



Sleep Patterns among South Korean Infants and Toddlers: Global Comparison

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The purpose of this study was to examine sleep patterns in a large sample of infants and toddlers (ages birth to 36 months) in Korea, and to compare sleep patterns, sleep problems, sleep ecology, and parental behaviors to global sleep data on young children in both predominately Asian (P-A) and predominately Caucasian (P-C) countries/regions. We additionally examined parent and child demographic information, parental behaviors, and aspects of the sleep ecology as predictors of sleep patterns among infants and toddlers in Korea. Parents/caregivers of 1,036 Korean infants and toddlers completed an expanded, internet-based version of the brief infant sleep questionnaire. Consistent with other studies of sleep in early childhood, sleep/wake patterns became increasingly consolidated with older child age for the Korea sample. Compared to both P-A and P-C infants and toddlers, children in Korea had the latest bedtimes, shortest total sleep and daytime sleep durations, and the least frequent rates of napping. Even though half of parents perceive their children's sleep problematic, parental perceptions of severe child sleep problems were the lowest. Within Korea, breastfeeding and bottle-feeding at sleep resumption were associated with increased nocturnal awakenings. Evening television viewing was associated with later bedtimes, which may have implications for sleep hygiene recommendations in clinical practice. The current study provides important information about sleep/wake patterns, parental behaviors, and aspects of the sleep ecology for infants and toddlers for physicians to support healthy sleep in Korea.

Keywords: Infant; Internet; Korea; Parents; Sleep; Survey; Toddlers

INTRODUCTION

Recent international research has shown that sleep patterns and problems during early childhood can vary substantially according to culture and context (1-3). Although maturational processes related to establishing sleep/wake cycles during infancy and toddlerhood are partially biologically- and physiologically-determined, psychosocial factors, including parenting behaviors and aspects of the child's sleep ecology, also influence the development of sleep patterns (4,5). Importantly, psychosocial factors can contribute to both the etiology and maintenance of early childhood sleep problems (2,5-8), which, if untreated, have deleterious effects on subsequent physical and mental health during childhood (9-12). Examining cross-cultural differences in sleep patterns, sleep ecology, and parenting behaviors can provide important information for parents, health providers, and researchers in conceptualizing and effectively addressing sleep problems in infancy and toddlerhood (1,2). For instance, comparisons between young children's sleep habits in predominately Asian versus predominately Caucasian countries/regions revealed that children from predominately Asian contexts had significantly later bedtimes, shorter

sleep duration, and increased room-sharing and parental perceptions of sleep problems (2). However, parental presence and behaviors at bedtime were found to be more strongly predictive of problematic sleep outcomes among children in predominately Caucasian regions (1).

Broad cross-cultural comparisons, such as those between predominately Asian and predominately Caucasian countries/regions, should be supplemented with additional country-specific comparisons given that child sleep patterns and problems may vary both within and across different cultures and contexts. For example, a study that examined young children's sleep patterns in Hong Kong showed that these children had later bedtimes and less total sleep duration compared to children in predominately Caucasian contexts and to children in predominately Asian contexts (9). Falling asleep independently was associated with longer nocturnal sleep duration and fewer nocturnal wakings. Such information is useful for parents and physicians in Hong Kong who are treating common early childhood sleep problems such as frequent night wakings, particularly given that children in Asian regions tend to room-share and are less likely to fall asleep independently (1,2). Similarly, a study examining infant and toddler sleep in Australia and New

Zealand found country-specific differences that have implications for understanding sleep patterns and treating sleep problems in these countries and in comparable contexts (3). Parents in Australia and New Zealand were more likely to encourage young children to self-soothe and to fall asleep independently; these positive parenting practices likely contributed to the longer sleep duration and fewer night wakings found among children in these countries (3). Context-specific studies have also provided normative data on infant and toddler sleep by age (3), which increases within-country/region knowledge of maturational sleep patterns and informs future context-specific research on sleep problems and related interventions.

Few studies have focused on infant and toddler sleep patterns in Korea. One study of 160 Korean infants (birth to 6 months) found decreased sleep duration and increased maternal contact with increasing infant age, although this trend was non-significant (13). A more recent study utilizing the Nursing Child Assessment Sleep/Activity Record in a sample of Korean infants ages birth to 6 months ($n = 94$), provided limited data on average sleep duration, night wakings, and maternal behaviors regarding infant sleep (14). Unfortunately, these and other studies of sleep among young children in Korea have included small samples that are limited in child age and have used a variety of different sleep assessment tools, making it difficult to generalize normative sleep patterns of infants and toddlers in Korea and to compare study findings across samples (15,16).

