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Sleep matters: The association of race, bedtime, outdoor time, and physical activity with preschoolers' sleep

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ABSTRACT

Sleep is necessary for optimal functioning. Little is known about the extent to which race and opportunities to be active influence sleep in preschool-aged children attending full-day child care. Participants (n = 359) in this cross-sectional study attended 30 randomly selected, childcare centers in Cincinnati, OH. Data collection occurred from November 2009 to January 2011. Hierarchical linear regression and generalized estimating equations tested for associations between nighttime sleep duration and race, outdoor/indoor active time, actual physical activity (PA), screen time, daytime nap, and bedtime after 9 pm. Participants slept a mean ± SD of 1.5 ± 0.8 h at childcare and 9.7 ± 1.0 h at bedtime. White children (β = 0.57 ± 0.14, p < 0.01) and children identifying as Other race (β = 0.40 ± 0.15, p < 0.01) slept more hours than Black children at nighttime. White children were less likely to nap at childcare than Black children. Inside PA time provided was associated with increased nighttime sleep duration (β = 0.092 ± 0.04 h per 30 min PA, p < 0.03). There was no association between outdoor time or moderate to vigorous PA and nighttime sleep. Black children slept less at night on average, but were more likely to engage in nap sleep at childcare resulting in similar overall sleep duration. Additional studies in diverse populations that explore the effects of nighttime versus nap time sleep on child health and well-being are needed.

1. Introduction

The appropriate amount of sleep is necessary for physical and mental functioning across all ages. Sleep is particularly important for young children as the hormones necessary for growth and development are released during sleep states (Paruthi et al., 2016). Nighttime sleep is known to be positively associated with biological, psychosocial, and overall wellbeing functions (Taheri, 2006; Ward et al., 2008; Weissbluth, 2015). Insufficient total sleep duration has been associated with adiposity in early childhood (Taheri, 2006; Sekine et al., 2002; Taveras et al., 2008; Padez et al., 2005). The mechanisms that drive the relationship between sleep and overweight/obesity in young children are not fully understood (Bell and Zimmerman, 2010).

The American Academy of Pediatrics supports the American Academy of Sleep Medicine guidelines that indicate preschool aged children (i.e. 3 to 5 year olds) should obtain 10 to 13 h of sleep per 24 h, including naptime sleep (Paruthi et al., 2016). In a secondary analysis of nationally representative sample, investigators found that children between the ages of 3 and 5 years old did in fact get 11 to 13 h of sleep over a 24 h period (Williams et al., 2013). Several factors have been linked to nighttime sleep duration, including bedtime, napping, daytime physical activity, and outdoor time. Later bedtimes have been associated with reduced sleep duration in children younger than two years of age (McDonald et al., 2014). The association between napping and nighttime sleep is unclear. In previous studies, Black children were more likely to nap and have shorter sleep duration than White children (Crosby et al., 2005; Lavigne et al., 1999). In these studies, however, children were not recruited from, and behaviors were not observed within, a child care setting. The majority (61%) of preschool-aged children spend time in child-care settings outside the home (Child FIFo, Statistics F, 2005). Little is known about how child-care settings may promote or hinder children's sleep (Ward et al., 2007). Because napping is an integral part of child care routines, this question warrants further study in preschoolers within a child care setting.

The relationship between sleep and physical activity (PA) among school-aged children has been examined previously; although, results

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have been inconsistent (Hager et al., 2016). Though one study of toddlers found that shorter sleep duration was associated with decreased PA, this study did not consider the effects of napping (Hager et al., 2016). The association between sleep and screen exposure has received the greatest attention with the presence of a TV in the bedroom, the number of hours participating in screen time, and participating in screen time at or near bedtime reported to negatively impact sleep (Hill et al., 2016; Owens et al., 1999).

The purpose of this study was to examine the relationship between nighttime sleep duration and race, outdoor and indoor active time, actual PA, daytime nap, bedtime after 9 pm, and screen time in preschoolers aged 3 to 5 years attending full-day child care.

