Japanese Sleep Questionnaire for Elementary Schoolers (JSQ-ES): validation and population-based score distribution

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Abstract

Objective: The Japanese Sleep Questionnaire for Elementary Schoolers (JSQ-ES) was developed to measure the sleep habits and disturbances of Japanese children. The current study aimed to present psychometric properties and describe the score distribution of the JSQ-ES. In addition, it examined correlations between the sleep and daytime behavior of school-aged children.

Method: Guardians of 4369 elementary school children and 100 children diagnosed with sleep disorders in two clinics completed the JSQ-ES.

Results: Exploratory factor analysis and confirmatory factor analysis suggested a nine-factor structure. The JSQ-ES internal consistency was 0.876 and 0.907 for the community and clinical groups, respectively. Score distribution differences were observed between the two groups. A cut-off point of 80 was identified for the total JSQ-ES score.

Conclusions: Exploratory factor analysis and confirmatory factor analysis suggested a nine-factor structure: (1) restless legs syndrome; (2) sleep-disordered breathing; (3) morning symptoms; (4) nighttime awakenings; (5) insomnia; (6) excessive daytime sleepiness; (7) daytime behavior; (8) sleep habits; and (9) irregular/delayed sleep phase. The study verified that the JSQ-ES is a valid and reliable instrument with which to evaluate Japanese sleep habits using a large population-based sample. The JSQ-ES may be useful in both clinical and academic settings.

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1. Introduction

Sleep plays an important role in normal development and daily functioning in childhood. It has been reported that sleep problems cause behavioral and affective problems [12], anxiety [3], depression, and attention deficit hyperactivity disorder (ADHD) [4]. Furthermore, there is accumulating evidence that insufficient sleep during childhood causes later cognitive impairment [5]. On the other hand, sleep problems are common in childhood [6]. In Japan, the percentage of children with sleep problems has been reported ranging from 31.8–66.2% [7,8]. Hence, a convenient screening tool was required to measure sleep habits and related disorders among outpatients.

Several questionnaires to measure sleep disturbances in children have been developed for clinical and research purposes in Western countries. The Pediatric Sleep Questionnaire (PSQ) [9], the Children’s Sleep Habits Questionnaire (CSHQ) [10], the Sleep Disturbance Scale for Children (SDSC) [11], and the Omnibus Sleep Problems Questionnaire for school-aged children (OSPQ) [12] are amongst the most commonly used questionnaires for children. The PSQ is focused on screening for sleep-disturbed breathing and does not cover all sleep problems. The other three questionnaires are intended to screen for various sleep disorders.
problems, including sleep-disturbed breathing. However, they are all premised on Western sleep habits, which are extremely different from Japanese habits.

In Japan, co-sleeping using futons is common, even among elementary school children. In a previous report, it was found that 74.3% of preschoolers and 73% of elementary schoolers co-slept with their parent(s) using futons [13,14]. A futon is a thin mattress laid out on the floor. Children sleep on the futon individually at first, but they cross over them easily and get into their parents’ futons during their sleep.

The CSHQ has been translated into many languages, including Japanese [15]; however, it is somewhat difficult to use with Japanese children because of sociocultural differences [16]. According to Liu et al., it is possible that co-sleeping affects CSHQ scores [17]. In particular, it is believed that the “sleep anxiety” items of these questionnaires do not take into consideration Japan’s sleeping environment. One of the most significant differences between the JSQ-ES and the other three questionnaires is the exclusion of an item about “sleep anxiety.” This item is not relevant in Japanese culture, considering the Japanese custom of co-sleeping as mentioned above. Therefore, the Japanese Sleep Questionnaire for Preschoolers (JSQ-P), taking into account Japanese sleep habits, has been utilized to screen for sleep disorders and for use in clinical research [14]. However, children’s lifestyles drastically change after entering school in Japan, which in turn modifies sleep behavior as well. The increase in the amount of homework and the fact that many children attend private schools (i.e., cram schools until 20:00–21:00) should be taken into consideration. These children’s parents become tolerant of their late sleep timings. Moreover, in Japan, lifestyle habits greatly differ among preschoolers, primary schoolers, and junior high schoolers. The CSHQ and SDSC questionnaires are designed for 4–10 year olds and 6–15 year olds, respectively, and these wide ranges of ages do not suit the lifestyle of Japanese children.

