



## Original Article

## Sleep characteristics of young children in Japan: Internet study and comparison with other Asian countries

Jun Kohyama,<sup>1</sup> Jodi A. Mindell<sup>2</sup> and Avi Sadeh<sup>3</sup>

<sup>1</sup>Tokyo Bay Urayasu/Ichikawa Medical Center, Urayasu, Japan, <sup>2</sup>Saint Joseph's University and Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA and <sup>3</sup>Adler Center for Research in Child Development and Psychopathology, Department of Psychology, Tel Aviv University, Israel

**Abstract** **Background:** A recent international Internet-based study of young children (birth to 36 months) found that total sleep duration in Japan was the shortest among 17 countries/regions. The present study compared features of children's sleep in Japan relative to those in other Asian countries/regions.

**Methods:** Parents of 872 infants and toddlers in Japan (48.6% boys), and parents of 20 455 infants and toddlers in 11 other Asian countries/regions (48.1% boys; China, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and Vietnam) completed an Internet-based expanded version of the Brief Infant Sleep Questionnaire.

**Results:** Young children in Japan exhibited significantly fewer nocturnal wakings and shorter daytime sleep in comparison with other Asian countries/regions. Although the former finding was apparent in all age groups, the reduced duration of daytime sleep in Japan was not present until after 3 months of age. Interestingly, sleep problems were reported by significantly fewer parents in Japan compared with those in other Asian countries/regions, although parents in Japan reported significantly more difficulty at bedtime.

**Conclusions:** The short sleep duration of young children in Japan is largely due to a relatively short duration of daytime sleep. Significant differences in sleep characteristics in Japan relative to other Asian regions were found primarily after 3 months of age. Future studies should further explore the underlying causes and the potential impacts of these sleep differences.

**Key words** Asia, bedtime routine, co-sleeping, culture, nap.

Sleep is an indispensable physiological activity for humans, including young children, for whom it accounts for one-third to half of their day.<sup>1</sup> Several sleep surveys have been conducted to understand sleep patterns and sleep behaviors in young children, with several studies conducted in Japan. There are limited studies, however, that have specifically investigated the sleep of young children in Japan in comparison to children in other Asian countries.

A number of studies conducted in Japan have noted poor sleep habits in young children living there, including delayed sleep onset time and short sleep duration. For example, according to the Japanese Society of Child Health, the proportion of 1-year-old children who fell asleep at 22.00 hours or later increased from 25.7% in 1980 to 54.4% in 2000.<sup>2</sup> Similarly, the rate for 3-year-old children increased from 22% in 1980 to 52% in 2000.<sup>2</sup> A second study conducted in 1999 found that the proportion of 18-month-old and 3-year-old children who fell asleep at 22.00

hours or later was 42.5% and 43.8%, respectively.<sup>3</sup> In another study, 1105 questionnaire responses collected during 1999 and 2000 showed that 49.6% of children in Japan aged 36–46 months (average, 38.8 ± 0.9 months) fell asleep at 22.00 hours or later.<sup>4</sup> The average sleep onset time (21:44 hours) of Japanese preschoolers reported in that study<sup>4</sup> was the second latest among a range of studies performed in Europe and the USA.<sup>5–7</sup> Bedtimes are an important consideration, given that several studies have noted that children who go to bed later obtain less overall sleep<sup>3,4,8</sup> and experience more sleep problems.<sup>8,9</sup> Recently, an Internet-based survey of young children, aged from birth to 36 months, across 17 countries/regions around the world was performed with a large sample of 29 287 participants.<sup>10,11</sup> Not only did bedtimes differ significantly across these countries/regions, but a late bedtime was found to be predictive of poorer sleep outcomes.

