptoms are prominent. Clinically, these findings support considering sleep difficulties as part of a broader assessment of children's attention-related functioning, while avoiding the assumption that particular sleep problems are specific to, or causally related to, CDS or ADHD. Given the predominantly nonclinical community sample and cross-sectional design, these implications should be considered preliminary and interpreted dimensionally rather than as recommendations specific to children with diagnosed ADHD.

Declarations

Author Contribution

Shoou-Lian Hwang-Gu: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision, Project administration. Shu-Wen Chou: Investigation, Data curation, Writing – original draft, Writing – review & editing. Ya-Wen Jan: Formal analysis, Data curation, Writing – original draft, Writing – review & editing. Liang-Jen Wang: Investigation, Resources, Writing – review & editing. Hsing-Chang Ni: Investigation, Resources, Writing – review & editing. All authors reviewed and approved the final version of the manuscript.

Acknowledgment

This study was supported by grants from the Ministry of Science and Technology (MOST 110-2410-H-182 -015 -MY3) and Chang Gung University (NMRPD1L0173), Taiwan. The founders had no role in the study design, data collection, analysis, publication decisions, or manuscript preparation. The authors thank all participants, their parents, and the research assistants for their valuable contributions to this study.

Declaration of Conflicting Interest

The authors report no conflicts of interest.

Ethical approval and informed consent statements

All authors complied with APA ethical standards in their treatment of participants. Before implementation, the Research Ethics Committee of the Chang Gung Medical Foundation Institutional Review Board approved this work (IRB No. 202002484A3).

References

1. Achenbach TM, Rescorla LA (2001) Manual for the ASEBA school-age forms & profiles. University of Vermont, Research Center for Children, Youth, & Families
2. Astill RG, Van der Heijden KB, Van IJzendoorn MH, Van Someren EJW (2012) Sleep, cognition, and behavioral problems in school-age children: A century of research meta-analyzed. *Psychol Bull* 138(6):1109–1138. <https://doi.org/10.1037/a0028204>
3. Barkley RA (2014) Sluggish cognitive tempo (concentration deficit disorder?): Current status, future directions, and a plea to change the name. *J Abnorm Child Psychol* 42(1):117–125. <https://doi.org/10.1007/s10802-013-9824-y>
4. Becker SP, Cusick CN, Sidol CA, Epstein JN, Tamm L (2018) The impact of comorbid mental health symptoms and sex on sleep functioning in children with ADHD. *Eur Child Adolesc Psychiatry* 27(3):353–365. <https://doi.org/10.1007/s00787-017-1055-2>
5. Becker SP, Epstein JN, Tamm L, Tilford AA, Tischner CM, Isaacson PA, Simon JO, Beebe DW (2019) Shortened sleep duration causes sleepiness, inattention, and oppositionality in adolescents with attention-deficit/hyperactivity disorder: Findings from a crossover sleep restriction/extension study. *J Am Acad Child Adolesc Psychiatry* 58(4):433–442. <https://doi.org/10.1016/j.jaac.2018.09.439>
6. Becker SP, Garner AA, Byars KC (2016) Sluggish cognitive tempo in children referred to a pediatric sleep disorders center: Examining possible overlap with sleep problems and associations with impairment. *J Psychiatr Res* 77:116–124. <https://doi.org/10.1016/j.jpsychires.2016.03.005>
7. Becker SP, Leopold DR, Burns GL, Jarrett MA, Langberg JM, Marshall SA, McBurnett K, Waschbusch DA, Willcutt EG (2016) The internal, external, and diagnostic validity of sluggish cognitive tempo: A meta-analysis and critical review. *J Am Acad Child Adolesc Psychiatry* 55(3):163–178. <https://doi.org/10.1016/j.jaac.2015.12.006>
8. Becker SP, Luebbe AM, Langberg JM (2014) Attention-deficit/hyperactivity disorder dimensions and sluggish cognitive tempo symptoms in relation to college students' sleep functioning. *Child Psychiatry Hum Dev* 45(6):675–685. <https://doi.org/10.1007/s10578-014-0436-8>
9. Becker SP, Willcutt EG, Leopold DR, Fredrick JW, Smith ZR, Jacobson LA, Burns GL, Mayes SD, Waschbusch DA, Froehlich TE, McBurnett K, Servera M, Barkley RA (2023) Report of a work group on sluggish cognitive tempo: Key research directions and a consensus change in terminology to cognitive disengagement syndrome. *J Am Acad Child Adolesc Psychiatry* 62(6):629–645. <https://doi.org/10.1016/j.jaac.2022.07.821>
10. Burns GL, Becker SP, Servera M, Bernad MDM, García-Banda G (2017) Sluggish cognitive tempo and attention-deficit/hyperactivity disorder (ADHD) inattention in the home and school contexts: Parent and teacher invariance and cross-setting validity. *Psychol Assess* 29(2):209–220. <https://doi.org/10.1037/pas0000325>
11. Chen Y-C, Huang H-L, Jao J-C (2009) Achenbach System of Empirically Based Assessment (ASEBA): Scoring manual. Psychological Publishing. [Chinese version]
12. Chiang HL, Gau SS-F, Ni HC, Chiu YN, Shang CY, Wu YY, Lin LY, Tai YM, Soong WT (2010) Association between symptoms and subtypes of attention-deficit hyperactivity disorder and sleep problems/disorders. *J Sleep Res* 19(4):535–545. <https://doi.org/10.1111/j.1365-2869.2010.00832.x>
13. Cortese S, Faraone SV, Konofal E, Lecendreux M (2009) Sleep in children with attention-deficit/hyperactivity disorder: Meta-analysis of subjective and objective studies. *J Am Acad Child Adolesc Psychiatry* 48(9):894–908. <https://doi.org/10.1097/CHI.0b013e3181ac09c9>
14. Dai Y, Hwang-Gu SL (in press) Reliability and validity of the Chinese version of the cognitive disengagement syndrome teacher rating scale in elementary school children and its associations with internalizing, externalizing, and adaptive functioning. *Journal of Education & Psychology*
15. De Los Reyes A, Augenstein TM, Wang M, Thomas SA, Drabick DAG, Burgers DE, Rabinowitz J (2015) The validity of the multi-informant approach to assessing child and adolescent mental health. *Psychol Bull* 141(4):858–900. <https://doi.org/10.1037/a0038498>
16. De Los Reyes A, Thomas SA, Goodman KL, Kundey SMA (2013) Principles underlying the use of multiple informants' reports. *Ann Rev Clin Psychol* 9:123–149. <https://doi.org/10.1146/annurev-clinpsy-050212-185617>
17. Dewald JF, Meijer AM, Oort FJ, Kerkhof GA, Bögels SM (2010) The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. *Sleep Med Rev* 14(3):179–189. <https://doi.org/10.1016/j.smrv.2009.10.004>
18. Díaz-Román A, Hita-Yáñez E, Buéla-Casal G (2016) Sleep characteristics in children with attention deficit hyperactivity disorder: Systematic review and meta-analyses. *J Clin Sleep Med* 12(5):747–756. <https://doi.org/10.5664/jcsm.5810>
19. Fredrick JW, Yeaman KM, Yu X, Langberg JM, Becker SP (2022) A multi-method examination of sluggish cognitive tempo in relation to adolescent sleep, daytime sleepiness, and circadian preference. *J Child Psychol Psychiatry* 63(12):1658–1667. <https://doi.org/10.1111/jcpp.13568>
20. Gau SS-F (2006) Prevalence of sleep problems and their association with inattention/hyperactivity among children aged 6–15 in Taiwan. *J Sleep Res* 15(4):403–414. <https://doi.org/10.1111/j.1365-2869.2006.00552.x>

