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Original Article

Cross-cultural differences in the sleep of preschool children

Jodi A. Mindell [a,*], Avi Sadeh [b], Robert Kwon [c], Daniel Y.T. Goh [d]

[a] The Children's Hospital of Philadelphia, Saint Joseph's University, United States
[b] The School of Psychological Sciences, Tel Aviv University, Israel
[c] Johnson & Johnson Asia Pacific, Division of Johnson & Johnson Pte. Ltd, Singapore
[d] National University of Singapore, Singapore

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ABSTRACT

Background: The aim of our study was to characterize cross-cultural sleep patterns and sleep problems in a large sample of preschool children ages 3–6 years in multiple predominantly Asian (P-A) and predominantly Caucasian (P-C) countries/regions.
Methods: Parents of 2590 preschool-aged children (P-A countries/regions: China, Hong Kong, India, Japan, Korea, Malaysia, Philippines, Singapore, Thailand; P-C countries: Australia-New Zealand, Canada, United Kingdom, United States) completed an Internet-based expanded version of the Brief Child Sleep Questionnaire (BCSQ).
Results: Overall, children from P-A countries had significantly later bedtimes, shorter nighttime sleep, and increased parental perception of sleep problems compared with those from P-C countries. Bedtimes varied from as early as 7:43 pm in Australia and New Zealand to as late as 10:26 pm in India, a span of almost 3 h. There also were significant differences in daytime sleep with the majority of children in P-A countries continuing to nap, resulting in no differences in 24-h total sleep times (TST) across culture and minimal differences across specific countries. Bed sharing and room sharing are common in P-A countries, with no change across the preschool years. There also were a significant percentage of parents who perceived that their child had a sleep problem (15% in Korea to 44% in China).
Conclusions: Overall, our results indicate significant cross-cultural differences in sleep patterns, sleeping arrangements, and parent-reported sleep problems in preschool-aged children. Further studies are needed to understand the underlying bases for these differences and especially for contributors to parents' perceptions of sleep problems.

1. Introduction

Research on sleep in young children has primarily focused on the first 3 years of life, especially as this is a period of rapid changes [1]. In addition, sleep problems often are a major concern for parents and professionals, especially in the first 3 years [2,3], but studies indicate that parents continue to have considerable concerns about their child's sleep past this initial period. For example, a study in China of young children ages 4–6 years found that 39% had difficulties initiating sleep and that almost 30% experienced fatigue [4]. Furthermore, we know that sleep is determined by both biologic and cultural determinants, and it is the interaction between these 2 factors that affect the establishment of behavioral and developmental norms [5]. Thus sleep expectations and perceptions of sleep problems by both parents and healthcare providers are influenced by cultural norms.

To our knowledge, there have been no cross-cultural studies conducted on sleep patterns or sleep problems in preschool-aged children to date [6,7]. Studies that have been conducted in this age group are country-specific, including studies in the United States [8], Singapore [9], Japan [10], and Taiwan [11], which do not enable cross-cultural comparisons. However, we found significant cross-cultural differences in a previous study of sleep patterns and sleep problems in infants and toddlers [12]. In this study of almost 30,000 young children (birth to age 3 years), children from predominantly Asian (P-A) countries/regions had significantly later bedtimes, shorter total sleep times (TST), and increased parental perception of sleep problems than children from predominantly Caucasian (P-C) countries/regions [12]. We also found that parents from P-A countries were significantly more likely to identify a sleep problem in their children (26% vs 52% overall) compared to parents from P-C countries [13]. Finally, whereas infant sleep variables were strong predictors of parental perception of sleep problems in P-C countries, they were significantly less predictive in P-A countries where demographic variables were more likely to play a role.

* Corresponding author. Address: Saint Joseph's University, Department of Psychology, Philadelphia, PA 19131, United States. Tel.: +1 610 660 1806.
E-mail address: jmindell@sju.edu (J.A. Mindell).