2. Methods

2.1. Study design

The data used for this analysis were collected from November 2009 to January 2011 as part of the Preschool Eating and Activity Study (PEAS), a cross-sectional study of the influence of the child care center environment on children's 24-hour physical activity (PA) (Copeland et al., 2016). The analytic sample consisted of n = 359 children in two randomly selected preschool classrooms in 30 randomly selected child-care centers (n = 60 classrooms) in Ohio. Centers were eligible if they offered full-day care to preschool-aged children. All children who were 36–72 months, enrolled in one of the randomly selected classrooms for at least one month, were present on the day of observation, did not have a disability prohibiting PA, and provided data on nighttime sleep and key covariates were eligible. All data was collected on either a Tuesday or a Wednesday to avoid sleep schedule shifts that can occur during the weekend. Ethical approval to conduct the research was obtained from the Institutional Review Board of Cincinnati Children's Hospital Medical Center.

2.2. Measures

2.2.1. Outcome variables

2.2.1.1. Sleep. The outcome measure nighttime sleep was defined as the time spent asleep at night. Sleep at night was primarily assessed using a one day sleep diary, in which parents reported their child's bedtime on the day of observation and rise time on the following day. The sleep diaries were also used to determine if the child went to bed before or after 9 pm. A 9 pm bedtime cutoff was used as prior research has shown that this is, in general, when the majority of children this age go to bed in the U.S. (Anderson et al., 2016). Sleep times for sleep duration were estimated within 15 min.

As a back-up if the sleep diary was not returned or if there was missing data in the diary or if there was a question regarding the accuracy of the sleep and wake times recorded in the diary (< 3% of sample), manual checking of accelerometry output was used to estimate bedtime and/or rise time (Lam et al., 2011). Study staff observed nap at the center and recorded the beginning and end of the time period allotted for nap, as well as individual times participating children fell asleep and woke from nap. Study staff were to scan the room every 5 min to check for any new children who had fallen asleep or awaken. The sleep times for nap observation data were estimated within 5 min. Total sleep included the time spent asleep at night and at nap.

2.2.2. Exposure variables

2.2.2.1. Physical activity. Actual time allotted to children to spend outdoors and in the gym on the day of observation was recorded by study staff. Actical uniaxial accelerometers (Mini-Mitter®, USA) (15-s epoch) were used to objectively measure PA for 24 h. The Acticals were attached to belts and placed on the child's right hip by study staff upon arrival at the center on the observation day, and removed the following morning. Established cut offs for count per minute (Pfeiffer et al., 2006) were used to quantify time (minutes/hour) spent in moderate, vigorous, light, and sedentary activity. Sleep at night, time allotted for nap, and non-wear times were removed from these periods. Parents recorded non-wear times at home in a diary while study staff recorded active play periods on the playground and in the muscle room, or gym, while in child care. The authors interpreted 120 consecutive epochs (30 min) with zero counts as non-wear time (Pfeiffer et al., 2006).

2.2.2.2. Screen time. Study staff recorded the presence of TVs and computers in the childcare and the minutes these devices were used by individual children. Screen time (including computers, TVs, and tablets) in the home was recorded by the parent. We assessed screen time use given their prevalence in US homes, including low-income populations (Kabali et al., 2015; Mobile Fact Sheet, 2018).

2.3. Analysis

Means and standard deviations and frequencies and percents were used to describe participant demographics, sleep, screen time and physical activity behaviors. Hierarchical linear regression models (HLM) and generalized estimating equations (GEE) were used to test for associations between race (Black, White, and Other including mixed race), outdoor and indoor active time, actual PA, daytime nap, and bedtime after 9 pm, and screen time in preschoolers aged 3 to 5 years attending full-day child care. HLMs were fit using restricted maximum likelihood with the Satterthwaite approximation for the degrees of freedom. Models included center as a random effect and fixed effect terms for model covariates. GEEs were estimated using a logit link function, center as the cluster term, a compound symmetry working correlation matrix, and robust standard errors. All models were multivariable and included the following covariates chosen a priori based on a review of the literature and subject matter knowledge: child sex, child age, low-income status (defined as eligible for free and reduced-price lunch in child care), single vs. couple status (regardless of marital status) day of the week and hours of daylight. Hours of daylight for each observation day were obtained from the Astronomical Applications Department of the U.S. Naval Observatory tables for daylight duration (Astronomical Applications Department). All analyses were conducted using SAS 9.3.