Accordingly, the purpose of this study was to examine sleep patterns in a large sample of 1,036 Korean infants and toddlers, in order to establish maturational norms on early sleep patterns and problems in this context. We also compared sleep patterns, sleep problems, sleep ecology, and parental behaviors at bedtime among children in Korea to global data from infants and toddlers in both predominately Asian and predominately Caucasian regions/countries, as a method to inform the treatment of early childhood sleep difficulties in Korea. We additionally examined parent and child demographic information, parental behaviors, and aspects of the sleep ecology as predictors of sleep patterns among infants and toddlers in Korea.

MATERIALS AND METHODS

Participants

Data were collected from parents/caregivers (hereafter referred to as "parents") of 1,032 Korean infants and toddlers aged birth to 36 months, who participated in a larger cross-cultural study of infant and toddler sleep (1,2). Participants in the larger study were categorized into predominately Asian (P-A) and predominately Caucasian countries/regions (P-C; Table 1), with each within-country/region sample evenly divided across age, and grouped according to the following categories: 0-2 month olds, 3-5 month olds, 6-8 month olds, 9-11 month olds, 12-17 month

Table 1. Participants categorized into predominately Asian and Predominately Caucasian groups

Countries/regions		No.
Predominately Asian (P-A)		
China	CN	7,505
Hong Kong	HK	1,049
India	IN	3,982
Indonesia	ID	967
Korea	KR	1,036
Japan	JP	872
Malaysia	MY	997
Philippines	PH	1,034
Singapore	SG	1,001
Taiwan	TW	896
Thailand	TH	988
Vietnam	VN	1,000
Predominately Caucasian (P-C)		
Australia	AU	1,073
Canada	CA	501
New Zealand	NZ	1,081
United States	US	4,505
United Kingdom	UK	800

olds, 18-23 month olds, and 24-36 month olds. For this study, data from the Korean group were compared to both the P-A and the P-C groups.

Procedure

Full participant recruitment and data collection procedures for the larger cross-cultural study are described in detail in Mindell et al. (1,2). Briefly, all parents responded to an expanded, Internet-based version of the Brief Infant Sleep Questionnaire (BISQ), which asked parents to complete questions related to their child's daytime and nighttime sleep patterns and sleep-related behaviors over the past two weeks. The survey also contained questions about sleep arrangements (bed- or room-sharing) and bedtime routines. The BISQ has shown strong test-retest reliability, as well as evidence of good convergent validity via intercorrelations with actigraphy and daily sleep logs (17). Further, the BISQ has been found to significantly differentiate between healthy and sleep-disturbed infant populations (17). Parents additionally provided demographic information, including parent age, education, employment status, and child's birth order. In Korea, parents were sent emails inviting them to complete a voluntary internet survey about child sleep. Parents' email addresses were obtained from local marketing firms and advertisers on parenting websites. Parents completed the survey on a free-standing website between September and December 2007, and were not provided any feedback for their survey responses.

Statistical analyses

Demographic information is presented using means and frequencies. For the purposes of this study, we selected seven salient sleep variables and compared these across the Korean,

P-A, and P-C groups. These variables were total sleep time, bedtime, longest sleep episode, nighttime sleep duration, daytime sleep duration, and the frequency and number of nocturnal awakenings. We also compared rates of co-sleeping and parental perceptions of child sleep problems across the Korean, P-A, and P-C groups. Continuous data were analyzed using ANOVA with Duncan post-hoc analyses to examine group differences. A chi-square test was used for categorical variables. We then examined sleep initiation and resumption behaviors in the Korean sample. Finally, we used stepwise regression to assess potential predictors of bedtime, daytime sleep duration, nocturnal sleep duration, nocturnal awakenings, and longest sleep episode in the Korean samples. Predictors included child demographic variables (age, sex, birth order), parental demographic variables (age, educational level, employment status), parental behaviors at bedtime, and other aspects of the sleep ecology (sleep arrangement, location, position, etc.). Given the large sample size and the multiple statistical comparisons, we used an adjusted P value of $P < 0.001$ for statistical significance.

Ethics statement

The study protocol was approved by the institutional review board of Saint Joseph's University (IRB No. 418321). Informed consent was confirmed by the board. Completion of questionnaire was voluntary after checking the consent form online or paper.