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As noted above, it is difficult to compare the results from country-specific studies, as they typically have utilized different age groups, included different questions, and used varied definitions of sleep problems. These differences in methodologies and definitions make it difficult to make conclusions about how sleep varies across countries and cultures and to determine if there are differences in parent-perceived sleep problems. Furthermore, compared to the limited data available on sleep in infants and toddlers, there is even less information on sleep in preschool-aged children, with lack of any data from most countries/regions in the world. As a start to collecting normative data on preschoolers and to begin to identify predictors of parent-perceived sleep problems, our study focused on P-C and P-A countries/regions in North America, the United Kingdom, and Asia–Pacific.

Thus the primary objectives of our study were to (1) characterize sleep patterns, sleep behaviors, and sleep problems in a large sample of preschool-aged children ages 3–6 years in multiple P-A and P-C countries/regions; (2) assess parental perceptions of sleep problems in these young children; and (3) evaluate predictors of parental perceptions of sleep problems in this age group.

2. Methods

2.1. Participants

Mothers of 2590 preschool-aged children (Australia and New Zealand [$n = 286$], Canada [$n = 272$], China [$n = 248$], Hong Kong [$n = 82$], India [$n = 294$], Japan [$n = 148$], South Korea [$n = 312$], Malaysia [$n = 121$], Philippines [$n = 76$], Singapore [$n = 81$], Thailand [$n = 88$], United Kingdom [$n = 298$], and United States [$n = 284$]) participated in our study. Countries or regions were grouped as either P-C ($n = 1139$; Australia, Canada, New Zealand, United Kingdom, and United States) or P-A ($n = 1447$; China, Hong Kong, India, Indonesia, Japan, Korea, Singapore, Malaysia, Philippines, Taiwan, Thailand, and Vietnam). Children's ages ranged from 3 to 6 years, evenly distributed across boys and girls. Data collection in each country/region was terminated when the target sample size was fulfilled.

2.2. Procedure

All participants completed the Brief Child Sleep Questionnaire (BCSQ). The BCSQ is based on the Brief Infant Sleep Questionnaire [11,14]. The questionnaire included specific questions about daytime and nighttime sleep patterns, as well as sleep-related behaviors. Additional age-appropriate questions were added, including sleep-related factors (e.g., daytime sleepiness, sleep terrors), daily screen time (i.e., television viewing, using a computer, playing other electronic games), and daily time spent outdoors. As with the original Brief Infant Sleep Questionnaire, the major sleep variables derived from the BCSQ have been compared to actigraphy with reasonable validity for sleep schedule measures (sleep-onset time, sleep duration) and lower validity for sleep quality variables such as number of night wakings, which often go unnoticed by parents in this age group [15]. The respondents were asked to describe their child's behavior during the last 2 weeks. The questionnaire was translated into each language and back-translated to check for accuracy. All data were collected online. In almost all countries/regions (Australia, China, India, Malaysia, Singapore, Philippines, United Kingdom, and United States), the questionnaire was set as a pop-up screen at a popular parenting Web site (BabyCenter) and invited mothers to complete a sleep survey. In 2 countries (Japan and Korea), recruitment was conducted via e-mail utilizing mailing lists obtained from local marketing firms and online advertising at other parenting sites. Completion of the questionnaire was voluntary and there were no exclusionary criteria. The study was approved by a university-based Institutional Review Board. No identifying information was collected. A few areas offered incentives for completion (e.g., free samples or gift vouchers) and participants were asked to provide their e-mail addresses at the end of the survey if they were interested. The complete sample was collected between February 2011 and March 2012.

In addition to the BCSQ, demographic information was collected, including maternal age, maternal education, and employment status. For quality control, responses were limited to avoid inappropriate or extreme data (e.g., sleep-onset before bedtime, total nighttime sleep of <5 h or >14 h).

2.3. Statistical analyses

Means and frequencies were used for demographic information. Analyses of covariance were used to compare sleep variables across countries, with effect sizes (ES) (partial η^2) reported for all comparisons. A priori analyses of covariance, covarying for sex, maternal age, maternal education, and employment status were then conducted to compare countries that were P-C to P-A. Analyses

Table 1
Participant demographics.