In addition, some sleep disorders show clear age dependency. According to the International Classification of Sleep Disorders–2 (ICSD-2), the most common morbidity rate of sleep-disordered breathing (SDB) is among school-aged children. Moreover, in the report by Agargun et al., parasomnia peaked at the age of 9–10 years [18], while Shang et al. and others reported that early insomnia, night waking, and enuresis decreased with age, whereas sleepwalking increased [19,20]. In consideration of these facts, the Japanese Sleep Questionnaire for Preschoolers (JSQ-P) and Elementary schoolers (JSQ-ES), and Junior high schoolers (JSQ-J, in preparation) were developed, respectively.

When developing of the JSQ-P and JSQ-ES, three clinicians with extensive experience in pediatric sleep disorders constructed 76 items including such items; “becomes irritated in the daytime,” “displays aggressive behavior towards others,” and so on, based on preexisting questionnaires; CSHQ, SDSC, and OSPQ, and ICSD-2. In the pilot survey, face validity was confirmed, the wording and contents were checked, inadequate items were excluded. The clinicians discussed the contents again, and selected about 40 items covering sleep disorders that were popular among children and appropriate for their age, 39 items for JSQ-P, and 38 items for JSQ-ES. The JSQ-P has already been reported [14]. A study was then conducted to use JSQ-ES for small samples as a preliminary study.

In the preliminary study, 683 questionnaires completed by the parents of elementary school children and 25 questionnaires of age-matched patients who visited pediatric sleep clinics at Osaka University Hospital were included. Sampling adequacy (Kaiser-Meyer-Olkin value of 0.87) was confirmed.

The differences in the screening items between the JSQ-P and the JSQ-ES were as follows. The items “taken for a car ride due to sleeping difficulty”, and “has trouble going to sleep”, which is often a problem in the early childhood, that put emphasis on sleeping were excluded. Instead, to ask about problem behavior during the day which is often seen as a result of sleep deprivation and insomnia, which increased in elementary school children, we added the items “has trouble getting up and often misses school”, “hits friends or siblings or talks to them rudely”, “gets irritated in the daytime”, and “misses school, oversleeping”. As a result of factor analysis, the cumulative explanatory variable of JSQ-ES preliminary was 67.5%. Two items, “gets grumpy at night” and “moves a lot during the night” were excluded due to the low factor loading in the JSQ-ES preliminary study.

The aim of this study was to examine the psychometric properties of the JSQ-ES in a large community sample and to define the cut-off values to screen for sleep problems. To this end, the following specific objectives were: (1) to verify the reliability of the JSQ-ES; (2) to establish the factor structure of the JSQ-ES; (3) to confirm its ability to distinguish between community and clinical groups; (4) to identify cut-off values for use as a screening test; and (5) to describe the characteristics of the sleep of Japanese elementary schoolers.

2. Materials and methods

2.1. Ethical considerations

This study was conducted in accordance with the guidelines of the Institutional Review Board of Osaka University Hospital, Osaka University, Japan, which approved the study protocol. All guardians provided informed consent for this study.