In addition to a focus on sleep patterns, previous studies have looked at the proportion of parents who report sleep problems in their children. Araki *et al.* surveyed 404 3-year-old children in Japan from 2004 to 2005 and found that 24% of parents had concerns about their children's sleep.<sup>12</sup> In comparison, a poll by the National Sleep Foundation in the USA found that only 10.5%

Correspondence: Jun Kohyama, MD, PhD, Tokyo Bay Urayasu/Ichikawa Medical Center, 3-4-32 Toudaijima, Urayasu 279-0001, Japan. Email: j-kohyama@jadecom.or.jp

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of 239 caregivers of toddlers believed that their child had a sleep problem, and 46.4% of these cases involved toddlers waking on a nightly basis.<sup>8</sup> In contrast, a study of 1129 children aged 1–23 months in China found that 66% of children were considered to exhibit a sleep problem by their parents.<sup>13</sup> In a study of Taiwanese children (ages 0–6), 64% of caregivers reported that their child had a sleep problem.<sup>14</sup> We reported in a recent cross-cultural study that parental perceptions of sleep problems may differ among countries or cultures not only as a result of possible real differences in sleep in these young children, but also as a result of cultural expectations about sleep and cultural differences in sleep practices.<sup>10</sup>

One such sleep characteristic that varies markedly across countries is co-sleeping, which is substantially more common in Japan (59% of families) than in the USA (15% of families).<sup>15</sup> In addition, room-sharing for children in predominantly Caucasian countries is found to be more common in the first few months, then decrease with age. In comparison, room-sharing is stable across all ages in Japan and in other predominantly Asian countries.

Focusing more specifically on Japan, our recent cross-cultural study found that average total sleep duration in Japan (11.62 h) was the shortest among the 17 countries/regions studied.<sup>10</sup> This short sleep time was in comparison to the country with the most sleep: New Zealand (13.31 h), resulting in a 101 min difference. This decreased sleep in young children in Japan is of concern, because studies in adults indicate that decreased sleep negatively affects daytime functioning,<sup>16–18</sup> general wellbeing,<sup>19</sup> metabolic and endocrine functions,<sup>20,21</sup> bodyweight,<sup>22</sup> psychomotor vigilance, and mood.<sup>23</sup> Sleep loss is likely to produce similar unfavorable effects on youngsters.<sup>24,25</sup>

The main purpose of the former study was to investigate the difference between predominantly Asian and predominantly Caucasian countries/regions.<sup>10</sup> In that study we found that children from predominantly Asian countries/regions had significantly later bedtimes, shorter total sleep times, increased parental perception of sleep problems, and were more likely to bed-share and room-share than children from predominantly Caucasian countries/regions. That previous study, however, did not focus on data obtained from Japan in detail. To better understand the unique characteristics of sleep in young children in Japan, the aim of the present study was to compare sleep patterns in infants and toddlers in Japan with those in other Asian countries/regions.

## Methods

Complete study methodology is described in previous studies,<sup>10,11</sup> with detailed information provided here. The previous study included 29 287 infants and toddlers, 7960 of whom were from predominantly Caucasian countries (Australia,  $n = 1073$ ; Canada,  $n = 501$ ; New Zealand,  $n = 1081$ ; USA,  $n = 4505$ ; and UK,  $n = 800$ ).

## Participants

In the present study, data from parents of 21 327 infants and toddlers from 12 regions in Asia (China,  $n = 7505$ ; Hong Kong,  $n = 1049$ ; India,  $n = 3982$ ; Indonesia,  $n = 967$ ; South Korea,  $n = 1036$ ; Japan,  $n = 872$ ; Malaysia,  $n = 997$ ; Philippines,  $n = 1034$ ;

Singapore,  $n = 1001$ ; Taiwan,  $n = 896$ ; Thailand,  $n = 988$ ; and Vietnam,  $n = 1000$ ) were analyzed.

Children's ages ranged from birth to 36 months. Sample sizes within each country were evenly distributed across the following age groups: 0–2 months, 3–5 months, 6–8 months, 9–11 months, 12–17 months, 18–23 months, and 24–36 months. There were similar numbers of boys (48.1%) and girls (51.9%) across the entire sample. Demographic information of the complete sample is given in Table 1.