RESULTS

Sleep/wake patterns

Demographic information for the Korean sample is shown in Table 2. There were equal numbers of boys (50.8%) and girls (49.2%) across age groups ($\chi^2 = 6.22$, $P = 0.399$). Fig. 1 shows variation in total sleep time, bedtime, longest sleep episode, nighttime sleep duration, daytime sleep duration, and the frequency of nocturnal awakenings by age group in infants and toddlers in Korea. Broadly, these figures show that sleep tends to consolidate with older child age. For instance, daytime sleep duration generally decreases whereas nighttime sleep duration generally increases from infancy to toddlerhood.

Results for analyses comparing these variables across the Korean, P-A, and P-C groups revealed significant group differences for children in Korea across all of the sleep outcomes (Fig. 2). Infants and toddlers in Korea had the shortest total sleep time ($M = 11.89$ hours) relative to infants and toddlers in the P-A ($M = 12.33$) and P-C groups ($M = 13.02$), ($F = 382.15$, $P < 0.001$). Infants and toddlers in Korea also had the latest bedtime ($M = 10:08$ pm), on average, compared to both the P-A ($M = 9:25$ pm) and P-C groups ($M = 8:25$ pm), ($F = 2,245.84$, $P < 0.001$).

Longest sleep episode, nighttime sleep duration, daytime sleep duration, and nap frequency also showed significant vari-

Table 2. Demographic data for participants in Korea

Demographic parameters	Percentage (%)
Child's age, mo	
0-2	4.5
3-5	6.7
6-8	11.9
9-11	10.9
12-17	13.4
18-23	16.0
24-36	36.6
Child's sex	
Girl	49.2
Boy	50.8
Child's birth order	
Oldest child	66.1
Middle child	7.7
Youngest child	23.4
A multiple (e.g., twin or triplet)	1.2
Only child	1.6
Respondent	
Father	4.3
Mother	95.4
Other	0.3
Respondent's education	
College education, college degree, or post-graduate degree	72.3
High school degree or less	19.3
Other	8.3
Respondent's employment	
Employed	26.5
At-home parent, student status, unemployment, other	73.5
Respondent's age range in years	
≤ 24	2.6
25-30	22.8
31-34	56.4
35-39	17.4
≥ 40	0.9

ation across the three groups. The average longest sleep episode for children in Korea was reported at 7.85 hours, which was significantly more than the 7.20 hours for children in other P-A countries/regions, but less than the 8.02 hours for children in P-C countries/regions ($F = 267.73$, $P < 0.001$). A similar pattern emerged for average nighttime sleep duration. Infants and toddlers in Korea obtained an average nighttime sleep duration of 9.42 hours, which was again significantly more than the average of 9.12 hours for children in other P-A countries/regions, but less than the 10.01 hours obtained for children in P-C countries/regions ($F = 149.49$, $P < 0.001$).

Daytime sleep duration was also significantly lower among infants and toddlers in Korea, as they obtained the least amount of daytime sleep among the three groups ($F = 113.27$, $P < 0.001$), at 2.47 hours compared to 3.01 hours for children in P-C countries/regions and 3.15 hours for children in P-A countries/regions. Consistent with this finding, nap frequency was also the lowest among children in Korea, who had an average of 1.64 naps per day. Nap frequency was significantly lower than both the 2.04 naps for children in P-C countries/regions and the 2.08

