

**Brief Research****Factors Influencing Problematic Sleep Among Preschool Children with ADHD: Brief Research**Prakasit Wannapaschaiyong<sup>1\*</sup>, Sureelak Sutthritpongsa<sup>1</sup>**Abstract**

This study aimed to examine the prevalence of sleep disturbances and related factors among preschool children with ADHD. Our results showed that the prevalence of sleep disturbances was 40%. Factors associated with problematic sleep include combined-type ADHD, higher severity of ADHD symptoms, the use of taking methylphenidate, higher behavioral difficulties, and no bedtime routine.

**Keywords:** ADHD, Preschool children, Sleep disturbances

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## Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder in children and adolescents with a 5.3% prevalence.<sup>1</sup> According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), ADHD symptoms include inattention, hyperactivity, and impulsiveness, which affect daily functions and learning processes.<sup>2</sup> Currently, pediatricians prefer to diagnose ADHD in the preschool period so that preschoolers with ADHD receive early intervention, which will lead to a reduction in negative consequences such as behavioral and emotional problems in the school-age period.<sup>2</sup>

Sleep problems are common in children with ADHD. According to a study by Owens (2009), 50% of school-aged children with ADHD have sleep problems, which is more than those without ADHD (25%).<sup>3</sup> Many factors, including the intrinsic features of ADHD, psychiatric comorbidities, and the influence of ADHD medications cause sleep disturbances in these children.<sup>4</sup> Many studies have shown the relationship between poor sleep quality and increased severity of ADHD symptoms and behavioral problems, including irritability, aggressive behavior, and conduct problems, in school-aged children with ADHD.<sup>4,5</sup> Moreover, increasing behavioral problems and severity of ADHD symptoms from poor sleep quality may lead to negative long-term consequences, including interpersonal problems in interpersonal relationships problems, peer rejection, and future academic and work failures.<sup>6</sup> Therefore, if sleep problems in children with ADHD can be reduced, negative behavioral sequences can also be reduced. Especially preschool-aged children, their self-regulation abilities are not yet fully developed at that age.<sup>7</sup> Thus, sleep disturbances in preschoolers with ADHD may cause behavioral and emotional problems more easily than in older children and for sleep adolescents. Screening sleep problems in preschool-aged children with ADHD and identifying factors that affect their sleep are crucial to caring for these children. Only one previous study, Stickley's study (2021), found that the prevalence of sleep problems in preschool children with ADHD was as high as 83.6%. The most common sleep problems in these children included awakening at night (59.6%), nightmares (29.9%), and snoring (22.6%).<sup>8</sup>

However, currently, there is no study to determine the related factors of sleep problems among preschool children with ADHD. Therefore, this research was developed to narrow the knowledge gap in this field.

## Methods

### Study Design and Participants

The secondary data from Wannapaschaiyong's unpublished cross-sectional study, which investigated the relationship between sleep disturbances and emotional/behavioral difficulties in preschoolers with ADHD, were used in this study. The 80 preschoolers aged 4-6 years were recruited from the child development clinic at Siriraj Hospital between October and December 2023. Developmental and behavioral pediatricians diagnosed and classified all participants according to DSM-5 criteria. Participants who had global developmental delay and autism spectrum disorder were excluded.

### Data Collection

The original study (Protocol number 719/2023) was approved by the Siriraj Institutional Review Board. Caregivers of eligible participants were recruited and informed about the original protocol. After providing informed consent, they completed the paper-based questionnaires, including the demographic information form, the Children's Sleep Habit Questionnaire (CSHQ), and the Strengths and Difficulties Questionnaire (SDQ).

### Research Instruments

#### 1. Demographic information form

The participant's demographic characteristics, including sex, bedtime environments, bedtime routine, type and severity symptoms of ADHD, comorbidities, and treatment modalities they received.

#### 2. The Children's Sleep Habits Questionnaire, Thai-version (CSHQ-Thai)<sup>9</sup>

The CSHQ-Thai was used to assess sleep characteristics and problem in children aged 4-10 years. This questionnaire comprises 33 sleep habit questions, each scored on a three-point Likert scale ranging from "usually" to "rarely." A total score greater than 41 points is evaluated characteristics and problems of sleep. This tool has strong internal consistency (Cronbach's alpha coefficients = 0.83).