## Procedure

All participants completed the Brief Infant Sleep Questionnaire (BISQ).<sup>26</sup> The BISQ includes specific questions about infant daytime and night-time sleep patterns, as well as a range of sleep-related behaviors. Sleeping arrangements (bed sharing and room sharing) and bedtime routines were also assessed. The respondents were asked to describe their child's behavior during the last 2 weeks. The BISQ is well-validated, and has high (>0.82) test-retest reliability.<sup>26</sup> Sleep quality measures derived from the BISQ have been found to significantly differentiate between referred sleep-disturbed infants and controls, and significant correlations have been found between the BISQ and measures derived from actigraphy and daily logs.<sup>26</sup>

Demographic information was collected in addition to the BISQ, including parental age, education, employment status, and child's birth order. The complete questionnaire was translated into each respective language and back-translated to ensure appropriate translation. All data were collected online, except in Thailand and Vietnam, where a paper-based version was completed face to face with a researcher. In five regions (China, India, Malaysia, Singapore, Philippines), the questionnaire was set as a pop-up screen at a popular parenting website (BabyCenter), which invited parents to complete a sleep survey for children aged between birth and 36 months. All other countries/regions utilized a freestanding website for the survey. Recruitment in these areas was conducted via email, utilizing mailing lists obtained from local marketing firms and online advertising at other parenting sites. The online version used pull-down menus with optional responses for each presented question. Those who completed paper copies of the questionnaire were able to skip questions. Completion of the questionnaire was voluntary and parents were not offered any feedback. In some regions, incentives for completion were offered (e.g. free samples or gift vouchers). The complete sample was collected between September and December 2007, except for Vietnam, where data were collected in April 2008.

## Statistical analysis

Means and frequencies were used for demographic information. Data analysis for continuous variables was based on ANOVA with Cohen's  $d$  utilized to calculate effect sizes comparing Japan to the average of all the other Asian countries/regions (China, Hong Kong, India, Indonesia, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and Vietnam). Categorical variables were examined utilizing  $\chi^2$  analysis. Effect sizes reported for  $\chi^2$  analyses are phi ( $\phi$ ). Because of the large

**Table 1** Subject characteristics

		<i>n</i>	%
Child's age (months)	0–2	1 515	7.10
	3–5	2 574	12.07
	6–8	2 634	12.35
	9–11	2 463	11.55
	12–17	4 104	19.24
	18–23	2 888	13.54
Child's sex	24–36	5 149	24.14
	Girl	10 259	48.10
Child's birth order	Boy	11 068	51.90
	Only child	10 498	49.22
Respondent	Youngest child	3 499	16.41
	Oldest child	6 609	30.99
	Middle or a multiple child	721	3.38
Respondent's education	Mother	18 541	86.94
	Other	2 786	13.06
Respondent's employment	Postgraduate degree	3 600	16.88
	College education or a college degree	9 119	42.76
	High-school degree	8 384	39.31
	Less than high-school degree	224	1.05
Respondent's age range (years)	Full time	12 883	60.41
	Part-time	1 037	4.86
	At-home parent, student status, unemployment, or other	7 407	34.73
Respondent's age range (years)	21–24	935	4.38
	25–29	8 636	40.49
	30–34	8 537	40.02
	35–39	2 641	12.38
	Age <21 or >39	578	2.71

cohort size and multiple analyses, findings were considered significant for  $P < 0.001$ .

Age-related changes were compared between Japan and the other Asian countries/regions within the following age groups: 0–2 months, 3–11 months, 12–23 months, and 24–36 months. ANOVAs were conducted with a 2 (Japan vs rest of Asia)  $\times$  4 (age groups) factor design. Main effects for age, main effects for group, and interactions were calculated. The  $\chi^2$  statistics were calculated separately within each age group, comparing Japan with the average of the rest of Asia for each variable.

## Results

Table 2 lists descriptive data for all sleep measures in Japan compared to the other Asian countries/regions. Youngsters in

Japan exhibited fewer night wakings, a shorter duration of night wakings, and longer periods of consolidated sleep than those in the other Asian countries/regions. In contrast, children in Japan took fewer naps and daytime sleep was significantly shorter (by almost 1 h) than children in the other Asian countries/regions. The average total sleep time in Japan was 0.78 h shorter than in the other Asian countries/regions, but this difference was not statistically significant. Bedtime and rising time were not significantly different between Japan and other Asian countries/regions.