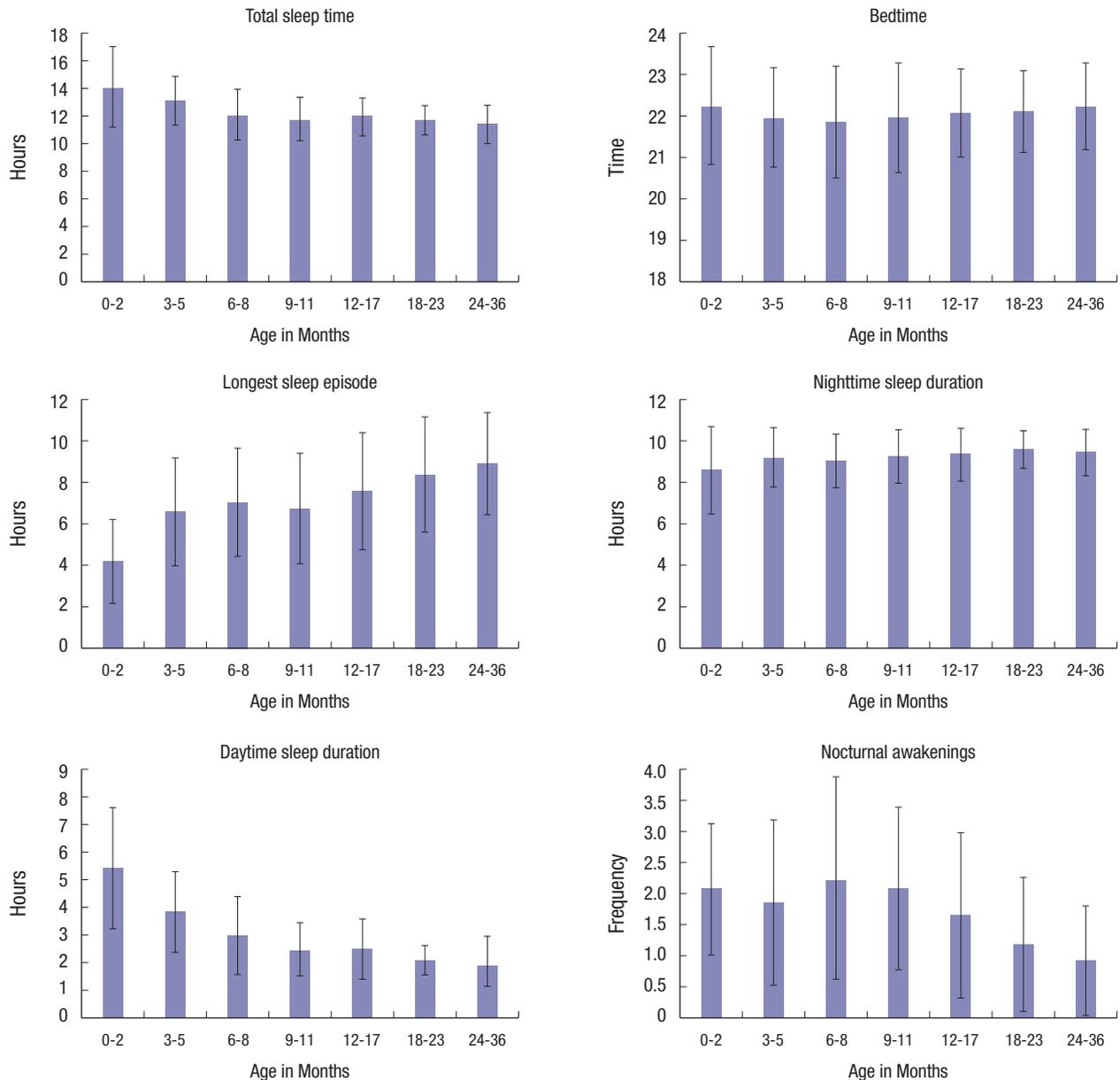


Fig. 1. Sleep variables by age for the Korean samples.

naps for children in P-A countries ($F = 113.27$, $P < 0.001$), although Duncan's post hoc tests showed that nap frequency did not differ between P-C and P-A groups.

Infants and toddlers in Korea additionally showed differences from children in P-A and P-C countries/regions with regard to the frequency and duration of nocturnal awakenings. Children in Korea had an average of 1.49 wakings per night, whereas children in P-A had an average of 1.70 wakings per night and children in P-C had an average of 1.13 wakings per night ($F = 226.60$, $P < 0.001$). Additionally, infants and toddlers in Korea had the shortest duration of nocturnal awakenings ($M = 0.34$ minutes) relative to both P-A ($M = 0.53$ minutes) and P-C regions/countries ($M = 0.41$ minutes, $F = 112.11$, $P < 0.001$).

Room-sharing and bed-sharing

Overall, only 5.5% of infants and toddlers in the Korea sample slept in their own room, whereas 30.6% slept in their parents' room and 63.9% slept in their parents' bed. These estimates of room-sharing and bed-sharing were similar to rates for children in the P-A group, with 6.2% sleeping in their own room, 26.3% sleeping in their parents' room, and 67.5% sleeping in their parents' bed. By contrast, most of the children in the P-C group slept in their own room (66.2%), with 21.3% sleeping in their parents' room and only 12.5% sleeping in their parents' bed. There were significant differences in these rates across the three groups ($\chi^2 = 12,115.56$, $P < 0.001$).

