Association Between Sleep Problems and Symptoms of Attention-Deficit/Hyperactivity Disorder in Young Adults

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Study Objective: To examine the association between sleep-related problems and symptoms of attention-deficit/hyperactivity disorder (ADHD) in a community sample of young adults in Taiwan.

Design: A college-based cross-sectional survey.

Participants: Two thousand two hundred eighty-four first-year college students (aged 18-20) in a university in Taiwan.

Measurements and Results: Each student completed a questionnaire regarding sleep schedule (self-estimated total sleep duration and sleep need), sleep problems (dyssomnia, parasomnia, and snoring), and the Chinese version of the Adult ADHD Self-Report Scale. Subjects were grouped separately for the inattention and hyperactivity subscales into highly likely ADHD (2.3%, 0.7%), probable ADHD (21.3%, 5.7%), and probably non-ADHD (76.4%, 93.6%) groups according to the scoring scheme of the subscales of the Adult ADHD Self-Report Scale. Results showed that, for both inattention and hyperactivity symptoms, the highly likely ADHD and probable ADHD groups were more likely than the non-ADHD group to have a variety of current and lifetime sleep problems. No significant difference in sleep problems was found between the highly likely ADHD and probable ADHD groups. Inattention, but not hyperactivity, was associated with greater sleep need and greater difference between sleep need and self-estimated nocturnal sleep duration. Hyperactivity, but not inattention, was associated with decreased nocturnal sleep duration.

Conclusions: Consistent with prior findings from children and adolescents, ADHD symptoms in young adults are related to sleep problems. Further studies on adults with ADHD should help to refine our understanding of the causal basis for any implications of this association.

Keywords: Sleep problems, inattention, hyperactivity-impulsivity, Adult ADHD Self-Report Scale

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INTRODUCTION

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD), CHARACTERIZED BY INATTENTION, HYPERACTIVITY, AND IMPULSIVITY, IS A COMMON neuropsychiatric disorder worldwide among children and adolescents,1 with a prevalence in the range of 5% to 10% in Western countries2 and 7.5% in Taiwan.3 It has been suggested that many people with ADHD, as high as 60% in some studies, continue to have clinically significant symptoms of ADHD when they become adults.4,5 Consistent with this suggestion, a recent national survey of adults in the United States found that 4.4% met the criteria for current adult ADHD.6 A companion report from this study documented substantial impair-

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and PLM, there has been no consistent evidence either of a relationship between sleep problems in general and symptoms of ADHD or of a clear causal direction of this relationship in cases in which the relationship has been found to exist. A complicating factor here is that, similar to the studies in children and adolescents, the findings from subjective reports are dissociated with those from objective measures, indicating an increased likelihood of a misinterpretation of sleep quality and problems in adults with ADHD.

Although the studies mentioned above have clearly documented associations of inattention and hyperactivity with sleep problems, particularly OSA and PLM, there has been a dearth of adequate data delineating the associations of ADHD with other sleep problems among adults. Studies based on parental reports have almost universally reported a high frequency of diverse sleep problems in children with ADHD. However, it is not clear whether similar specifications exist in the adult population. In view of this, and given the considerable public health importance of adult ADHD, we conducted a survey study of 2284 young adults to examine whether the associations of ADHD symptoms with sleep problems are similar to those found among children.

METHODS

Participants and Procedures

The Institutional Review Board of National Taiwan University Hospital approved this study prior to implementation. A letter describing the purposes and procedures of the study was mailed to those who were accepted by the National Taiwan University as first-year college students in July 2004. All students were informed that participation in the survey was completely voluntary, and the confidentiality was assured in the letter. Of the 3756 first-year students, 2284 (60.8%, 1156 men and 1128 women) consented to participate and completed the self-administered questionnaire survey in the first week of fall semester in conjunction with a routine physical examination. There was no information about the proportion of eligible subjects who received the mailings. The trained school counselors provided clear instructions on self-administration prior to the questionnaire being filled out. Trained research assistants then checked the completed questionnaires immediately to minimize missing data.