Table 3 lists the contextual factors related to sleep and parental perception of sleep behaviors. In Asian regions including Japan, >97.5% of parents reported being present at bedtime while their child is falling asleep. Although only a small proportion of the youngsters slept in their own room in all Asian

**Table 2** Sleep measures

	Japan (Mean $\pm$ SD) <i>n</i> = 872	Other Asian countries (Mean $\pm$ SD) <i>n</i> = 20 455	<i>F</i>	Effect size Cohen's <i>d</i>
Bedtime	21.29 $\pm$ 1.07	21.45 $\pm$ 1.25	0.86	
Number of wakings	1.25 $\pm$ 1.25	1.71 $\pm$ 1.36	20.29*	0.34
Duration of wakings	0.28 $\pm$ 0.42	0.53 $\pm$ 0.79	27.34*	0.32
Longest sleep	8.23 $\pm$ 2.82	7.19 $\pm$ 2.97	19.18*	0.35
Nighttime sleep	9.42 $\pm$ 1.09	9.18 $\pm$ 1.51	9.24	
Number of naps	1.44 $\pm$ .82	2.09 $\pm$ 1.21	37.13*	0.54
Daytime sleep	2.19 $\pm$ 1.29	3.15 $\pm$ 1.78	18.92*	0.55
Rise time	7.14 $\pm$ 0.97	7.11 $\pm$ 1.26	1.33	
Total sleep time	11.62 $\pm$ 1.48	12.33 $\pm$ 2.18	1.34	

\* $P < 0.001$ .

**Table 3** Child's sleep environment and parent's perception of child's sleep

	Japan <i>n</i> = 872	Other Asian countries <i>n</i> = 20 455	$\chi^2$	Effect size $\phi$
Parent's bed	69.72	64.43	10.26	0.02
Parent's room	88.07	86.40	1.99	
Own room	2.98	7.20	22.79*	0.03
Consistent bedtime routine (>4 nights/week)	72.71	60.13	111.26*	0.07
Sleep latency (>30 min)	22.71	19.15	8.55	
Bedtime difficulty	28.44	21.91	37.99*	0.04
Parental presence at bedtime	97.80	99.56	51.00*	0.05
Sleep problems	19.61	53.28	399.90*	0.14

\**P* < 0.001.

countries/regions, significantly more children in Japan (7.2%) slept in their own room compared with only 3% of children in other Asian countries/regions. Furthermore, significantly fewer parents reported that their child had a sleep problem in Japan (19.6%) compared with other countries/regions (53.3%). Parents in Japan, however, were more likely to report difficulties at bedtime. Interestingly, more parents in Japan reported having a consistent bedtime routine for their child.

Age-related data regarding sleep patterns are summarized in Table 4. As expected, total sleep time and daytime sleep decreased with age in both Japan and other Asian countries/regions. Several other findings of interest emerged when specific age groups were examined more closely. For example, the average total sleep time of 0–2-month-olds in Japan was similar to that in other Asian countries/regions, and then became shorter in all other age groups. Similarly, the duration of daytime sleep in 0–2-month-olds in Japan (5.46 h) was similar to that in other Asian countries/regions (5.44 h), but became significantly shorter in all other age groups. The longest duration of night-time sleep was reported in 24–36-month-olds in Japan, and in 12–23-month-olds in the other Asian countries/regions.

Another interesting interaction effect was found for bedtime. Bedtime became earlier in Japan with age, whereas it was the earliest in the group of 3–11-month-olds in the other Asian countries/regions. Furthermore, with age, morning wake time showed no marked changes in Japan, whereas it became substantially later in the other Asian countries/regions. Finally, the number of night wakings in Japan was lower in all age groups. Night wakings were most prevalent in 3–11-month-olds in Japan, whereas night waking decreased gradually with age in the other Asian countries/regions.

Table 5 lists age-related changes of parental perceptions of sleep. No marked differences were found in patterns of age-related changes between Japan and the other Asian countries/regions.

## Discussion

The current study focused on the unique sleep characteristics of young children in Japan in comparison with the other Asian countries/regions. Overall, young children in Japan were found to have less sleep overall than young children in other Asian countries/regions, by almost 45 min (0.78 h). In addition, parents

in Japan were less likely to perceive that their child had a sleep problem, although there was increased perception of bedtime difficulties.