	Total %	Total *n*	P-C %	P-A %	χ^2	Effect size φ
Sex					0.04	.00
Boy	50.0	1293	49.8	50.2		
Girl	50.0	1293	50.2	49.8		
Employment status						
Full time	37.6	972	27.7	45.4	131.06**	.23
Part time	14.3	371	21.6	8.6		
Home/student	48.1	1243	50.7	46.0		
Education					14.92	.08
Elementary school	0.5	12	0.4	0.5		
High school	36.7	949	37.5	36.2		
College	44.8	1159	43.0	46.2		
Postgraduate	18.0	466	19.1	17.1		
Age of respondent, y					119.88**	.22
<25	2.9	74	4.0	2.0		
25–29	17.8	461	14.3	20.6		
30–34	39.2	1014	32.7	44.4		
35–39	29.9	773	33.0	27.4		
⩾40	10.2	264	16.1	5.6		

Abbreviations: P-C, predominantly Caucasian; P-A, predominantly Asian; y, year.
*$P < .001$.
** $P < .0001$.

were performed on continuous variables, including bedtime, sleep-onset latency (SOL), duration and number of night wakings, nighttime sleep, wake time, daytime sleep (naps), and TST across 24 h. The χ^2 analyses were used for categorical variables, including parent-perceived sleep problems, sleep-specific problems, and daytime functioning (i.e., daytime sleepiness, daytime behavioral difficulties). ES reported for χ^2 analyses are phi (ϕ). Stepwise logistic regression analyses and Spearman rank correlations were used to assess the prediction of parental definition of poor sleep. Predictors included reported child sleep measures (daytime sleep duration, bedtime, SOL, night sleep duration, number of night wakings, number of naps, total nap duration, morning wake time) and background measures (number of children in the family, maternal age, education, and employment status). Pearson product moment correlation coefficients were conducted to assess relationships between screen time and time spent outdoors with sleep variables. Missing data were handled using pairwise deletion. Because of the large cohort size and the multiple analyses, findings were considered significant at $P < .001$.

3. Results

3.1. Demographics

Complete demographic data for the entire sample and within P-A and P-C groups are provided in Table 1. Overall, there were equal boys (50.0%) and girls (50.0%) ($\chi^2 = 0.04$; $P = .84$). The majority of respondents (69.1%) were between the ages of 30 and 39 years; most of the respondents had a college degree (62.8%) and almost half were not employed outside of the home (48.1%). There were significant differences between P-A and P-C for age of respondent and employment status, with mothers in P-A countries/regions more likely to be younger and employed fulltime. However, there were no significant differences for education level between the 2 groups.

3.2. Sleep patterns

Data on nighttime (Table 2) and daytime sleep (Table 3) are presented for each country or region. All sleep measures significantly

Table 2
Nighttime sleep variables across country.

Country or region	Bedtime		Sleep-onset latency		Number of wakings		Duration of wakings		Wake time		Nighttime sleep	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Australia/New Zealand	7.83	0.78	19.24	14.74	1.53	0.76	7.35	18.60	6.95	0.71	10.73	0.87
Canada	8.38	0.93	19.17	14.35	1.60	0.78	7.12	14.19	7.28	0.82	10.45	0.96
China	9.65	0.81	18.14	12.51	1.62	0.81	7.46	24.63	7.36	0.90	9.47	0.99
Hong Kong	10.18	0.71	22.83	13.17	1.53	0.57	5.75	11.11	7.87	0.99	9.41	1.11
India	10.44	1.02	22.10	12.15	1.69	0.87	11.41	32.34	7.67	1.03	8.96	1.10
Japan	9.08	0.83	14.64	11.03	1.31	0.56	4.53	15.66	7.32	0.76	10.04	0.90
Korea	9.91	1.05	21.66	14.20	1.85	0.96	14.42	32.22	7.98	0.94	9.69	1.02
Malaysia	10.17	1.18	24.44	16.58	1.60	0.88	10.06	30.36	7.63	1.05	9.11	1.23
Philippines	9.99	1.26	29.56	21.75	1.63	0.83	6.92	19.45	7.91	1.53	9.57	1.22
Singapore	9.77	1.01	21.27	12.62	1.57	0.79	5.00	11.45	7.59	0.83	9.25	1.15
Thailand	8.97	0.96	24.91	12.71	1.83	0.90	15.12	36.94	6.88	0.79	9.35	1.08
United Kingdom	7.71	0.64	16.42	11.21	1.60	0.91	8.02	19.14	7.02	0.65	10.88	0.96
United States	8.63	1.01	21.46	15.21	1.64	0.83	6.36	12.91	7.28	1.00	10.16	1.09
Total	9.10	1.33	20.31	14.11	1.63	0.84	8.71	23.48	7.40	0.96	9.93	1.22
ANCOVA	216.16**		9.91**		4.49**		3.55**		32.13**		75.64**	
Effect size	.50		.04		.02		.02		.13		.26	

