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Original article

High incidence of sleep problems in children with developmental disorders: Results of a questionnaire survey in a Japanese elementary school

Michiko Matsuoka [a,b,c], Shinichiro Nagamitsu [a], Mizue Iwasaki [a], Akiko Iemura [a], Yushiro Yamashita [a], Masaharu Maeda [b], Shingo Kitani [d], Tatsuyuki Kakuma [e], Naohisa Uchimura [b], Toyojiro Matsuishi [a,*]

[a] *Department of Pediatrics and Child Health, Kurume University School of Medicine, Fukuoka, Japan*
[b] *Department of Neuropsychiatry, Kurume University School of Medicine, Fukuoka, Japan*
[c] *Department of Neuropsychiatry, Kurume University Graduate School of Medicine, Fukuoka, Japan*
[d] *Department of Biostatistics, Kurume University Graduate School of Medicine, Fukuoka, Japan*
[e] *Biostatistics Center, Kurume University School of Medicine, Fukuoka, Japan*

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Abstract

Objective: The aim of the present school-based questionnaire was to analyze the sleep problems of children with developmental disorders, such as pervasive developmental disorder and attention deficit hyperactivity disorder. *Methods:* The sleep problems of 43 children with developmental disorders were compared with those of 372 healthy children (control group). All children attended one public elementary school in Kurume, Japan; thus, the study avoided the potential bias associated with hospital-based surveys (i.e. a high prevalence of sleep disturbance) and provided a more complete picture of the children's academic performance and family situation compared with a control group under identical conditions. Children's sleep problems were measured with the Japanese version of the Children's Sleep Habits Questionnaire (CSHQ). *Results:* Children with developmental disorders had significantly higher total CSHQ scores, as well as mean scores on the parasomnias and sleep breathing subscales, than children in the control group. The total CSHQ score, bedtime resistance, sleep onset delay, and daytime sleepiness worsened with increasing age in children with developmental disorders; in contrast, these parameters were unchanged or became better with age in the control group. In children with developmental disorders, there was a significant association between a higher total CSHQ score and lower academic performance, but no such association was found in the control group. For both groups, children's sleep problems affected their parents' quality of sleep. There were no significant differences in physical, lifestyle, and sleep environmental factors, or in sleep/wake patterns, between the two groups. *Conclusions:* Children with developmental disorders have poor sleep quality, which may affect academic performance. It is important for physicians to be aware of age-related differences in sleep problems in children with developmental disorders. Further studies are needed to identify the association between sleep quality and school behavioral performance.

Keywords: Sleep problem; Children; The Children's Sleep Habits Questionnaire; Pervasive developmental disorder; Attention deficit hyperactivity disorder; Developmental disorder

1. Introduction

The way in which sleep disturbances may detrimentally affect children's cognitive function, developmental

* Corresponding author. Address: Department of Pediatrics and Child Health, Kurume University School of Medicine, 67 Asahi-Machi Kurume City, Fukuoka 830-0011, Japan. Tel.: +81 942 31 7565; fax: +81 942 38 1792.
E-mail address: tmatsu@med.kurume-u.ac.jp (T. Matsuishi).

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behavior, and academic performance is a growing field of research [1–4]. In addition, there is interest in the association between poor sleep in children and poor parental mental health [5,6]. Previous studies have estimated that the prevalence of sleep disturbances in typically developing children is in the range 20–40% [7–10]; conversely, the prevalence of sleep disturbances in children with developmental disorders, such as pervasive developmental disorder (PDD) and attention deficit hyperactivity disorder (ADHD), has been reported to be two- to threefold higher [11–14]. Furthermore, because of poorer prosocial skills and peer relationships, children with PDD and ADHD could experience considerably more psychological stress than healthy children [13,15], resulting in secondary sleep disturbance. Studies using parental subjective questionnaires have consistently reported that children with developmental disorders exhibit difficulties in initiating and/or maintaining sleep. For example, parents have reported sleep onset delays, decreased sleep duration, and parasomnias in children with developmental disorders, in addition to sleep disordered breathing and daytime sleepiness [16–18].

The biological mechanisms underlying sleep disturbances in children with ADHD or PDD are not completely understood. For example, decreased melatonin concentrations in the pineal gland have been proposed to account for sleep disturbances in children with PDD [19]. Another study in autistic children has reported a significant association between sleep disturbances and abnormalities in the expression of acetyl serotonin methyl transferase (*ASMT*) genes, which are involved in melatonin production, as well as polymorphisms of the clock genes *per1* and *Npas2*, which control the biological clock [20]. Dopaminergic disruption is likely to be the mechanism underlying the association between ADHD and restless leg syndrome (RLS), which is considered to be a sleep disorder and has been reported to occur in 10–40% of patients with ADHD [21,22]. Other studies also suggest an association between sleep disordered breathing, such as snoring, hypopnea, and apnea, and inattention or hyperactivity, with evidence indicating impaired central nervous system function in the regulation of sleep and attention/arousal [13,15,23–25]. However, the precise mechanisms underlying sleep disturbances in ADHD remain unknown. Objective sleep assessment using polysomnography (PSG) and actigraphy has revealed consistent evidence of differences between healthy children and children with developmental disorders, such as night hyperkinesis, changes in sleep onset latency, increased night waking, decreased total sleep time, and decreased rapid eye movement (REM) latency [13–15,26–28]. However, the results are inconsistent between studies because of methodological limitations, such as investigations in children from different age groups, the inclusion of subjects with comorbid psychiatric problems, small sample size, and the confounding effects of stimulant medication.

Previous sleep studies in children with PDD or ADHD have been performed primarily in clinical samples in university hospitals or sleep clinics. Sampling from such institutions could result in a bias towards a higher prevalence of sleep disturbance: many of the families of PDD and ADHD children who participate in such studies of sleep disturbance are likely to have some concerns about their child's sleep compared with control families. Furthermore, these institutions tend to provide medical care to children with more severe and complicated PDD or ADHD, and these children are more likely to exhibit poor sleeping patterns. Thus, the selection biases involved with the use of clinical samples may have a critical effect on the results of the study. To minimize the effects of any such bias, we planned a school-based sleep survey for PDD or ADHD children in which all the study participants (i.e. PDD and ADHD children, as well as healthy controls) were recruited from a single elementary school.

The Children's Sleep Habits Questionnaire (CSHQ) has been used in several countries to assess children's sleep patterns and sleep problems as reported by parents [29–31]. The Japanese version of the CSHQ was created in 2007 [32]; however, as yet there has been no study that has used this questionnaire to evaluate sleep patterns and/or problems in children with developmental disorders. The present study is the first in Japan that has used the CSHQ in this group of children. The aim of the present questionnaire survey was to compare the sleep patterns and sleep problems of children with PDD and ADHD with those of healthy children from the same elementary school, focusing on age-related changes, any association between sleep patterns and/or problems and academic performance, and the impact of sleep patterns and/or problems on the parents' sleep.

2. Methods

The design of the study and the procedures for obtaining informed consent were approved by the Medical Ethics Committee of Kurume University School of Medicine. Informed consent was obtained from each child and his/her parents prior to their participation in the study.

2.1. Participants

A parental questionnaire was administered between September and October 2010 at one public elementary school in Kurume, Japan (436 students from Grade 1 to Grade 6; age range 6–12 years), to assess children's sleep. Forty-three students at the school were receiving support for behavioral problems, development of social