### 3. Strengths and Difficulties Questionnaire, parent rating – Thai version (SDQ-parent rating)<sup>10</sup>

Behavioral difficulties were screened with SDQ-parent rating. The 25 items in this questionnaire evaluated the participant's five aspects of behaviors, including emotional symptoms, hyperactivity, conduct problems, peer relationship problems, and prosocial behaviors. Their parents were required to rate on a 3-point Likert scale: 0 = "not true," 1 = "somewhat true," and 2 = "definitely true." The four behavioral domains of hyperactivity, emotional symptoms, conduct problems, and peer relationship problems were then used to calculate the overall difficulty score. Participants assessed greater than having a total difficulty score exceeding 16 are considered to have significant behavioral difficulties. SDQ had an overall Cronbach's alpha internal consistency of 0.7, exhibiting a sensitivity and specificity of 0.63 and 0.95, respectively.

#### Statistical Analyses

A descriptive analysis was performed to calculate the frequency and percentage in this study. Chi-square and Fisher's exact test were used to compare the related factors between participants with and without problematic sleep. This study used IBM SPSS version 25.0 (SPSS Inc., Chicago, USA) for analyses.

## Results

80 preschool children, including 60 boys (75%) and 20 girls (25%) were studied. The mean age of participants was  $5 \pm 0.61$  years. More than one third of the participants (40%) had clinically significant sleep disturbances. In Table 1, the proportion of participants diagnosed with combined presentation had more sleep problems than those with hyperactive and impulsive presentation ( $p = 0.002$ ). 75% of participants without sleep problems had mild severity of ADHD symptoms. On the other hand, 87.5% of participants with problematic sleep had moderate to severe ADHD symptoms. When comparing the participants with and without sleep disturbances, the severity of ADHD symptoms was significantly different ( $p < 0.001$ ). Nearly 60% of participants with sleep problems were treated with methylphenidate, which was different from those without sleep problems (2.08%) ( $p < 0.001$ ).

Almost all participants who showed behavioral difficulties from the SDQ assessment had sleep problems. When comparing the participants with problematic sleep and those without sleep problems, the proportion of participants with behavioral difficulties is significantly different ( $p < 0.001$ ). In addition, compared to the participants with sleep problems, the proportion of participants without sleep disturbances who had bedtime routines was higher ( $p < 0.001$ ). On the other hand, the bedroom environment, such as temperature and exposure to light and sound during the night, did not show a difference between participants with and without problematic sleep.

**Table 1** Comparison of problematic sleep and related factors among preschool children with ADHD

Characteristics	Participants without problematic sleep (n = 48)	Participants with problematic sleep (n = 32)	P-value
Sex			0.292
Boy	34 (70.83)	26 (81.25)	
Girl	14 (29.17)	6 (18.75)	
ADHD type			0.002*
Hyperactive/Impulsive	39 (81.25)	15 (46.88)	
Combined presentation	9 (18.75)	17 (53.12)	
Severity of ADHD			< 0.001*
Mild	36 (75)	4 (12.5)	
Moderate	11 (22.92)	24 (75)	

**Table 1** Comparison of problematic sleep and related factors among preschool children with ADHD (cont.)

Characteristics	Participants without problematic sleep (n = 48)	Participants with problematic sleep (n = 32)	P-value
Severe	1 (2.08)	4 (12.5)	
Pharmacological therapy			< 0.001*
No	31 (64.59)	7 (21.88)	
Methylphenidate	1 (2.08)	19 (59.38)	
Risperidone	16 (33.33)	6 (18.75)	
Behavioral difficulties			< 0.001*
Not significant difficulties	47 (97.92)	8 (25)	
Significant difficulties	1 (2.08)	24 (75)	
Bedtime routine			< 0.001*
No	21 (43.75)	31 (96.88)	
Yes	27 (56.25)	1 (3.12)	
Bedroom temperature (Parents' perception)			1.000
Normal	45 (93.75)	30 (93.75)	
Cold	3 (6.25)	2 (6.25)	
Exposed light in bedroom			0.400
No	41 (85.42)	25 (78.12)	
Yes	7 (14.58)	7 (21.88)	
Exposed sound in bedroom			1.000
No	47 (97.92)	31 (96.88)	
Yes	1 (2.08)	1 (3.12)	

Data presented as number (percentage)

Abbreviations: ADHD = Attention Deficit Hyperactivity Disorder

\*significant with level of  $P < 0.05$

## Discussion

This study found that 40% of preschoolers with ADHD had significant sleep disturbances. Our result was less than the Stickley's study (2021), which found that of the prevalence of sleep problems among preschool children with ADHD was as high as 83.6%.<sup>8</sup> Our small population, collected from a single center, can explain this inconsistency, which may be the reason for the low prevalence rate in this study. In addition, Stickley's research did not use the standard questionnaire to ask about sleep problems, which may lead to overestimating the prevalence result.