2.2. Participants

Public elementary school principals were asked to participate in the study, and 17 schools enrolled. Classroom teachers distributed the JSQ-ES to 5937 children aged between 6 and 12 years. Their parents filled the questionnaire and returned it to the respective classroom teacher the next day. In total, 4369 completed questionnaires were collected. Thus, the valid response rate was 73.6%. All submitted surveys remained completely anonymous and did not include personal information that might identify respondents or their children. The location of the enrolled elementary schools covered a wide area of both rural and urban areas in Japan and included Hokkaido, Toyama, Yamanashi, Tokyo, Kanagawa, Hyogo, Osaka, Wakayama, and Miyazaki. Of the 4369 questionnaires returned from the community group, 66 were excluded, due to invalid responses (57 did not answer all items, nine provided the same value for all items). Thus, 4303 respondents were included in the community group for the analysis.

In addition, 100 JSQ-ES were directly distributed to the guardians of children who attended pediatric sleep clinics at the Osaka University Hospital or Osaka Kaisei Hospital because of sleep problems, and collected from the guardians following completion. The response rate was 83%; these 83 children were defined as the clinical group. Their sleep diagnoses were as follows: restless legs syndrome (RLS) (n = 10), insomnia (n = 11), parasomnia (n = 14), excessive daytime sleepiness (EDS) (n = 5), sleep-disordered breathing (SDB) (n = 43), and circadian rhythm disorders (CRD) (n = 6). Three pediatric neurologists with extensive experience in pediatric sleep disorders engaged in this research, and they made the diagnoses using interviews, polysomnography (PSG), multiple sleep latency test (MSLT), pulse oximetry, actigraphy, cranial Xp, and blood examinations at the Osaka University Hospital.
2.3. Japanese Sleep Questionnaire for Elementary Schoolers

The JSQ-ES consisted of two parts: the first part (first page) of the questions was to be answered freely. It asked about lifestyle habits (i.e., dinner time, bath time, co-sleeping status, wake-up time, and bedtime (hh:mm)). Regarding sleep latency, the questionnaire presented the Likert scale in 10-minute increments (within 10 min, within 20 min, within 30 min, within 1 h, over 1 h, unknown) as mentioned previously. The total sleep time was calculated from the bedtime and wake-up time.

The second part (second page) was a set of 38 items to be answered on a 6-point intensity rating scale. Two reversed items were rescored prior to analysis. Higher scores on this scale indicated greater signs of sleep disorders or deleterious sleep habits. One of 38 items, “falls asleep without any help”, refers to children not making a request to their parents to hang around, watch, or sleep along with them when going to bed.

In the preliminary study, it was found that “going out after 20:00” and “viewing time: TV or video” were related to late sleep time. In addition, the use of multiple electronic devices has been associated with less sleep at night and a greater degree of sleepiness during the daytime [8]. Van den Bulck and Johnson et al. have also reported that excessive TV viewing is not good for sleeping [21,22]. “Taking caffeine products after 19:00” “using the Internet >1 h/day” and “playing time: videogames” caused excessive excitement of the brain and were considered as causes of insomnia and parasomnia [23–26]. These questions were included in the JSQ-ES by a six-grade evaluation (1–6) on the Likert scale (the higher the frequency, the higher the score), while the amount of daily viewing time of TV, video, DVD and the playing time of games were obtained through free writing.

The preliminary analysis classified the 38 items of the JSQ-ES into nine domains: sleep-disordered breathing, RLS, sleep habits, insomnia/sleep rhythm, daytime behaviors, excessive daytime sleepiness, morning symptoms, sustained sleep, and weekend sleep rhythm.

2.4. Statistical analysis

Statistical analyses were carried out using SPSS version 21.0 (IBM, Chicago, IL, USA) and AMOS version 21.0 (IBM) for Windows. Although an exploratory factor analysis (EFA) had already been conducted with the JSQ-ES in a small sample study, this larger population study aimed to reevaluate its factor structure and reliability. First, the community group was randomly divided into two (Group 1: n = 2110, Group 2: n = 2110) to examine the factor structure of the JSQ-ES. A random split was performed using SPSS random division function, and as a result, the grade structure and sex composition were almost equal. Which group could be used for the CFA and EFA analyses was then examined. The first-step EFA was performed with Group 1, to determine the possible factor structure. In the EFA, maximum likelihood factoring and promax rotation were used due to inter-factor correlations.