Instruments

Adult ADHD Self-Report Scale

The Adult ADHD Self-Report Scale (ASRS) is an 18-question scale developed in conjunction with revision of the World Health Organization Composite International Diagnostic Interview. The ASRS consists of 2 subscales, inattention and hyperactivity-impulsivity, each of which contains 9 items. All the items were mapped onto the 18 Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) Criterion A symptoms of ADHD. Each item asks how often a symptom occurred over the past 6 months on a 5-point Likert scale: 0 for never, 1 for rarely, 2 for sometimes, 3 for often, and 4 for very often. Individuals with a sum score on either subscale of 24 or greater, 17 to 23, and 0 to 16 are considered highly likely to have ADHD (described in this paper as ADHD), likely to have ADHD (probable ADHD), and unlikely to have ADHD (non-ADHD), respectively. Moreover, for estimating the prevalence of ADHD, we combined the ADHD categories based on 2 subscores to generate highly likely having ADHD (ie, meeting both ranges of highly likely ADHD for both subscales), probably having ADHD (ie, meeting both ranges of probable ADHD for each subscale), and possibly having ADHD (ie, meeting either the probable ADHD for each subscale).

The Chinese version of the ASRS was prepared with culturally appropriate colloquial expressions by the authors. A 2-way translation was performed independently by 3 child psychiatrists and professional bilingual translators in Taiwan and by psychiatrists and researchers from Harvard University. In a group of leading board-certificated child psychiatrists in Taiwan, the linguistic validity and content validity of this scale were performed. The 18-question ADHD-ASRS Symptom Checklist and 6-Question ADHD-ASRS Screener (Traditional Chinese) can be reached at website: http://www.hcp.med.harvard.edu/ncs/asrs.php.

The psychometric properties of the Chinese ASRS have been examined in another college-based sample of 3203 first-year college students (mean age in years ± SD: 18.88 ± 0.86). The Chinese ASRS demonstrated good internal consistency (Cronbach α) for the Inattention subscale (α = 0.85) and Hyperactivity-Impulsivity subscale (α = 0.83). In a subsample of 73 subjects, the Pearson correlation coefficients for test-retest reliability at a 4-week interval were 0.80 and 0.82 for the inattention and hyperactivity-impulsivity subscales, respectively.

Items regarding sleep hours and sleep problems were modified from the Sleep Habit Questionnaire, an instrument used in previous studies of children and adolescents, with operational definitions of each sleep problem in accordance with the DSM-IV. The Sleep Habit Questionnaire was designed to survey current (past 6 months) and lifetime sleep-related problems that included early insomnia (sleep latency more than half an hour at least 3 times a week for 1 month), middle insomnia (waking up more than half an hour, at least once per sleep, 3 times a week for 1 month), sleep terror (DSM-IV criteria), sleepwalking (DSM-IV criteria), sleep talking, nightmare, bruxism, and snoring. Items regarding sleep hours consisted of self-estimated total sleep duration and need of sleep to maintain normal daytime function. PLM, restless legs syndrome, and OSA were not measured in this study. The 4-week test-retest reliability (kappa) of these questions in the sleep parameters of a sample of 73 college students ranged from a low of 0.50 (lifetime sleep terrors) to a high of 0.79 (current bruxism).

Data Analysis

The statistical analysis was conducted by using SAS 9.1 (SAS Institute Inc., Cary, NC). The preselected α value was at p < .01 level. Two major types of comparison groups were (1) men and women, and (2) the “ADHD,” “probable ADHD” and “non-ADHD” groups based on the sum scores of each subscale. The descriptive results of comparing the demographics between the men and women were demonstrated in frequency, percentage, and χ² statistics for categorical variables and mean, SD, and 1-way analyses of variance for continuous variables.

Linear and nonlinear multilevel models using the MIXED and NLMIXED procedures in SAS were employed to control for effects of the lack of independence within the same department derived from a college-based sample. The linear multilevel model was used to conduct the analysis of covariance to compare the sleep schedules among the 3 groups defined by severity of the
ASRS score. The nonlinear multilevel model was used to examine the rates of sleep-related problems across different comparison groups and to test the random-intercept effect. If the p value of the t statistic of the random-intercept effect was less than .05, indicating that the random intercept was not equal to 0, we used the nonlinear mixed model to conduct the logistic regression and to compute the odds ratios and 95% confidence intervals for the odds ratios. Otherwise, the logistic-regression model was used. These statistical models were controlled for participants’ age, sex, body mass index, residential area, and parental marital status to decrease potential confounding effects from these variables.

RESULTS

Demographics

Table 1 presents the distribution of age, residency, birth order, symptoms of ADHD, and parents’ educational attainment, job status, and marital status. Men were more likely than women to be the single child or youngest child, to have the father’s job be in the category of neither professional nor technical, and to score higher in symptoms of inattention and hyperactivity/impulsivity. There was no sex difference in other demographics measured in this study.