There are several possible causes for the observed shorter total sleep time in children from Japan. One possibility is a later bedtime, given that several studies have indicated that children with later bedtimes tend to have less sleep than those who go to bed earlier.<sup>3,4,8</sup> The present study, however, did not find a particularly late bedtime in Japan relative to other Asian countries, which may be the result of a nationwide education campaign in Japan.<sup>27</sup> This campaign, which began in 2002, encouraged children to go to bed early at night, wake up early in the morning, and eat breakfast. This campaign is consistent not only with a famous 1735 saying by Benjamin Franklin, "Early to bed and early to rise, makes a man healthy, wealthy, and wise,"<sup>28</sup> but also recent findings of the importance of "sleep health" practices that are consistent with naturally occurring circadian rhythms.<sup>29,30</sup> In 2006, this promotional campaign was supported by the Japanese Ministry of Education, Culture, Sports, Science and Technology. The results of this nationwide educational effort may have played a role in the transition to earlier bedtimes reflected by the current results, given that earlier studies noted much later bedtimes in children in Japan.<sup>2-4</sup>

Another possibility is that within this age group, when young children are still commonly taking daytime naps, differences in sleep may not be manifested solely in bedtime and night-time sleep, but may be reflected to a greater extent in differences in daytime sleep. As noted, young children in Japan have significantly less sleep during the day. Interestingly, this difference in daytime sleep was not evident in newborns (0–2-month-olds), but began after 3 months of age. Previously we reported that the average duration of daytime sleep in newborns exceeded 5 h across all countries/regions, encompassing both predominantly Asian and predominantly Caucasian countries/regions.<sup>10</sup> Thus, daytime sleep >5 h might be a universal requirement for youngsters between 0 and 2 months of age, and sleep patterns in these very young children may be biologically driven. In contrast, the relatively short duration of daytime sleep in Japan in children after the age of 3 months might be due to cultural influences. Although a siesta or daytime nap is common in some cultures, even in adults,<sup>31</sup> contemporary Japanese culture does not encourage napping. This attitude could explain the comparatively short

**Table 4** Age-related changes of sleep variables

Countries/areas Sleep variables	0-2 months		3-11 months		12-23 months		24-36 months		Fa	Fb	Fc
	Japan	Other Asian countries	Japan	Other Asian countries	Japan	Other Asian countries	Japan	Other Asian countries			
Bedtime (Time in h)	21.82	21.64	21.40	21.27	21.26	21.45	21.22	21.67	3.19	0.86	9.72*
SD	1.81	1.58	1.28	1.38	1.01	1.12	0.91	1.04			
No. wakings	1.71	2.59	1.89	2.03	1.31	1.59	0.74	1.11	117.32*	20.29*	2.37
SD	0.91	1.48	1.34	1.40	1.27	1.26	0.93	1.07			
Nightwaking duration (h)	0.56	1.22	0.46	0.61	0.29	0.42	0.15	0.33	35.25*	27.34*	2.23
SD	0.47	1.11	0.49	0.81	0.44	0.67	0.27	0.63			
Longest sleep (h)	6.54	4.74	6.92	6.53	8.01	7.69	9.32	8.30	107.04*	19.18*	4.60
SD	1.89	2.40	2.78	2.88	2.96	2.88	2.34	2.68			
Night-time sleep (h)	9.21	8.32	9.03	9.17	9.52	9.33	9.61	9.27	13.68*	9.24	5.77*
SD	1.75	2.22	1.35	1.58	0.94	1.29	0.90	1.28			
No. naps	3.07	3.61	2.24	2.79	1.29	1.10	0.97	1.18	502.77*	37.13*	6.19*
SD	1.07	1.37	0.80	1.30	0.55	0.80	0.47	0.71			
Daytime sleep (h)	5.46	5.44	2.94	3.53	2.13	2.76	1.61	2.41	165.19*	18.92*	1.85
SD	1.97	2.49	1.54	1.69	0.97	1.32	0.79	1.45			
Wake time (Time in h)	7.14	6.54	7.05	6.83	7.16	7.28	7.18	7.48	18.93*	1.33	9.42*
SD	1.50	1.46	1.11	1.26	0.94	1.20	0.86	1.12			
Total sleep time (h)	14.68	13.76	11.97	12.70	11.65	12.08	11.22	11.68	54.13*	1.34	3.19
SD	2.33	3.49	1.93	2.21	1.27	1.74	0.98	1.83			

\* $P < 0.001$ .