Thereafter, confirmatory factor analysis (CFA) was performed with Group 2 to examine the best fitting model from step 1 and to confirm that the model could be applied to different community groups. This cross-validation procedure of the two-step method allowed construction and verification of a robust factor model. A method of confirming reliability by dividing a group into two and performing CFA and EFA is used in conventional research [27,28]. Values of Cronbach’s α between 0.70 and 0.90 are generally considered adequate [29,30]. In the CFA, the following model fit indices were considered: comparative fit index (CFI), root-mean-square error of approximation (RMSEA), Akaike’s Information Criterion (AIC), and Browne-Cudeck Criterion (BCC). The acceptability criteria for these indicators were as follows: RMSEA <0.05 [31], and the AIC and BCC were relative indicators such that lower values indicated better fit. To identify the discriminative power of the questionnaire, item scores were compared between community (n = 83) and clinical (n = 83) groups. For this analysis, 83 individuals were chosen from the community group, and matched for age and sex with the clinical group.

A receiver operating characteristics (ROC) curve analysis was conducted to examine the predictive power of the JSQ-ES. The area under the ROC curve (AUC) was calculated using both community and clinical groups: an AUC of 1.0 indicated a perfect test, and an AUC of 0.5 denoted unsatisfactory performance. The cut-off score, a numerical value showing the highest sensitivity among the specificity of 0.7 or more, was selected.

In order to confirm the normal assumption of the T score of the total score, a Shapiro–Wilk test was performed. The Kruskal–Wallis test and the Mann–Whitney U test were also conducted to confirm whether the JSQ-ES score differed depending on age and sex. Furthermore, a multiple linear regression was conducted to determine the influence of children’s lifestyle on their sleep using the JSQ-ES item scores. There are several conditions that have an age dependency, such as SDB and parasomnia. Moreover, with regard to sex, girls encounter drowsiness that becomes strong in the second sexual period in which sexual hormone secretion becomes active. There are also reports that women tend to have poor sleep quality even after puberty [32,33]. Therefore, the study wished to analyze the relationship between the JSQ-ES and sex and age. To ensure comparability and to assess score distributions in the population group, subscale scores were transformed to T scores. The statistical significance level was set at 0.01.

3. Results

3.1. Participant characteristics

Descriptive statistics are shown in Table 1. The age distributions of the community and clinical groups did not differ (t = 1.03,
3.3. Reliability

Behaviors; Factor 8, sleep habits; and Factor 9, insomnia or JSQ-P; however, sensory and motor symptoms of RLS were combined. The AUC of the total score was 0.824 with a 95% confidence interval (0.762, 0.873), indicating a good level of predictive power of the JSQ-ES for sleep problems. The cut-off score for the total JSQ-ES score of 80 was determined by the intersection of sensitivity of 0.710 and specificity of 0.806. This cut-off score corresponded to 20.14% of the community sample. AUCs and cut-off scores for the subscales are shown in Table 4. The CRD subscale did not have sufficient discriminative power based on the ROC analysis (AUC = 0.543); hence, its cut-off score was determined based on the expert opinion of two specialists in pediatric sleep medicine (M.T. and I.M.) from a clinical point of view.

The result of the Shapiro–Wilk test for the total score was (w = 0.967, p < 0.001), and it showed a skewed model. Hence, nonparametric analysis (Kruskal–Wallis test and the Mann–Whitney U test) was conducted to confirm whether the JSQ-ES score differed depending on age and sex (Table 5).