Estimated Prevalence of Adult ADHD

Using the ASRS cutpoints of both subscales, 2.8% of respondents (n = 64) were classified as highly likely to have ADHD, an additional 3.2% (n = 74) were classified as probably having ADHD, and an additional 19.6% (n = 447) were classified as possibly having ADHD.

Sleep Duration and Symptoms of Inattention or Hyperactivity

ADHD or probable ADHD associated with inattention was associated with significantly longer required sleep time to maintain normal daytime function and greater difference between required sleep and self-estimated nocturnal sleep duration than their counterparts but not with actual self-estimated sleep duration (Table 2). ADHD associated with hyperactivity-impulsivity, in contrast, was not significantly related to any of the sleep measures.

Sleep Problems and Symptoms of Inattention or Hyperactivity

Table 3 displays the current and lifetime rates of several sleep problems by the severity of inattention and hyperactivity-impulsivity. In terms of inattention, subjects with ADHD were more likely than non-ADHD subjects to have current early insomnia, middle insomnia, sleep talking, nightmares, and snoring and lifetime early insomnia, middle insomnia, sleep terrors, and nightmares; subjects with probable ADHD, compared with non-ADHD subjects, were more likely to have problems in all of the investigated current and lifetime sleep questions except for current sleep talking and bruxism. As to the hyperactivity-impulsivity subscale, ADHD subjects were more likely than non-ADHD subjects to have current early insomnia, snoring, and all of the in-

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Table 1—Demographic Characteristics by Sex

<table>
<thead>
<tr>
<th></th>
<th>Men n = 1156</th>
<th>Women n = 1128</th>
<th>Total N = 2284</th>
<th>Sex differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>19.4 ± 2.9</td>
<td>19.2 ± 2.6</td>
<td>19.3 ± 2.7</td>
<td></td>
</tr>
<tr>
<td>Residency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taipei City and County</td>
<td>643 (55.8)</td>
<td>606 (53.9)</td>
<td>1249 (54.9)</td>
<td></td>
</tr>
<tr>
<td>Paternal education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior high or lower</td>
<td>328 (29.4)</td>
<td>319 (18.0)</td>
<td>647 (29.2)</td>
<td></td>
</tr>
<tr>
<td>College or higher</td>
<td>789 (70.6)</td>
<td>780 (82.0)</td>
<td>1569 (70.8)</td>
<td></td>
</tr>
<tr>
<td>Maternal education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior high or lower</td>
<td>485 (43.3)</td>
<td>473 (42.9)</td>
<td>958 (43.1)</td>
<td></td>
</tr>
<tr>
<td>College or higher</td>
<td>634 (56.7)</td>
<td>629 (57.1)</td>
<td>1263 (56.9)</td>
<td></td>
</tr>
<tr>
<td>Paternal jobb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td>260 (22.5)</td>
<td>248 (22.0)</td>
<td>508 (22.3)</td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>614 (53.1)</td>
<td>661 (58.6)</td>
<td>1275 (55.8)</td>
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</tr>
<tr>
<td>Other</td>
<td>282 (24.4)</td>
<td>219 (19.4)</td>
<td>501 (21.9)</td>
<td></td>
</tr>
<tr>
<td>Maternal jobb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td>80 (6.9)</td>
<td>72 (6.4)</td>
<td>152 (6.7)</td>
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</tr>
<tr>
<td>Technical</td>
<td>507 (43.9)</td>
<td>501 (44.4)</td>
<td>1008 (44.1)</td>
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</tr>
<tr>
<td>Other</td>
<td>569 (49.2)</td>
<td>555 (49.2)</td>
<td>1124 (49.2)</td>
<td></td>
</tr>
<tr>
<td>Parental marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married and cohabit</td>
<td>1056 (91.8)</td>
<td>1026 (91.1)</td>
<td>2082 (91.5)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>94 (8.2)</td>
<td>100 (8.9)</td>
<td>194 (8.5)</td>
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<tr>
<td>Birth order</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Single child</td>
<td>110 (9.5)</td>
<td>84 (7.5)</td>
<td>194 (8.5)</td>
<td></td>
</tr>
<tr>
<td>First child</td>
<td>518 (44.9)</td>
<td>544 (48.4)</td>
<td>1062 (46.7)</td>
<td></td>
</tr>
<tr>
<td>Middle child</td>
<td>106 (9.2)</td>
<td>168 (14.9)</td>
<td>274 (12.0)</td>
<td></td>
</tr>
<tr>
<td>Youngest child</td>
<td>419 (36.4)</td>
<td>329 (29.2)</td>
<td>748 (32.8)</td>
<td></td>
</tr>
<tr>
<td>Inattention, sum score</td>
<td>13.5 ± 5.2</td>
<td>13.0 ± 4.7</td>
<td>13.2 ± 4.9</td>
<td></td>
</tr>
<tr>
<td>Hyperactivity, sum score</td>
<td>9.3 ± 5.1</td>
<td>8.5 ± 4.7</td>
<td>8.9 ± 4.9</td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as number (%), except age and inattention and hyperactivity sum scores, which are presented as mean ± SD.

aThe job classification was based on the criteria of occupation category of Executive Yuan, Taiwan, which was modified from the Standard International Occupational Prestige Scale.