Fa, F(main effect age); Fb, F(main effect group); Fc, F(interaction of age group).

**Table 5** Age-related changes of parent perception (%)

	0-2 months		3-11 months		12-23 months		24-36 months		$\chi^2$
	Japan	Other Asian countries	Japan	Other Asian countries	Japan	Other Asian countries	Japan	Other Asian countries	
Sleep problem	7.14	53.37	11.95	56.60	129.50*	21.38	54.66	138.04*	100.71*
Regular bedtime routine <sup>†</sup>	57.14	43.57	5.84	61.77	25.38*	75.98	64.07	39.20*	45.02*
Difficult bedtime	42.85	27.65	4.24	28.06	22.73	9.61	20.83	18.14	27.92
Sleep latency >30 min	35.71	22.19	6.41	15.40	6.71	22.37	18.96	4.35	23.43
Parent present at bedtime	100.00	99.60	0.06	99.69	2.36	96.68	99.55	41.69*	97.87
Parents bed	78.57	48.43	5.04	53.39	1.67	72.37	68.99	1.56	77.78
Parents room	100.00	85.61	2.35	86.88	0.00	87.83	86.24	0.62	88.59
Own room	0.00	9.59	1.48	6.90	4.72	2.30	7.27	10.93*	6.83

\* $P < 0.001$ .

<sup>†</sup> $\geq 5$  nights/week.

duration of naps in Japan, but a definitive explanation for this finding (short daytime sleep) is yet to be established.

In addition to the finding of shorter total sleep, the prevalence of parent-reported sleep problems was lower in Japan (19.6%) than in most of the other Asian countries/regions (excluding Thailand [10.8%] and Vietnam [10.1%]<sup>10</sup>). This perception by parents may reflect our finding that youngsters in Japan exhibited longer consolidated sleep duration and decreased night-wakings than other Asian countries/regions (Table 2). Thus, not only may shorter sleep duration during the day produce greater physiological pressure to sleep, leading to increased sleep consolidation, but may also explain the lower incidence of parental complaints related to their children's sleep. An alternative explanation is that there are culturally based factors contributing to parent perception, leading to fewer parents in Japan reporting that their child has a sleep problem. Neither of these possibilities, however, would explain the higher rate of parent-reported difficulty at bedtime. It is interesting that parental concerns regarding sleep in Japan are predominantly related to bedtime, rather than regarding their children's sleep overall.

A consistent bedtime routine has been reported as efficacious in reducing bedtime difficulties.<sup>32</sup> As previously reported in 1999, bedtime routines were reported in 62.4% of young children aged 19–27 months (mean, 21.6 ± 1.0 months).<sup>3</sup> Accordingly, in the present study, parents in Japan reported a high rate of instituting a consistent bedtime routine, and were more likely to have such a routine than in the other Asian countries/regions studied. In contrast, however, parents in Japan also reported more difficulties at bedtime, which may reflect differing cultural expectations, as discussed in the previous section.

In terms of sleep settings, children in Japan were less likely to sleep in a separate room than those in most other Asian countries/regions. The proportion of children sleeping in their own rooms, however, was extremely low in both Japan and in the other Asian countries/regions (2.98% vs 7.20%). This finding is likely to reflect both the housing situation in Asia, as well as long-standing Asian cultural practices of parents co-sleeping with young children. Furthermore, in Asian countries, including Japan, more than 97.5% of parents are present at bedtime while their child is falling asleep. Although co-sleeping has been found to be associated with poorer sleep, including going to bed more than 1 h later, waking almost twice as much at night, and obtaining less sleep at night and overall,<sup>11</sup> it appears that the mechanism for this relationship is parental presence at bedtime, rather than co-sleeping per se. It should be noted that previous reports have pointed out the benefits of co-sleeping,<sup>33,34</sup> and thus educational efforts are needed to maximize sleep for families who choose to co-sleep. Education about safe co-sleeping practices also needs to be addressed, given that bed sharing is a risk factor for sudden infant death syndrome.<sup>35</sup>