The items “daytime behavior” and “sleep-disordered breathing” showed significantly higher points in boys than girls. Moreover, in the “morning symptoms” and “irregular/delayed sleep phase” items, girls showed significantly higher points than boys. In the item “daytime behavior,” a significant difference was recognized between the lower and upper grades. The median was the same (median = 48.58), but the upper limit of the range was higher in the upper grades (first and second grade range = 35–81, fifth and sixth grade range = 35–86). For the item “excessive daytime sleepiness,” there was a significant difference between the lower and upper grades, and between the intermediate and the upper grades. The median was the same for all three groups (median = 49.03), but the range width was different for all three groups (first and second grade range = 38–103), (third and fourth grade range = 38–107), (fifth and sixth grade range = 38–93). In “irregular/delayed sleep phase,” a significant difference was observed between each grade, and the median tended to be higher as the grade increased. The item “sleep habits” also showed a significant difference between each grade, and the median tended to be lower as the grade increased.

3.5. Multiple linear regression with lifestyle habits

A multiple linear regression was performed to determine the influence of children’s lifestyle on sleep, using the JSQ-ES item scores. As expected, items such as “watching TV at bedtime,” “intake of caffeine after 19:00,” “playing computer games or going on the Internet >1 h/day” and “total time spent watching TV or playing video games” affected children’s bedtime. Furthermore, “going out after 20:00” was considered the most influential factor on overall variables (Tables 6–8).

4. Discussion

4.1. Validity and reliability of the JSQ-ES

This study examined the validity and reliability of the JSQ-ES as a measure of problematic sleep habits and sleep-related disorders in community populations in Japan. The distributions of the total and subscale scores were acceptable. The internal consistency coefficient of the total score of the JSQ-ES in the community population was sufficiently high (0.876), and those of the subscale scores met an acceptable standard (0.70). The study found a similar structure and number of factors as identified in a preliminary small-sample analysis of the JSQ-ES. However, this large-sample study of the JSQ-ES employed a cross-validation procedure with
two steps (EFA and CFA) to construct and verify a robust factor model.

4.2. The differences between the JSQ-P and the JSQ-ES

The JSQ-P and JSQ-ES are different in their targeted age range; the former is for 2–6-year-olds, and the latter is for 6–12-year-olds. The same expert who created the JSQ-P was involved in the preparation of the items. Among the lifestyle items, others were added such as “I spend more than 1 h on e-mail and the Internet” and “I will take caffeine after 19:00.”

As for the screening items on the back side of the questionnaire, the differences from the infant version are as follows. The items were deleted, as they are often problems in early childhood where there is emphasis on sleeping. Moreover, since the habit of a nap is not present after elementary school, the item “takes for a car ride due to sleeping difficulty” and “has trouble going to sleep” were deleted, as they are often problems in early childhood where there is emphasis on sleeping. Moreover, since the habit of a nap is not present after elementary school, the item “get more than two naps” was also excluded.
Approximation; AIC, Akaike’s Information Criterion; BCC, Browne-Cudeck criterion.

74

of sleep deprivation and insomnia, were asked about through items among elementary school children, which are often seen as a result

Table 4

fi
difference in means between Community sample vs Clinical sample (covarying age and sex).

5. Insomnia 0.99 45.44 (45 e 4)

Nighttime awakenings 0.13 45.96 (42 e 129) 0.09 0.73 0.19 46.51 (33 85) 0.012 0.21 <0.001 47.01 (39 102) 0.39 0.14 0.422 48.34 (35 74) 45.43 (45 116) 45.43 (45 116) 0.23 (0.33)

6. Excessive daytime sleepiness 0.39 49.04 (38 103) 49.04 (38 107) 0.758 <0.001 <0.001 49.03 (38 103) 49.03 (38 107) 49.03 (38 93) 34.03 (<0.001)

7. Daytime behavior <0.001 51.14 (35 84) 46.03 (35 86) 0.012 0.21 <0.001 48.58 (35 81) 48.58 (35 86) 15.4 (<0.001)

8. Sleep habit <0.001 46.52 (40 70) 46.51 (33 85) <0.001 <0.001 49.55 (40 70) 46.51 (40 70) 43.47 (40 70) 143.79 (<0.001)