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investigated lifetime problems; the probable ADHD, compared with the non-ADHD subjects, had a higher likelihood of having current early insomnia, sleep terrors, nightmares, and snoring and all the lifetime sleep problems except for current sleep talking.

There was no difference between the ADHD and the probable ADHD subjects (in terms of subscales of inattention and hyperactivity-impulsivity) either in current or lifetime sleep problems (p values ranging from .086 to 1).

Prediction for Symptoms of Inattention or Hyperactivity Based on Sleep Problems

Table 4 summarizes the parameter estimates and F statistics for the sleep problems that were significantly related with symptoms of inattention and hyperactivity-impulsivity separately in the final model using the backward elimination procedure in the model selection. The results showed that the most-related sleep problems for the symptoms of inattention were current early insomnia, nightmare, and snoring; lifetime middle insomnia; and increased sleep need to maintain daytime functioning. The most-related sleep problems for the hyperactive-impulsive symptoms were current early insomnia, middle insomnia, and snoring; lifetime middle insomnia, sleep talking, and nightmares; and decreased nocturnal sleep hours. In addition, men scored higher in both symptom dimensions, as compared with women.

DISCUSSION

Although researchers have long been interested in the associations between sleep problems and symptoms of ADHD in children and adolescents, the current study is one of the few studies to investigate these relationships among adults and the first to do so in a large nonreferred sample of young adults and to demonstrate the existence of similar findings based on subjective measures as those found in studies of child and adolescent populations. Findings indicate that young adults with inattention and hyperactivity-impulsivity have a significantly higher prevalence than do others of both current and lifetime sleep problems, including dysomnia, parasomnia, and snoring.

Because of the large sample size and the questionable validity of diagnosing OSA and PLM based on subjective self-reports in this study, we did not specifically investigate this association; instead, we examined snoring and more-general sleep problems and their associations with ADHD symptoms in young adults, issues that have not previously been well studied. Although different measures (self-reports by subjects vs parental reports on subjects) and different age groups (young adults vs children and adolescents) were employed in this study, as compared with previous studies in children and adolescents, our findings provide evidence to support the associations between several sleep problems and symptoms of ADHD in an adult population. Consistent with studies in children and adolescents, and different age groups (young adults vs children and adolescents) were employed in this study, as compared with previous studies in children and adolescents, our findings provide evidence to support the associations between several sleep problems and symptoms of ADHD in an adult population. Consistent with previous studies in children and adolescents, our findings provide evidence to support the associations between several sleep problems and symptoms of ADHD in an adult population.
sleep duration in children with ADHD. The negative findings are further supported by 2 studies using objective measures. In contrast to findings from objective measures, which show no difference, and those from self-reports of adults with ADHD, which show shorter total sleep duration, findings from parental reports show longer nocturnal sleep time in children with ADHD. Although this study showed that college students with ADHD or probable ADHD did not have different sleep durations from those without ADHD, the finding of a correlation between increased hyperactivity-impulsivity and decreased sleep duration identified in the final model should be further examined by an objective measure of sleep duration because a discrepant finding between objective measures and self-report measures in adults has been documented. If this relationship exists, it can be explained that individuals with short sleep may fidget with fingers and move body to maintain their alertness. Despite several studies of the effect of sleep duration on ADHD symptoms, no study has examined the relationship between perceived sleep need and ADHD symptoms. Interestingly, this study demonstrates the relationship between perceived sleep need and ADHD symptoms. The perceived longer need for sleep may explain why, despite no difference in recorded sleep time, there are still increased symptoms of inattention and hyperactivity. Hence, young adults presenting with inattention problems may require a longer sleep time to maintain their normal daytime function.