There were a number of limitations to this study. First, information regarding physical activity,<sup>36</sup> timing of meals,<sup>37,38</sup> and media exposure<sup>39</sup> of youngsters and parents was not collected. These issues are known to affect sleep and circadian rhythms, and may contribute to the differences found between Japan and other Asian countries. Low amounts of physical activity, irregular meal

practices, and extreme media exposure of not only youngsters, but also parents, could have produced irregular daily rhythms, leading to the observed differences in perception of bedtime difficulty and decreased daytime sleep. Further studies are needed to clarify the contribution of these and similar factors underlying the present results. Another inherent limitation of the present study was that it is an Internet-based study, which resulted in a sample of parents of higher socioeconomic status. Thus, the results may not be representative of all families in Japan and in the other Asian countries. In addition, parents who were more concerned about sleep issues may have been more likely to respond. These potential biases, however, were true for all participants from all countries/regions.

### Conclusion

Overall, the present study found that young children in Japan obtain less overall sleep, primarily due to differences in daytime sleep, than those from other Asian countries/regions. Educational efforts regarding the importance of sleep and healthy sleep practices need to continue in Japan. These efforts need to not only target families, but also health-care providers and society at large.

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### References

- 1 Siegel JM. Do all animals sleep? *Trends Neurosci.* 2008; **31**: 208–13.
- 2 Kawai H. Investigation on the health of young children in 2000. *J. Child Health* 2000; **60**: 543–87 (in Japanese).
- 3 Kohyama J, Shiiki T, Hasegawa T. Sleep duration of young children is affected by nocturnal sleep onset time. *Pediatr. Int.* 2000; **42**: 589–91.
- 4 Kohyama J, Shiiki T, Ohinata-Sugimoto J, Hasegawa T. Potentially harmful sleep habits of 3-year-old children in Japan. *J. Dev. Behav. Pediatr.* 2002; **23**: 67–70.
- 5 Mantz J, Muzet A. Sleep of the three-year-old child: A survey at school. *Arch. Fr. Pediatr.* 1991; **48**: 19–24.
- 6 Ottaviano S, Giannotti F, Cortesi F *et al.* Sleep characteristics in healthy children from birth to 6 years of age in the urban area of Rome. *Sleep* 1996; **19**: 1–3.
- 7 Dahl RE, Scher MS, Williamson DE, Robles N, Day N. A longitudinal study of prenatal marijuana use: Effects on sleep and arousal at age 3 years. *Arch. Pediatr. Adolesc. Med.* 1995; **149**: 145–50.
- 8 Mindell JA, Meltzer LJ, Carskadon MA, Chervin R. Developmental aspects of sleep hygiene: Findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep Med.* 2009; **10**: 771–9.
- 9 Sadeh A, Mindell JA, Luedtke K, Wiegand B. Sleep and sleep ecology in the first three years. *J. Sleep Res.* 2009; **18**: 60–73.
- 10 Mindell JA, Sadeh A, Wiegand B, How TH, Goh DY. Cross-cultural differences in infant and toddler sleep. *Sleep Med.* 2010; **11**: 274–80.
- 11 Mindell JA, Sadeh A, Kohyama J, How TH. Parental behaviors and sleep outcomes in infants and toddlers: A cross-cultural comparison. *Sleep Med.* 2010; **11**: 393–9.