9. Irregular/delayed sleep phase <0.001 49.39 (33 85) 49.40 (33 85) <0.001 <0.001 46.82 (33 77) 49.40 (33 85) 51.96 (33 85) 147.57 (<0.001)

Table 5

Sex and age differences of the standardized r-scores of the Japanese Sleep Questionnaire for Elementary Schoolers.

p

Mann–Whitney U

Kruskal–Wallis

<table>
<thead>
<tr>
<th>Sleep subscales</th>
<th>Community sample (n = 80)</th>
<th>Clinical sample (n = 80)</th>
<th>ANCOVAa</th>
<th>Cut-off score</th>
<th>% of children who met criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SD</td>
<td>Mean SD</td>
<td>Mean</td>
<td>p</td>
<td>η²</td>
<td>AUC</td>
</tr>
</tbody>
</table>
| 1. Restless legs syndrome 7.88 3.200 10.94 6.873 13.192 <0.001 0.077 0.617 0.523–0.711 0.017 8 51.90 28.66
| 2. Sleep-disordered breathing 8.36 3.587 15.93 7.397 67.825 <0.001 0.305 0.817 0.744–0.890 <0.001 10 77.33 22.21
| 3. Morning symptoms 7.84 3.707 11.05 4.671 23.058 <0.001 0.127 0.709 0.623–0.796 <0.001 9 67.51 48.26
| 4. Nighttime awakenings 6.95 2.396 10.24 5.138 27.212 <0.001 0.149 0.687 0.597–0.776 <0.001 8 64.47 33.04
| 5. Insomnia 3.67 1.500 5.41 3.731 14.060 <0.001 0.088 0.636 0.543–0.729 0.006 4 82.22 27.93
| 6. Excessive daytime sleepiness 7.37 2.865 11.65 5.804 36.394 <0.001 0.181 0.718 0.631–0.806 <0.001 8 67.95 48.46
| 7. Daytime behavior 9.73 3.910 13.51 4.810 28.851 <0.001 0.159 0.709 0.664–0.826 <0.001 11 70.50 37.31
| 8. Sleep habitb 4.81 3.300 6.25 3.402 7.615 0.006 0.045 0.610 0.516–0.703 0.026 7 44.30 31.86
| 9. Irregular/delayed sleep phase 10.03 4.053 11.51 4.438 4.841 0.029 0.030 0.543 0.447–0.639 0.384 12 47.50 36.49

ANCOVA, analysis of covariance; SD, standard deviation; AUD, area under the receiver operation characteristics curve.
a The direction of score is opposite, due to reverse items.
b Difference in means between Community sample vs Clinical sample (covarying age and sex).

Rather, problematic behaviors during the day that increase among elementary school children, which are often seen as a result of sleep deprivation and insomnia, were asked about through items such as “missing sleep, overslept”, “displaying aggressive behavior toward others”, and “gets irritated in the daytime”.

4.3. Screening ability of the JSQ-ES

This questionnaire showed good sensitivity for both the total score and each subscale score, except for irregular/delayed sleep phase, for which the AUC was <0.6. It was assumed that the items “gets up later than usual on holidays” and “goes to bed later than usual on weekends” in the irregular/delayed sleep phase subscale were often rated high for children without sleep problems; therefore, there was a large overlap between the community and clinical groups. To ensure that the JSQ-ES had sufficient discriminative power to screen for sleep disturbances and problematic sleep hygiene, a cut-off point for the irregular/delayed sleep phase subscale was determined using the expert opinions of two children’s sleep specialists.
While the JSQ-ES has diagnostic features, it cannot offer the equivalent of a definitive diagnosis. As the questionnaire is a screening tool, the overlap between the normal and clinical groups could be large. Thus, according to Owen, the ratio of children who score over the cut-off point would be higher than that expected epidemiologically [10]. This screening tool should therefore be followed up with a diagnostic test to accurately assess sleep problems in children who score above the cut-off point.