Abbreviations: SD, standard deviation; ANCOVA, analysis of covariance.
* $P < .001$.
** $P < .0001$.

Table 3
Daytime sleep across country.

Country/region	Number of naps		Daytime sleep		Total sleep time	
	Mean	SD	Mean	SD	Mean	SD
Australia/New Zealand	1.28	0.44	0.43	0.72	11.16	1.04
Canada	1.37	0.49	0.62	0.90	11.07	1.12
China	1.95	0.46	1.84	0.88	11.31	1.19
Hong Kong	2.00	0.67	1.73	0.97	11.14	1.02
India	1.92	0.75	1.75	1.34	10.71	1.41
Japan	1.46	0.63	0.70	0.91	10.74	0.94
Korea	2.06	1.21	1.46	1.50	11.14	1.55
Malaysia	2.00	0.86	1.73	1.09	10.83	1.39
Philippines	2.02	0.66	2.08	1.16	11.65	1.28
Singapore	1.88	0.49	1.67	0.82	10.92	1.10
Thailand	2.06	0.59	1.68	0.87	11.03	1.39
United Kingdom	1.14	0.36	0.17	0.43	11.04	0.98
United States	1.48	0.61	0.80	0.97	10.92	1.19
Total	1.66	0.77	1.11	1.20	11.04	1.23
ANCOVA	51.02**		72.61**		5.73**	
Effect size	.19		.26		.03	

Abbreviations: SD, standard deviation; ANCOVA, analysis of covariance.
* $P < .001$.
** $P < .0001$.

differed across country or region. Comparisons for all variables also were significant between P-C and P-A, except for 24-h TST (Table 4). Overall, young children in P-A had later bedtimes, longer SOL, later wake times, and less nighttime sleep. No differences in night wakings were found. Daytime sleep also was different, with children in P-A taking more naps and for longer during the day. Interestingly, this significance resulted in no differences in TST across the 24 h between P-C and P-A.

There were significant differences in the prevalence of napping overall between P-C (29.1%) and P-A (76.8%) ($\chi^2 = 577.89$; $P < .0001$ [phi = .48]). In looking at trajectories across age (Fig. 1), the majority of P-C children stopped napping by the end of the preschool period (3 y, 44.3%; 4 y, 23.5%; 5 y, 6.8%). In contrast, P-A children continued to nap throughout the preschool period (3 y, 86.9%; 4 y, 75.4%; 5 y, 60.7%).

An investigation to determine if other significant changes in sleep occurred over the preschool years only yielded differences for 24-h sleep, with significant decreases in 24-h sleep from 3 years (mean, 11.32 h; standard deviation [SD], 1.22) to 4 years (mean, 10.94 h; SD, 1.16) to 5 years of age (mean, 10.64 h; SD, 1.26)($F[2,2543] = 61.94$; $P < .001$; ES, .05). There was no significant interaction between age and culture.