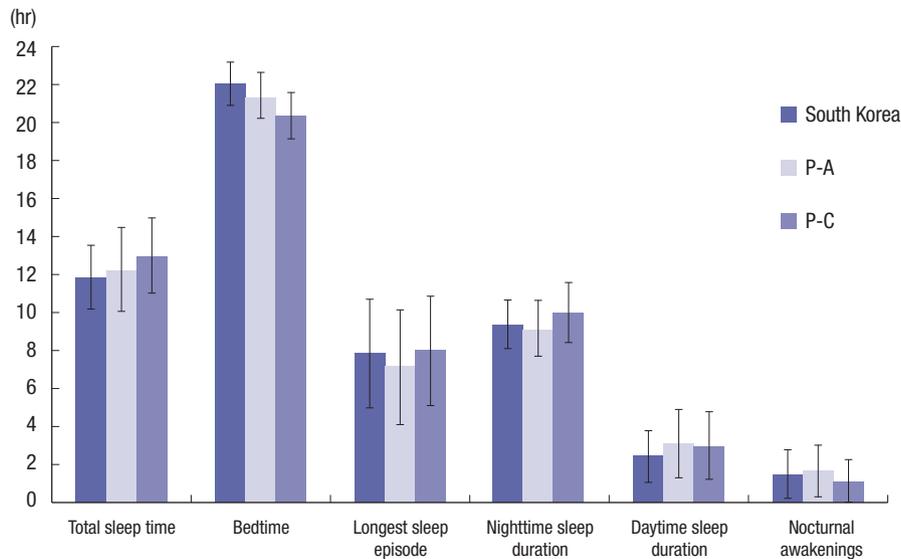


Fig. 2. Comparisons of Korean, predominately Asian, and predominately Caucasian groups by sleep outcomes. Bar means with different letters are significantly different. P-A, predominately Asian; P-C, predominately Caucasian.

Parental perceptions of sleep problems

A total of 46.9% of parents in Korea reported that they perceived their infant or toddler as having a sleep problem. This was significantly more than the 26.3% of parents from P-C countries/regions who reported infant or toddler sleep problems, but similar to the 52.2% of parents from P-A countries/regions reporting child sleep problems ($\chi^2 = 1,547.08$, $P < 0.001$). Within Korea, 2.3% of parents endorsed their child as having a “severe” sleep problem, and 44.6% endorsed a “small” sleep problem. These rates differed across groups as well, as ratings of “severe” and “small” sleep problems were 18.1% and 34.06%, respectively, in P-A countries/regions and 2.2% and 24.2%, respectively, in P-C countries/regions.

Parental behaviors

Table 3 shows age-based frequencies of parental sleep-related behaviors at children’s sleep initiation and resumption for the Korea sample. For sleep initiation practices, there were some significant differences by age, with rates of bottle-feeding, breastfeeding, rocking, and holding babies before sleep generally decreasing with increasing age. By contrast, watching television at sleep initiation increased with age. Age-related differences were not always linear, as at some ages certain sleep initiation behavior peaked, such as holding, bottle-feeding, and rocking among children ages 3-5 months.

For sleep resumption practices, rubbing or patting children in bed to put them back to sleep increased with age, such that more parents reported this sleep resumption behavior as child age increased. Nursing back to sleep, giving the child a bottle, and holding or rocking back to sleep generally decreased with older child age, consistent with the sleep initiation behaviors. Other age-related differences did not follow a linear pattern.

For instance, although verbal comfort in bed was increasingly frequent as children aged, the rate of this behavior was lower in the 9-11-month old group (2.65%) than both the 6-8-month-old and 12-17-month-old groups (5.7% and 7.2%, respectively).

Predictors of sleep patterns

Table 4 shows the results of stepwise linear regressions utilizing child and parent demographics and sleep ecology variables to predict salient sleep outcomes (bedtime, daytime sleep duration, nighttime sleep duration, night wakings, and longest sleep episode). As noted above, due to the large sample, size statistical significance was set at $P < 0.001$ and predictors were reported if they contributed at least 1.0% unique variance to the sleep outcome.

Bedtime was explained by respondent age and the use of television at sleep initiation, with older respondent age being associated with earlier child bedtime, and the viewing of television at night being associated with a later bedtime. Together, these two predictors explained 4.0% of the variation in this outcome. For daytime sleep duration, only child age emerged as a significant predictor, with older child age associated with decreased daytime sleep. Child age predicted 30.9% of the variation in daytime sleep duration. Similarly, child age significantly predicted nocturnal sleep duration, explaining 2.4% of the variance, with older child age associated with longer nocturnal sleep. Respondent employment also significantly predicted nocturnal sleep duration, such that non-employed or partially employed respondents reported longer infant and toddler nighttime sleep. Together, child age and respondent employment explained 3.9% of the variation in nocturnal sleep duration.