Factors associated with significant sleep disturbances among preschool children with ADHD include type and severity of ADHD, taking methylphenidate, considerable behavioral difficulties,

and no bedtime routine. Our results are consistent with previous studies that found that combined-type ADHD and higher severity symptoms were associated with sleep disturbances.<sup>4</sup> Children with combined-type ADHD may have more significant sleep problems than those who have predominantly inattentive or hyperactive-impulsive type because children with combined-type ADHD have more impaired regulation of brain activity, which leads to delayed circadian rhythm with a later onset of melatonin production.<sup>11</sup> In addition, the higher the severity of ADHD symptoms, the worse the function related to brain networks, which leads to more severe sleep problems.<sup>11</sup> More behavioral difficulties are another symptom that reflects the deterioration of behavioral and emotional control caused by the worsening prefrontal cortex function.<sup>11</sup>

The use of methylphenidate use, which is the first-line treatment for children with ADHD, results in sleep difficulties.<sup>4</sup> Although the United States Food and Drug Administration (FDA) approves methylphenidate for the treatment of ADHD in patients older than 6 years, current guidelines and studies recommend the use of this medication for the treatment of children under six who continue to have symptoms of ADHD and seriously impaired daily living activities and social function, after intensive treatment with parent management training and behavioral modification.<sup>12,13</sup> However, younger children tend to have a more significant response to psychostimulants than older children and adolescents and therefore, younger children are more likely to experience medical side effects, including insomnia and prolonged sleep latency.<sup>14</sup> This data supports our findings that the use of psychostimulants in these children may be a significant cause of sleep disturbances.

Whereas psychostimulants can interfere with sleep, implementing a consistent bedtime routine can ameliorate sleep problems because it supports children in managing themselves calmly before bed, creating a regular sleep schedule, and promoting falling asleep independently.<sup>15</sup> Our results are consistent with studies by Mindell (2009)<sup>16</sup> and Henderson and Jordan (2010),<sup>17</sup> which found that having adaptive bedtime routines in preschool children is associated with better sleep quality, longer duration of sleep at night, and decreased bedtime resistance. Therefore, preschool children with ADHD, who are more prone to sleep difficulties, are likely to benefit significantly from a regular bedtime routine.

Our study has some limitations. First, this study is based on secondary data analysis of the original research investigating the relationship between sleep problems and behavioral problems in preschool children. Some potential variables related to sleep problems, including the dose and duration of receiving medication, and demographic characteristics and parenting practices of primary caregivers, were not collected. Therefore, further research should also collect these variables. Second, the number of participants in our study was small. In a single addition, our participants were recruited from single center, which may have selective bias and did not represent all preschool-aged children with

ADHD. Large sample sizes and multicenter studies should be investigated. Finally, this cross-sectional study design cannot determine the causal relationship between related factors and sleep disturbances. Thus, longitudinal studies should be conducted in the future.

In conclusion, almost half of preschoolers with ADHD are likely to experience sleep problems. Therefore, identifying sleep problems and related factors in these children should always be checked and addressed. The implementation strategies that can reduce these children's sleep problems include providing effective treatment for ADHD, appropriate management of behavioral difficulties, avoiding the use of methylphenidate without appropriate indications, and promoting a regular bedtime routine.

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#### **Compliance with Ethics Requirements**

All procedures performed in this study involving human participants were in accordance with the ethical standards of the Siriraj Institutional Review Board (SIRB), Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand (Protocol number: 719/2023) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Conflict of Interest** The authors declare no conflict of interest regarding the contents and publication of this article.

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**Author Contributions** All authors approved the final article. The authors involved in the study are as follows; Prakasit Wannapaschaiyong: Conceptualization, Methodology, Investigation and data collection, Writing-Original draft. Sureelak Sutthritpongsa: Writing-Review and editing.

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