Furthermore, we examined the impact of having a daycare or school arrangement outside of home on sleep patterns. Daycare or school arrangement was reported in 38.32% of the children. We performed multivariate analysis of variance with control for age of the child and yes or no for daycare arrangement with the sleep variables as the dependent variables. This analysis revealed that children with such arrangement went to sleep significantly earlier (bedtime, 8.96 ± 1.27 vs 9.32 ± 1.40; $F = 39{,}94$; $P < .0001$) and woke up earlier (wake time, 7.26±.82 vs 7.63 ± 1.11; $F = 65.22$; $P < .0001$) compared to children with no daycare or school arrangement. No other significant effects of daycare or school arrangement on sleep were found.

3.3. Sleep setting

As expected, there were significant differences in sleep setting for the preschoolers across country/region (Table 5) and culture

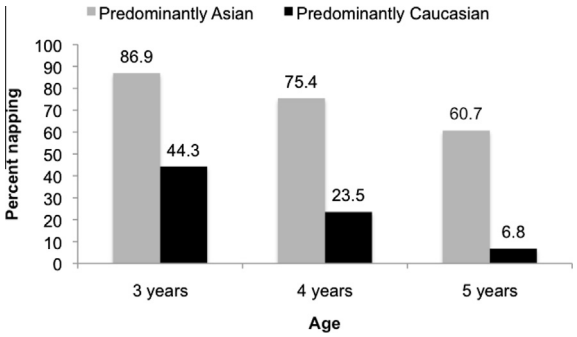

Fig. 1. Percent napping across age by culture.

(Table 4). Preschoolers in P-A countries were significantly more likely to sleep in their parents' room and sleep in their parents' bed. Children were less likely to bed share in all countries than to room share. In both cultures, the prevalence of room sharing and bed sharing was stable across the preschool years. Additional analyses of variance covarying for sleep proximity (room sharing and bed sharing) were calculated comparing all sleep pattern variables between P-C and P-A. All significant differences were maintained at $P < .001$, except that SOL was no longer statistically significant.

3.4. Sleep problems

In addition to significant differences in sleep patterns, there also were significant country- or region-based differences in sleep problems (Table 5). Parents' perception of their child experiencing a sleep problem ranged from 15.1% in Korea to 43.7% in China. Overall, parents from P-A countries/regions were more likely to view their child as having a sleep problem (24.2% vs 18.4%). Minimal differences were seen in parental report of specific sleep problems, though P-A parents were less likely to report nightmares. The most commonly reported specific sleep problem was bruxism in

Table 4
Sleep measures of predominantly Caucasian and predominantly Asian countries/regions.

	P-C		P-A			
	Mean	SD	Mean	SD	ANCOVA	ES
Bedtime	8.15	0.93	9.85	1.07	1755.43**	.41
SOL	19.12	14.05	21.25	14.06	14.18**	.01
NW times	1.59	0.83	1.66	0.85	3.36	–
NW duration	7.19	16.48	9.90	27.71	8.21	–
Wake time	7.12	0.81	7.62	1.02	175.88**	.06
TST night	10.54	1.01	9.44	1.12	653.24**	.21
Naps number	1.32	0.50	1.93	0.82	465.83**	.15
TST/d	0.52	0.82	1.58	1.22	620.96**	.20
24-h sleep	11.06	1.08	11.03	1.34	.39	–
	Percent		Percent		χ^2	ES ϕ
Sleep problem	18.4		24.2		12.42**	.07
Own room	79.5		10.1		1271.62**	.70
Bedtime routine	87.3		62.2		204.41**	.28
Own bed	90.6		28.1		1008.00**	.62
Sleep terrors	5.0		2.6		10.17	.06
Nightmares	7.0		2.4		31.76**	.11
Bruxism	11.8		10.7		.79	–
Growing pains	5.4		3.7		3.92	–
Daytime sleepiness	12.6		9.5		5.96	–
Daytime behavior problems	8.2		15.4		31.27**	.11

Abbreviations: P-C, predominantly Caucasian; P-A, predominantly Asian; SD, standard deviation; ANCOVA, analysis of covariance; SOL, sleep-onset latency; NA, night awakenings; TST, total sleep time; d, day; h, hour; ES, effect size.
All results except for SOL remained significant at $P < .001$ with sleep proximity as a covariate.
* $P < .001$.
** $P < .0001$.