21. Gau SS, Shang CY, Liu SK, Lin CH, Swanson JM, Liu YC, Tu CL (2008) Psychometric properties of the Chinese version of the Swanson, Nolan, and Pelham, version IV scale - parent form. *International Journal of Methods in Psychiatry Research*. 2008;17(1):35–44. <https://doi.org/10.1002/mpr.237>
22. Gau SS-F, Lin C-H, Hu F-C, Shang C-Y, Swanson JM, Liu Y-C, Liu S-K (2009) Psychometric properties of the Chinese version of the Swanson, Nolan, and Pelham, Version IV Scale–Teacher Form. *J Pediatr Psychol* 34(8):850–861. <https://doi.org/10.1093/jpepsy/jsn133>
23. Jeon M, Dimitriou D, Halstead EJ (2021) A systematic review on cross-cultural comparative studies of sleep in young populations: The roles of cultural factors. *International Journal of Environmental Research and Public Health*, 18(4), 2005. <https://doi.org/10.3390/ijerph18042005>
24. Knouse LE, Becker SP (2025) Unique associations of ADHD and cognitive disengagement syndrome symptoms with sleep problems and circadian preference in adults. *Sleep Med* 131:106531. <https://doi.org/10.1016/j.sleep.2025.106531>
25. Koriakin TA, Mahone EM, Jacobson LA (2015) Sleep difficulties are associated with parent report of sluggish cognitive tempo. *J Dev Behav Pediatr* 36(9):717–723. <https://doi.org/10.1097/DBP.0000000000000224>
26. Langberg JM, Becker SP, Dvorsky MR, Luebke AM (2014) Are sluggish cognitive tempo and daytime sleepiness distinct constructs? *Psychol Assess* 26(2):586–597. <https://doi.org/10.1037/a0036276>
27. Langberg JM, Molitor SJ, Oddo LE, Eadeh H-M, Dvorsky MR, Becker SP (2020) Prevalence, patterns, and predictors of sleep problems and daytime sleepiness in young adolescents with ADHD. *J Atten Disord* 24(4):509–523. <https://doi.org/10.1177/1087054717690810>
28. Lee S, Burns GL, Snell J, McBurnett K (2014) Validity of the sluggish cognitive tempo symptom dimension in children: Sluggish cognitive tempo and ADHD-inattention as distinct symptom dimensions. *J Abnorm Child Psychol* 42(1):7–19. <https://doi.org/10.1007/s10802-013-9714-3>
29. Li SH, Jin XM, Shen XM, Wu SH, Jiang F, Yan CH, Yu XD, Qiu YL (2007) [Development and psychometric properties of the Chinese version of Children's Sleep Habits Questionnaire]. *Zhonghua Er Ke Za Zhi* 45(3):176–180. <https://doi.org/10.3760/cma.j.issn.0578-1310.2007.03.105>
30. Liu X, Liu L, Owens JA, Kaplan DL (2005) Sleep patterns and sleep problems among schoolchildren in the United States and China. *Pediatrics* 115(Supplement1):241–249. <https://doi.org/10.1542/peds.2004-0815F>
31. Mayes SD, Calhoun SL, Bixler EO, Vgontzas AN, Mahr F, Hillwig-Garcia J, Elamir B, Edhere-Ekezie L, Parvin M (2009) ADHD subtypes and comorbid anxiety, depression, and oppositional-defiant disorder: Differences in sleep problems. *J Pediatr Psychol* 34(3):328–337. <https://doi.org/10.1093/jpepsy/jsn083>
32. Mayes SD, Calhoun SL, Waschbusch DA (2021) Relationship between sluggish cognitive tempo and sleep, psychological, somatic, and cognitive problems and impairment in children with autism and children with ADHD. *Clin Child Psychol Psychiatry* 26(2):518–530. <https://doi.org/10.1177/1359104520978459>
33. Mayes SD, Calhoun SL, Waschbusch DA (2023) Agreement between mother, father, and teacher ratings of cognitive disengagement syndrome (sluggish cognitive tempo) in children with autism and children with ADHD. *Psychol Assess* 35(7):582–588. <https://doi.org/10.1037/pas0001234>
34. McBurnett K, Villodas M, Burns GL, Hinshaw SP, Beaulieu A, Pfiffner LJ (2014) Structure and validity of sluggish cognitive tempo using an expanded item pool in children with attention-deficit/hyperactivity disorder. *J Abnorm Child Psychol* 42(1):37–48. <https://doi.org/10.1007/s10802-013-9801-5>
35. Milich R, Balentine AC, Lynam DR (2001) ADHD combined type and ADHD predominantly inattentive type are distinct and unrelated disorders. *Clin Psychol Sci Pract* 8(4):463–488. <https://doi.org/10.1093/clipsy.8.4.463>
36. Mindell JA, Owens JA (2015) *A clinical guide to pediatric sleep: Diagnosis and management of sleep problems*, 3rd edn. Lippincott Williams & Wilkins
37. Owens JA, Spirito A, McGuinn M (2000) The Children's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep* 23(8):1–9. <https://doi.org/10.1093/sleep/23.8.1d>
38. Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, Malow BA, Maski K, Nichols C, Quan SF, Rosen CL, Troester MM, Wise MS (2016) Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *J Clin Sleep Med* 12(6):785–786. <https://doi.org/10.5664/jcsm.5866>
39. Penny AM, Waschbusch DA, Klein RM, Corkum P, Eskes G (2009) Developing a measure of sluggish cognitive tempo for children: Content validity, factor structure, and reliability. *Psychol Assess* 21(3):380–389. <https://doi.org/10.1037/a0016600>
40. Smith ZR, Eadeh H-M, Breaux RP, Langberg JM (2019) Sleepy, sluggish, worried, or down? The distinction between self-reported sluggish cognitive tempo, daytime sleepiness, and internalizing symptoms in youth with attention-deficit/hyperactivity disorder. *Psychol Assess* 31(3):365–375. <https://doi.org/10.1037/pas0000671>