Our results show that, although young adults with symptoms of ADHD have higher rates of sleep problems than those without ADHD, the criteria of the ASRS, highly likely ADHD) didn’t report more sleep problems than those with mild symptoms of ADHD (probable ADHD). The failure to find a strong dose-response relationship of the ADHD symptoms and sleep problems might provide hints as to the causality between sleep problems and ADHD that...
could be followed up in future research.

The causal factors linking ADHD and sleep problems are unclear from the results reported here. Possible explanations include the following: first, sleep problems may cause daytime sleepiness and behavioral problems, perhaps through sleep disruption or deprivation, resulting in frequent attention-shifting and stimulus-seeking behaviors making individuals with sleep problems look like they are “hyperactive” and “inattentive.” Second, behavioral problems, such as hyperactivity, might result in sleep problems. For example, challenging behaviors of ADHD children might increase the likelihood of difficulties with sleep onset and awakening in the morning and more restless sleep. Or, adults with ADHD might overschedule and feel compelled to do things before sleep. A third possibility is that sleep problems and ADHD might have some common causes. For example, common vulnerability in brain dysfunction might lead to both types of disorders. Consistent with this possibility, a shorter daytime sleep latency in individuals with ADHD is consistent with the possibility that a deficit in alertness affects not only daytime inattention and hyperactivities, but also sleep mechanisms.

**Strengths and Limitations**

Most previous studies on this topic have been conducted in populations of children and adolescents. The large college-aged community sample in this study provides information on young adults that has not been investigated in previous studies. Moreover, the use of the measures covering a wide variety of sleep problems and the Chinese ASRS with satisfactory reliability and validity allowed us to comprehensively examine the relationship of sleep problems and ADHD and increase the internal validity of this study. Despite the strengths, the present study is limited by a cross-sectional study design, questionable external validity, a lack of objective measures, lack of assessment of full criteria for a diagnosis of ADHD, and no knowledge of medical problems or medication. First, the cross-sectional study design does not allow us to investigate the causal relationship between sleep problems and ADHD symptoms. Second, because this is a college-based study, the findings may not be generalized to the broader Taiwanese adult population. Third, the present study used subjective measures of sleep problems that may not generalize to more-objective measures of sleep problems. Not only does a self-administered measure, which has been commonly used in sleep studies related to ADHD, make it feasible, easy, and inexpensive to conduct a study with a large sample size, but it also prevents interviewer assessment biases. Fourth, without conducting a psychiatric interview to make the ADHD diagnosis or having knowledge about a formal clinical diagnosis of ADHD, this study provides no data about whether individuals with ADHD are more likely to suffer from sleep problems. However, this study targets on the relationship of sleep problems with symptoms related to the core symptoms of ADHD, and the relationship of sleep problems with ADHD diagnosis will be examined in future studies. Last, lack of information about what medical problems the subjects had or medications (such as stimulants and hypnotics) the subjects were taking prevents us from investigating whether these factors might have influenced ADHD symptoms and sleep parameters and subsequently confounded our findings.

**Implications**

Combining findings from several lines of work, including our prior study on children and adolescents and this study, we should know that although individuals with ADHD may not increase the risk for some sleep problems; individuals with sleep problems may manifest varied degree of symptoms similar to the core symptoms of ADHD. Without detailed and comprehensive assessments, these individuals with sleep problems could easily be misdiagnosed with ADHD, particularly for those adults who did not have information about a childhood history of ADHD. It is particularly important for those subjects in this study who had symptoms of mild inattention and hyperactivity to have a complete assessment of sleep-related problems and vice versa, given that these problematic behaviors that mimic symptoms of ADHD may also result in adverse outcomes such as academic failure or low work achievements, injuries and motor vehicle crashes, and substance abuse. Therefore, for individuals with ADHD-like symptoms and sleep problems, psycho-education of sleep hygiene and behavior modification should be provided first to prevent daytime inattention, irritability, and sleepiness in order not to influence their school or occupational performance. If a behavioral approach does not work, medication and other treatment for sleep problems should be the next step if the diagnosis of ADHD cannot be confirmed. For individuals with severe symptoms of ADHD and sleep problems, a complete assessment for the diagnosis of ADHD and sleep problems should be performed before initiation of medication for treating ADHD in addition to treatment for sleep problems. Further study employing adults with a diagnosis of ADHD are needed to determine the relationship between diagnoses of ADHD and sleep problems, and prospective cohort studies aiming at demonstrating a cause-and-effect relationship of sleep problems and ADHD-related symptoms are crucial and merit being done.

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**REFERENCES**


7. Kessler RC, Adler L, Ames M, et al. The prevalence and effects of adult attention deficit/hyperactivity disorder on work performance...