Table 5
Parent perception of sleep problems and prevalence of sleep-specific problems (%).

Country/ region	Sleep problem	Bedtime routine	Own room	Own bed	Sleep terrors	Nightmares	Bruxism	Growing pains	Daytime sleepiness	Daytime behavior
Australia/New Zealand	17.8	89.5	81.1	92.0	6.6	8.4	10.8	5.9	12.6	6.3
Canada	19.5	85.7	82.4	89.7	5.1	6.6	13.2	4.4	7.4	9.9
China	43.7	60.3	6.9	21.9	2.0	1.6	8.9	0.8	2.4	17.8
Hong Kong	31.7	80.5	31.7	14.4	0.0	0.0	8.5	0.0	0.0	11.0
India	19.2	54.5	2.4	14.4	1.7	0.7	6.6	9.7	11.7	19.9
Japan	14.9	81.1	1.4	16.9	0.0	0.7	13.5	2.0	10.1	3.4
Korea	15.1	55.4	13.1	28.8	3.5	6.4	11.2	5.8	12.5	11.9
Malaysia	27.3	62.0	13.2	48.8	6.6	3.3	15.7	1.7	15.7	22.3
Philippines	23.7	64.5	9.2	18.4	3.9	1.3	19.7	0.0	14.5	18.4
Singapore	24.7	79.0	33.3	60.5	6.2	3.7	9.9	0.0	9.9	14.8
Thailand	22.7	51.1	3.4	27.3	1.1	0.0	10.2	1.1	6.8	19.3
United Kingdom	15.4	91.9	78.5	93.6	3.7	5.0	10.4	6.4	15.1	4.7
United States	21.2	81.6	76.0	86.9	4.6	8.1	12.7	4.6	14.8	12.0
Total	21.7	73.2	40.6	55.6	3.7	4.4	11.1	4.5	10.9	12.2
χ^2	101.84**	288.37**	1324.24**	1138.89**	29.30*	54.98**	19.34	49.24**	49.26**	79.54**
ES (ϕ)	.20	.33	.72	.66	.11	.15	–	.14	.14	.18

Abbreviation: ES, effect size.
Sleep problems: prevalence includes small problems to serious problems.
All other variables: prevalence includes <3 times per week and ⩾3 times per week.
* $P < .001$.
** $P < .0001$.

both regions. Daytime sleepiness (10.9%) and daytime behavioral difficulties (12.2%) were common.

Based on stepwise logistic regressions, the following variables were found as significant predictors of parent-perceived sleep problems: (1) increased number of night wakings (Wald $\chi^2 = 94.4$); (2) increased SOL (Wald $\chi^2 = 88.6$); (3) later bedtime (Wald $\chi^2 = 50.7$); and (4) decreased nighttime sleep duration (Wald $\chi^2 = 11.6$) ($P < .001$ for all). Because none of the nonparametric variables were significant, we used linear regression analyses and Spearman rank correlations to assess the full range of the sleep problem definition in each region. The above 4 variables explained 31.34% of the variance in P-C countries and only 15.02% in the P-A countries. These correlations are presented for each region in Fig. 2.

3.5. Sleep and common activities

Having a consistent bedtime routine was more likely to be reported in P-C (87%) compared to P-A (62%), with significant differences across countries ranging from 51% in Thailand to 92% in the United Kingdom (Tables 4 and 5). The frequency of a nightly bedtime routine was found to be significantly associated with bedtime ($r = -.37$), SOL ($r = -.19$), number of night awakenings ($r = -.19$), duration of night wakings ($r = -.13$), wake time ($r = -.25$), nighttime sleep ($r = .27$), daytime sleep ($r = -.19$), and TST ($r = .08$) ($P < .001$ for all).