Nursing during the night predicted a significant amount of variance in the number of reported nighttime wakings (23.3%),

Table 3. Percentages of parental behaviors at child sleep initiation and resumption by age for Korean samples

Behaviors	Total n = 1,036	Age (mo)						χ^2	
		0-2	3-5	6-8	9-11	12-17	18-23		24-36
		47	69	123	113	139	166	378	
At sleep initiation									
Bottle-feeding	15.3	21.3	30.4	21.1	25.7	18.0	16.3	5.3	56.51*
Breastfeeding	23.8	63.8	50.7	54.5	49.6	28.8	6.0	2.1	303.86*
Rocking	4.9	12.8	18.8	13.8	4.4	2.9	1.2	1.1	73.86*
Holding	26.6	63.8	68.1	49.6	31.9	18.7	14.5	13.7	178.18*
Watching TV	8.2	0.0	0.0	0.8	1.8	4.3	13.3	14.3	52.29*
In swing or stroller	1.9	4.3	8.7	2.4	2.7	2.2	1.2	0.3	124.56 [†]
In crib/bed alone in room	2.6	10.6	2.9	2.4	2.7	1.4	1.2	2.6	14.02
In parents' bed alone	1.6	6.4	4.4	1.6	0.9	0.7	0.6	1.6	11.93
In crib/bed with parent present	8.4	4.3	1.5	5.7	4.4	6.5	12.1	11.4	16.69
In parents' bed with parent	20.2	10.6	7.3	12.2	8.0	12.2	24.7	11.3	59.62*
At sleep resumption									
Holding or rocking to sleep	31.0	51.1	30.4	39.0	35.4	36.0	28.9	23.8	24.85 [†]
Picking up—returning awake	1.9	0.0	1.5	1.6	1.8	1.4	1.2	2.1	3.61
Rub or pat in crib/bed	39.3	25.5	27.5	24.4	35.4	37.4	45.2	47.2	32.53*
Giving a bottle	14.5	25.5	31.9	22.8	22.1	12.2	15.1	5.5	58.74*
Nurse back to sleep	23.9	70.2	52.2	52.9	48.7	28.8	6.0	2.4	307.74*
Pacifier	5.3	10.6	10.1	11.4	10.6	6.5	3.6	0.5	39.79*
Diaper	16.1	48.9	43.5	27.6	17.7	13.0	15.7	4.2	128.66*
Verbal comfort in crib	13.4	2.1	2.9	5.7	2.7	7.2	17.5	23.0	65.98*
Bringing child to parents' bed	2.6	2.1	0.0	4.9	0.9	1.4	3.6	2.9	7.25
Let cry to fall asleep	5.1	2.1	1.5	3.3	0.9	6.5	9.6	2.0	15.49
Wait a few minutes	21.9	8.5	8.7	19.5	18.6	20.9	24.7	26.9	19.51
Play until ready for sleep	4.6	6.4	7.3	2.4	4.4	5.0	3.6	1.8	3.31
Watch TV or video	1.5	0.0	0.0	0.8	0.9	1.4	1.8	2.4	4.38
Sing to child	9.6	14.9	10.1	11.4	9.7	12.2	8.4	7.7	5.04

* $P < 0.001$; [†] $P < 0.01$.**Table 4.** Stepwise regression results using demographic and sleep ecology variables to predict sleep outcomes

Sleep outcomes	Predictors	Beta	% Variance explained	F
Bedtime	Respondent age	-0.22	2.23	23.53
	TV at sleep initiation	0.30	1.73	18.58
Daytime sleep duration	Child age	-0.41	30.86	460.68
Nocturnal sleep duration	Child age	0.11	2.39	25.28
	Respondent employment	0.18	1.46	15.69
Night awakening	Nursing during the night	1.26	23.33	314.01
	Child age	-0.12	3.60	50.82
	Giving a bottle during the night	0.43	1.09	15.56
Longest sleep episode	Child age	0.30	15.43	188.35
	Nursing at sleep initiation	-1.07	4.66	60.16
	Giving a bottle during the night	-1.16	1.42	18.69
	Respondent age	-0.41	1.21	16.08

All entered variables met the criteria of $P < 0.001$ and at least 1.0% unique variance explained. Beta coefficients are drawn from final models with the full set of predictors. On all variables, high scores reflect higher levels of the item described.

with child age and giving infants and toddlers a bottle during the night contributing little additional variance to the model (3.6% and 1.1% unique variance, respectively). Together, these variables explained 28.0% of the variation in night wakings. Whereas nursing and giving a bottle during the night were both associated with increased night wakings, child age was associated with decreased night wakings. A similar pattern emerged for longest sleep episode, in that older child age was associated

with longer sleep episodes, while nursing at sleep initiation and giving a bottle during the night were associated with shorter sleep episodes. Older respondent age was also associated with shorter sleep episodes. Together, these variables predicted a total of 22.7% of the variation in longest sleep episode, with child age explaining most of variation in this outcome (15.4%) relative to the other significant predictors in the model.