- 12 Araki A, Ohinata J, Suzuki N *et al.* Questionnaire survey on sleep habit of 3-year-old children in Asahikawa city. *No To Hattatsu* 2008; **40**: 370–74 (in Japanese).
- 13 Jiang F, Shen X, Yan C *et al.* Epidemiological study of sleep characteristics in Chinese children 1–23 months of age. *Pediatr. Int.* 2007; **49**: 811–16.
- 14 Chou Y. Survey of sleep in infants and young children in northern Taiwan. *Sleep Biol. Rhythms.* 2007; **5**: 40–49.
- 15 Latz S, Wolf AW, Lozoff B. Cosleeping in context: Sleep practices and problems in young children in Japan and the United States. *Arch. Pediatr. Adolesc. Med.* 1999; **153**: 339–46.
- 16 Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. *Child Dev.* 1998; **69**: 875–87.
- 17 Randazzo AC, Muehlbach MJ, Schweitzer PK, Walsh JK. Cognitive function following acute sleep restriction in children ages 10–14. *Sleep* 1998; **21**: 861–8.
- 18 Teixeira LR, Lowden A, Turte SL *et al.* Sleep and sleepiness among working and non-working high school evening students. *Chronobiol. Int.* 2007; **24**: 99–113.
- 19 Ohayon MM, Vecchierini MF. Normative sleep data, cognitive function and daily living activities in older adults in the community. *Sleep* 2005; **28**: 981–9.
- 20 Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. *Lancet* 1999; **354**: 1435–9.
- 21 Spiegel K, Knutson K, Leproult R, Tasali E, Van Cauter E. Sleep loss: A novel risk factor for insulin resistance and type 2 diabetes. *J. Appl. Physiol.* 2005; **99**: 2008–19.
- 22 Taheri S. The link between short sleep duration and obesity: We should recommend more sleep to prevent obesity. *Arch. Dis. Child.* 2006; **91**: 881–4.
- 23 Dinges DF, Pack F, Williams K *et al.* Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4–5 hours per night. *Sleep* 1997; **20**: 267–77.
- 24 Sadeh A. Consequences of sleep loss or sleep disruption in children. *Sleep Med. Clin.* 2007; **2**: 513–20.
- 25 O'Brien LM, Gozal D. Neurocognitive dysfunction and sleep in children: From human to rodent. *Pediatr. Clin. North Am.* 2004; **51**: 187–202.
- 26 Sadeh A. A brief screening questionnaire for infant sleep problems: Validation and findings for an Internet sample. *Pediatrics* 2004; **113**: e570–7.
- 27 Hoshino K, Kohyama J, Suzuki M. Kodomo no hayaoki wo susumeru kai. [Accessed 13 May 2010.] Available from URL: <http://www.hayaoki.jp> (in Japanese).
- 28 Franklin B. *Poor Richard's Almanack*. B. Franklin and D. Hall, Philadelphia, PA, 1735.
- 29 Kohyama J. A newly proposed disease condition produced by light exposure during night: Asynchronization. *Brain Dev.* 2009; **31**: 255–73.
- 30 American Academy of Sleep Medicine. *The International Classification of Sleep Disorder*, 2nd edn. American Academy of Sleep Medicine, Westchester, IL, 2005.
- 31 Valencia-Flores M, Castaño VA, Campos RM *et al.* The siesta culture concept is not supported by the sleep habits of urban Mexican students. *J. Sleep Res.* 1998; **7**: 21–9.
- 32 Mindell JA, Telofski LS, Wiegand B, Kurtz ES. A nightly bedtime routine: Impact on sleep in young children and maternal mood. *Sleep* 2009; **32**: 599–606.
- 33 Buswell SD, Spatz DL. Parent-infant co-sleeping and its relationship to breastfeeding. *J. Pediatr. Health Care* 2007; **21**: 22–8.
- 34 Lozoff B. Culture and family: Influence on childhood sleep practice and problems. In: Ferber R, Kryger M (eds). *Principles and Practice of Sleep Medicine in the Child*. WB Saunders, Philadelphia, PA, 1995; 69–73.
- 35 Ostfeld BM, Esposito L, Perl H, Hegyi T. Concurrent risks in sudden infant death syndrome. *Pediatrics.* 2010; **125**: 447–53.
- 36 Nixon GM, Thompson JM, Han DY *et al.* Falling asleep: The determinants of sleep latency. *Arch. Dis. Child.* 2009; **94**: 686–9.
- 37 Mistlberger RE, Rusak B. Circadian rhythms in mammals: Formal properties and environmental influences. In: Kryger MH, Roth T, Dement WC (eds). *Principles and Practice of Sleep Medicine*. Elsevier Saunders, Philadelphia, PA, 2005; 321–34.
- 38 Mieda M, Williams SC, Richardson JA, Tanaka K, Yanagisawa M. The dorsomedial hypothalamic nucleus as a putative food entrainable circadian pacemaker. *Proc. Natl Acad. Sci. USA* 2006; **103**: 12 150–55.
- 39 Hancox RJ, Milne BJ, Poulton R. Association between child and adolescent television viewing and adult health: A longitudinal birth cohort study. *Lancet* 2004; **364**: 257–62.