41. Stoppelbein L, McRae E, Smith S, Becker S, Fite P, Luebbe A, Greening L (2020) Sluggish cognitive tempo and behavioral difficulties in children with ADHD: Associations with internalizing and externalizing symptoms. *Child Psychiatry Hum Dev* 51(4):609–616.
<https://doi.org/10.1007/s10578-019-00943-z>
42. Vélez-Galarraga R, Guillén-Grima F, Crespo-Eguílaz N, Sánchez-Carpintero R (2016) Prevalence of sleep disorders and their relationship with core symptoms of inattention and hyperactivity in children with attention-deficit/hyperactivity disorder. *Eur J Pediatr Neurol* 20(6):925–937. <https://doi.org/10.1016/j.ejpn.2016.07.004>
43. Wagner J, Schlarb AA (2012) Subtypes of ADHD and their association with sleep disturbances in children. *Somnologie* 16(2):118–124.
<https://doi.org/10.1007/s11818-012-0569-6>
44. Willoughby MT, Angold A, Egger HL (2008) Parent-reported attention-deficit/hyperactivity disorder symptomatology and sleep problems in a preschool-age pediatric clinic sample. *J Am Acad Child Adolesc Psychiatry* 47(9):1086–1094.
<https://doi.org/10.1097/CHI.0b013e31817eed1b>

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryTables.docx](#)