DISCUSSION

The purpose of this study was to examine sleep patterns in a large sample of infants and toddlers (ages birth to 36 months) in Korea, and to compare sleep patterns, sleep problems, sleep ecology, and parental behaviors to global sleep data on young children in both predominately Asian (P-A) and predominately Caucasian (P-C) countries/regions. We also examined demographic and sleep ecology predictors of sleep/wake patterns within the Korean cultural context. To the best of our knowledge, this is the first large-scale study of infant and toddler sleep in Korea. It is our hope that these findings will be used as a reference for future studies of sleep habits among children in Korea.

About the sleep/wake patterns, consistent with other cohort-based studies of sleep in early childhood (18-20), infants and toddlers in Korea showed increasingly consolidated sleep patterns with increasing child age. Daytime sleep duration and nocturnal awakenings generally decreased with older child age, whereas nighttime sleep duration and the longest sleep episode both tended to increase. Although it is difficult to directly compare study results to previous work on infant and toddler sleep in Korea due to differences in study measures and samples, findings on increased sleep consolidation with increased child age do align with available research in Korea on this topic. For instance, a previous study of 94 infants in Korea showed that between 0 and 6 months, daytime sleep duration decreased with increased child age (14). Findings from stepwise regressions using child and parent variables to predict sleep outcomes (discussed further below) also support these results, given that older child age significantly predicted decreased night wakings and daytime sleep, increased nocturnal sleep duration, and longer sleep episodes.

Sleep/wake patterns as well as aspects of the sleep ecology and parental perceptions of child sleep problems in the Korea samples differed in comparison to infants and toddlers in P-A and P-C countries/regions. Study findings suggest that infants and toddlers in Korea generally obtain less sleep than their counterparts in both P-A and P-C samples. Specifically, children in Korea had the latest bedtimes, the shortest total sleep time, the shortest daytime sleep duration, and the least number of naps per day compared to both P-A and P-C groups.

On the one hand, shorter total sleep for children in Korea could suggest that these children may be at higher risk for subsequent psychosocial problems relative to children in comparison countries/regions, given linkages between insufficient sleep and poor academic and behavioral functioning in early childhood (9,12,21). Indeed, although normative sleep requirements do vary on both individual and contextual levels, the average of 11.89 total hours of sleep for the samples in Korea is slightly lower than the 12 to 15 hours that infants and toddlers are thought to need (22). On the other hand, children in Korea

also had less frequent and shorter night wakings than children in P-A countries/regions (but not P-C countries/regions), which could mean that nighttime sleep, while shorter for children in Korea, is more efficient and consolidated at nighttime compared to their counterparts in P-A countries/regions. Additionally, it may be that children in Korea require less sleep than infants and toddlers in other countries/regions or that these differences in total sleep do not have a significant impact on behavioral functioning (2), although research that tests these hypotheses is needed.

These findings merit further study and global comparisons, particularly in light of cross-cultural differences in parental perceptions of sleep problems (23). Despite the sample in Korea having less total sleep, rates of parent-identified "severe" child sleep problems were lower in both the Korea (2.3%) and P-C (2.2%) samples compared to the P-A sample (18.1%), although overall sleep problem endorsement was similar in Korea and P-A countries/regions (46.9% and 52.2%, respectively). It could be that lower levels of night wakings among infants and toddlers in Korea contributed to lower rates of parent-identified severe sleep problems compared to the P-A group. However, demographic variables (e.g., parent and child characteristics) have been found to be more predictive of parent-identified sleep problems among P-A countries/regions than sleep measures like estimates of night wakings (23). As such, the lower rate of parent-identified severe sleep problems in Korea compared to other P-A countries/regions could be due to unmeasured cultural factors, such as different socio-cultural expectations about child sleep habits or perceptions about what constitutes a "severe" versus a "small" sleep problem (23). Given that Sadeh et al. (23) found substantial heterogeneity in the extent to which parents of different countries/regions within the larger P-A group endorsed severe child sleep problems, future studies should focus on examining in more detail how sleep variables versus socio-cultural factors play a role in determining the severity of parent-reported child sleep concerns among P-A samples.