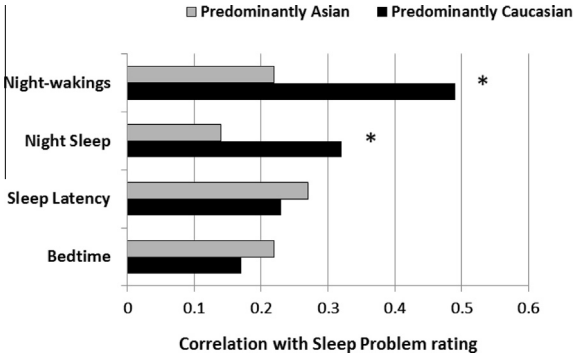

Fig. 2. Spearman rank correlations between predictors and parental definition of a sleep problem. Significant difference between correlations in predominantly Asian and predominantly Caucasian countries, $P < .0001$.

Overall, parents reported daily screen time of 2.35 h (SD, 1.59), with less daily screen time reported in P-C (mean, 2.21 h) than P-A (mean, 2.47 h)($F[1,2583] = 17.06$; $P < .001$; ES, .16). Screen time was found to be significantly associated with bedtime ($r = .21$), SOL ($r = .11$), number of night wakings ($r = .07$), wake time ($r = .19$), and nighttime sleep ($r = .08$)($P < .001$ for all). No significant associations between screen time and duration of night wakings, daytime sleep, TST, or parent perception of sleep problems were found.

Compared to screen time, children were reported to spend more time outdoors daily (mean, 3.13 h, SD, 2.34 h), with P-C (mean, 2.30 h) spending less time outdoors than P-A (mean, 3.79 h) ($F[1,2583] = 286.51$; $P < .001$; ES, .67). Time spent outdoors was only correlated with bedtime ($r = .15$), nighttime sleep ($r = -.11$), and daytime sleep ($r = .10$)($P < .001$).

4. Discussion

To our knowledge, our study is the only large-scale cross-cultural survey of preschool sleep to date and involves a large cohort of P-C and P-A children across 13 countries/regions. The most striking results of our study were the vast differences in bedtimes and daytime sleep across countries/regions, with almost no differences in TST across 24 h. Across all countries/regions, bedtime varied from as early as 7:43 pm in Australia and New Zealand to as late as 10:26 pm in India, a span of almost 3 h (163 min). With such varied bedtimes and limited differences in wake times, nighttime sleep also significantly differed by almost 2 h, from a low of 8.96 h in India to a high of 10.88 h in the United Kingdom. However, there were no differences in TST across the 24-h cycle, given that there were such differences in daytime sleep. The majority of children in P-A countries continued to nap throughout the preschool years, from 87% at the age of 3 years to 61% at the age of 5 years, in contrast to only 7% of children in P-C countries who were still napping at the age of 5 years. Thus preschool-aged children in P-C countries were no longer napping, were going to bed early in the evening, and were getting the majority of their sleep at night. In contrast,

preschoolers in P-A continued to nap during the day and went to bed later at night; in addition, their sleep was divided across the day and night. These results are different than what we found in infants and toddlers in similar countries [12]. In that large cross-cultural sample, there were almost no differences in daytime sleep across culture; thus, there were vast differences in TST, as children in P-A countries had later bedtimes and significantly less nighttime sleep with no compensation in wake times or daytime sleep. One possible explanation could be that children's daytime sleep becomes more flexible and modified by cultural influences as they grow from infancy to preschool years. We also found that childcare or school arrangements had minimal impact on sleep patterns in children other than an earlier bedtime and wake time. Such attendance did not impact napping, as might have been expected.

Another interesting finding was that only one other sleep pattern differed across age in addition to changes in daytime sleep. There was a significant decrease in TST, which was universal, from an average of 11.3 h at the age of 3 years to 10.6 h at the age of 5 years (a decrease of 42 min). It should be noted that our finding of an average of 11.04 h of TST across the entire sample was approximately 30 min less than what was reported for 4- to 5-year-old children in a recent meta-analysis [16] of all studies that measured sleep duration. Sleep location continues to highly differ throughout the preschool years, with children in P-A countries more likely to room share and bed share compared to children in P-C countries with almost no change in sleep location across the preschool years in either culture.