Finally, in the analysis of the linear regression model, the adjusted R2 value was low. JSQ-ES is a form in which parents observe their children's behavior and sleep patterns, and fill out the questionnaire on behalf of the children. In the field of sociology research, it is said that R2 tends to be low because human behavior has a wide range and is difficult to predict. Moreover, it is said that R2 tends to be low when handling large samples [35,36].
4.4. Effect of sex and age on sleep disorders

On the score distribution of JSQ-ES by age and sex (Table 5), boys showed significantly higher scores in the item of SDB than girls. Some research has shown that school-aged boys are affected more by SDB than girls [37,38]. Among adults, most studies have estimated a greater risk of SDB for men than women [39,40]. In another previous report, there was a tendency for complaints of daytime sleepiness to increase with school grade [41]. The current study’s results supported this finding.

Gulliford et al. reported that girls have earlier bedtimes and longer sleep duration on schooldays than boys [42]. The item “irregular/delayed sleep phase” showed a tendency for girls more than boys towards the higher the grade level, the higher the score. Going to bed later and waking later on weekends than on schooldays reflects the biology of the circadian rhythm and is also a response to insufficient weekday sleep [43]. Most Japanese children participate in after-school activities, including extra course work, sports lessons, and music lessons, at least once a week. It was reported that Japanese elementary school children who were female and in a higher grade were shown to be independently associated with delayed bedtime on weekdays, later wake time on weekends, and longer sleep duration on weekends, compared to schooldays [44]. The current results also supported this finding. The reason is unclear, but girls may spend more time chatting on their cell phones with friends, or doing homework for a longer time than boys. To clarify this, further investigation is needed.

4.5. Sleep problems, lifestyle habits, and media use

It is well known that TV and computer game use before bedtime can have a powerful negative influence on children’s sleep and daily life [1]. And it has been reported that time spent on the internet [45,46], playing video games, and watching TV could affect children’s sleep time or sleep hygiene. In a preliminary study, it was found that “viewing time: TV or video” was related to late sleep time. However, in the current study, these factors were significant but low β coefficients, and had small effects for both the total and subscale scores. With respect to sleep disturbances, various factors affect each other in a complex manner; thus, it is unlikely that a single factor would become a major cause.

Going out at night has been shown to correlate with crime and juvenile trauma admissions [47]. In the current study, “going out after 20:00” (not including private tutoring school) showed some correlation with sleep disturbances such as irregular/delayed sleep phase, EDS, insomnia, and RLS. However, the proportion of children who responded yes to “going out after 20:00” was small (3.2–4.1%). In Japan, many students go to private tutoring school until late at night. Rather, various aspects of children’s lifestyles, including “going out after 20:00” likely affect sleep in a complex manner.

4.6. Limitations

The current study had several limitations. First, there could have been “parental and retrospective bias” in the responses to items because parents completed the questionnaires based on recollection. More objective methodologies such as polysomnography (PSG) are needed to assess children’s sleep, to reduce information bias; however, this is difficult in a large sample. Second, since the study did not include items about history of sleep disorders, developmental disabilities, mental disorders, and past use of central nervous agonist medication that could affect sleep, children with latent and actual sleep disorders may have been present in the community group. The third limitation was that there was a high percentage of SDB children in the disease group. This is because the proportion of SDB patients who visited the hospital was high; however, there is a possibility that the characteristics of the disease group may have been biased. Fourth, as Murata and others reported [13], the sleep habits of Japanese children are largely affected by the family situation; however, this study did not measure the socioeconomic status of each family. The sample came from widespread elementary schools, including schools in high and low latitudes and from urban and suburban areas. Since the study was intended to standardize the questionnaire, it did not examine the association between JSQ-ES scores and bed sharing. An additional study is needed to investigate cultural factors (eg, bed or bedroom sharing) contributing to sleep habits and disturbances.

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Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2017.07.025.

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