Study findings on rates of co-sleeping were consistent with previous research in this regard (8,24), and with the larger cross-cultural study from which these data were drawn (1,23). There were comparable rates of room-sharing and bed-sharing among families in Korea and in other P-A countries/regions. These co-sleeping rates were significantly higher than those of families in P-C countries/regions, where having children sleep in a separate bedroom is more common (8,24).

Findings for parental behaviors at sleep initiation and resumption within the Korea sample generally converge with the literature on this topic. For instance, rates of bottle-feeding, breastfeeding, rocking, and holding babies at sleep initiation all tended to decrease with increasing child age. Nursing back to sleep, giving the child a bottle, and holding or rocking the child back to sleep also decreased with older child age. Most of these

trends are in line with parent behaviors at sleep initiation and resumption by child age reported in the larger cross-cultural examination of these data by P-A and P-C groups, which showed similar reductions in these initiation and resumption behavior with older child age (1). Of note, watching television at sleep initiation increased with older child age, and this behavior was also associated with later child bedtimes, as described further below.

Overall, few demographic, sleep ecology, and parental behavior variables emerged as predictors of significant variation (> 1%) in salient child sleep outcomes. However, child age explained 30.9% of the variance in daytime sleep duration and 23.3% of the variance in night wakings. These findings are consistent with literature showing that child sleep becomes increasingly consolidated at nighttime from infancy to toddlerhood (14,18-20). As mentioned previously, older child age was also associated with longer sleep episodes and nocturnal sleep, although age explained little variation in these outcomes.

Study findings support previous work indicating that active parent behaviors at sleep initiation or resumption, such as nursing or bottle-feeding, are associated with increased sleep fragmentation (1). In this sample, nursing and bottle-feeding predicted some variation in both nocturnal awakenings and longest sleep episodes. In particular, breastfeeding during the night accounted for 23.3% of the variance in nocturnal awakenings.

Importantly, watching television at sleep initiation was associated with having a later bedtime. This finding is of interest given that infants and toddlers in Korea have significantly later bedtimes and shorter total sleep times than children in both P-C and P-A countries/regions. In light of recent work in predominately Caucasian contexts linking the use of television or electronics at bedtime to insufficient sleep and other poor sleep-related outcomes, television habits, bedtime, and insufficient sleep should be studied further among infants, toddlers, and young children in Korea (14-16). While it is premature to conclude that television at bedtime is causal in producing later bedtimes for children in Korea, these two variables appear to be linked, and are typically associated with insufficient sleep in other child samples (14-16). Future studies should also examine other factors that could contribute to later bedtimes among infants and toddlers in Korea, especially as television watching and respondent age together explained only a small proportion of the total variance (4.0%) in this outcome.

Study findings are limited by the nature of the sample, which is confined to parents who elected to respond to an Internet-based survey on infant and toddler sleep. Internet-based surveys are likely skewed toward individuals of a higher socioeconomic status and educational background. Additionally, although the BISQ has been shown to be a reliable and valid measure of infant and toddler sleep, parent characteristics may have influenced their BISQ responses (17). Future studies

should include objective measures to assess sleep/wake patterns. The cross-sectional nature of this study precludes any conclusions about causal relationships between any parental behaviors or demographics and child sleep outcomes. Longitudinal studies of infant and toddler sleep habits in Korea are necessary, as is research that examines other factors that could contribute to child sleep/wake patterns during this time period, such as bidirectional parent-child interactions (8) and socio-cultural perceptions or expectations about child sleep (23).

In conclusion, several findings from this study can be used to inform culture-specific research directions and clinical practices related to early childhood sleep in Korea. This study suggests that infants and toddlers tend to obtain less total sleep and have later bedtimes in Korea than their counterparts in P-A and P-C countries/regions. Furthermore, almost half of all parents perceive their children as having a sleep problem. Given the associations found in this study between bedtime behaviors (including feeding to sleep and television viewing) and later bedtimes and nighttime awakenings, pediatric practitioners should provide parents with information about healthy sleep habits to encourage positive sleep outcomes.

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DISCLOSURE

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AUTHOR CONTRIBUTION

Conception and design of the study: Ahn YM, Mindell JA. Data collection: Ahn YM, Mindell JA. Data analysis: Sadeh A. Writing the paper: Ahn YM, Williamson AA, Seo HJ, Mindell JA. ICMJE criteria for authorship: Ahn YM, Williamson AA, Seo HJ, Sadeh A, Mindell JA. Agreeing with manuscript results and conclusions: all authors.

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