Another finding of interest was that parent-defined sleep problems continued to be a universal issue. Parents in all 13 countries/regions reported significant sleep issues, ranging from 15% in Korea to 44% in China. To date, pediatric sleep research has primarily focused on infants and toddlers; however, these results indicate that it is important for researchers and practitioners to consider sleep problems throughout childhood. Similar to our previous results in younger children [13], sleep problems were more likely to be reported by parents from P-A areas (24%) compared to those who live in P-C countries (18%), though the effect size was quite small. Again, there were differences in predictors of parent-perceived sleep problems across culture, which were similar to our previous findings. Overall, night wakings were the predominant predictor of a parent reporting a sleep problem, with SOL, bedtime, and nighttime sleep duration also noted. What is most striking is that sleep variables explain only 31% of the variance in P-C countries and 15% in P-A countries. More research is clearly needed to assess what defines a sleep problem for parents, especially as this is based on parental perception, and this perception may or may not include symptoms of sleep disorders (e.g., sleep-disordered breathing). Research also should consider the contributing factors to these parental perceptions in differing cultures, as clearly this concept is not universal.

Similar to other studies that have investigated the impact of television viewing and computer use on sleep, we found that increased screen time was associated with later bedtimes, longer SOL, and increased number of night wakings. Previous studies have found that media use was associated with sleep problems in children across cultures for all types of media (e.g., television, video games, computers) in all ages including preschoolers [17–19]. However, screen time also was related to later wake times, and thus overall slightly increased nighttime sleep in this sample. As previously postulated, these results are consistent with additional factors that may contribute to the relationship between screen time and sleep including parenting style. The implementation of a consistent bedtime routine, which can be considered part of parenting style, also was associated with earlier bedtimes, SOL, decreased night wakings, and increased nighttime sleep. These results also are consistent with other studies, further indicating the importance of a nightly bedtime routine [20,21].

Finally, as with our previous Internet-based cross-cultural studies, there are a number of limitations that must be considered. First, the cohort in our study was skewed toward higher education; however, this bias is likely consistent across almost all countries, and we believe that we obtained similar segments of the population within each country/region. In addition, these results are likely not representative of all preschoolers within each country. We expect that this sample, similar to our previous samples, represents more urban-based populations, especially in the P-A countries, given the need for Internet access to participate in this survey. However, we do note that our findings are similar to the results of other studies that have utilized traditional surveys in many of the surveyed countries. For example, TST duration in our sample was almost identical to a survey of almost 40,000 children aged 4.5 years in Japan [10]. Similar results were found comparing our findings to studies conducted in Singapore [9]. Finally, although our study was not targeted as such, parents with concerns about their child's sleep may have been more likely to participate; however, it is again expected that these differences are likely consistent across all participants. Finally, as always the reliance on parental reports in assessing sleep in their child has inherent limitations. More objective measurement of sleep (i.e., actigraphy) is warranted in the future to not only decrease reliance on self-report but also to overcome any language or cultural perceptual biases in wording of questions.

It is important to emphasize that the conclusions made in this paper are broad interpretations of cultural differences. The terminology utilized, especially *predominantly Caucasian* and *predominantly Asian,* are simplistic given that there are vast subcultural and ethnic differences within each country and within each culture. Thus individual variability within these regions must be considered when interpreting the applicability of these results to any specific child.

5. Conclusions

Overall, these results indicate significant cross-cultural differences in sleep patterns and sleep problems in preschool-aged children. In our study, preschoolers in P-A countries have later bedtimes, are more likely to bed share and room share, are perceived to have more sleep problems, and continue to nap throughout the preschool years than young children in P-C countries. However, there are no differences in overall sleep. In addition, approximately 20–25% of parents across these parts of the world perceive that their child has a sleep problem, varying from 15% in Korea to 44% in China. These findings indicate that sleep needs to continue to be addressed by healthcare practitioners worldwide beyond the first few years. Our results also indicate that parental concerns about sleep are highly dependent on cultural expectations and norms and should be individually assessed on the basis of the actual sleep difficulties of the child. Finally, further studies are needed to expand our study of young children's sleep to other areas of the world (e.g., Latin America, Europe, Africa).

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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.2013.09.002.

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