3. Results

Thirty randomly-selected child-care center directors agreed to participate with a 10% refusal rate. Two classrooms in each center were randomly selected with no refusals. Of the 570 potentially eligible children, 447 (77%) families gave consent to participate, and 415 children were present on the day of observation. A total of n = 380 children had complete sleep data. Of these, an additional n = 21 were missing data on at least one key covariate (n = 12 race, n = 15 income status, n = 16 single parent status) leaving a final n = 359 children available for analysis. Participant characteristics are described in Table 1. The demographics for the child participants were roughly evenly split with 51.5% female, 53.5% from a couple status home, and 56.6% classified as low-income. Racial categories for children were Black (39.6%), White (44.3%), and Other (16.2%).

3.1. Center time allotted for outdoor and indoor activity and actual PA

Childcare centers, on average, allotted mean (SD) of 73.9 (40.9) minutes for children to be active (Table 1). This time allotment included both outdoor time and gym time. Childcare centers allotted an average of 35.2 (38.8) minutes outdoors and an average of 38.8 (42.2) minutes in the gym as measured by study staff. Children accumulated an average of 314 (72.1) minutes spent in light activity and an average of 17 (12.8) minutes of moderate to vigorous PA over the 24 h period as measured by the accelerometer. Children accumulated an average of

Table 1
Demographic and behavioral characteristics of participants.

	n (359)
Child age (y), mean (SD)	4.4 (0.7)
Child sex, n (%)	
Female	185 (51.5)
Male	174 (48.5)
Child race, n (%)	
Black	142 (39.6)
White	159 (44.3)
Other	58 (16.2)
Single vs. Couple status, n (%)	
Two parent home	192 (53.5)
One parent home	167 (46.5)
CACFP, n (%)	
Eligible	203 (56.6)
Not eligible	156 (43.5)
Any TV time, n (%)	308 (85.8)
Any computer time, n (%)	137 (38.2)
Total TV time at center (minutes), mean (SD)	8.0 (20.5)
Total computer time at center (minutes), mean (SD)	6.4 (12.9)
Total TV time at home (minutes), mean (SD)[a]	57.9 (50.3)
Total computer time at home (minutes), mean (SD)[b]	4.1 (13.9)
Napped at center, n(%)	
Yes	305 (85)
No	54 (15)
Nighttime sleep (hours), mean (SD)	9.7 (1.0)
Nighttime and nap sleep (hours), mean (SD)	11.2 (1.0)
Bedtime after 9 pm, n (%)	232 (64.6)
Actual accumulated PA by accel	
Total light (minutes), mean (SD)[c]	314 (72.1)
Total MVPA (minutes), mean (SD)[c]	17 (12.8)
Total LMVPA (minutes), mean (SD)[c]	331 (76.0)
Total center time allotted for PA	
Total active time outdoors (minutes), mean (SD)	35.2 (38.8)
Total active time in gym (minutes), mean (SD)	38.8 (42.2)
Total Time allotted (outdoors + gym; minutes), mean (SD)	73.9 (40.9)

[a] n = 354.
[b] n = 353.
[c] n = 358.

331 (76.0) minutes of total PA.

3.2. Screen time

As shown in Table 1, approximately 85% of children (n = 308) were exposed to a television and approximately 40% were exposed to a computer (n = 138) either at home or at the center or both. Children participated in a mean (SD) of 14.4 (33.4) minutes of total screen time at the center and 62.0 (64.2) minutes of total screen time at home.

3.3. Bedtime

Approximately 65% of children went to bed after 9 o'clock (Table 1). Fewer White children went to bed after 9 o'clock in comparison to Black children (OR = 0.46 [0.26; 0.83]) (Table 2). Bedtimes did not differ between Other race children and Black children, nor was bedtime after 9 pm associated with child sex, number of parents in the home, or low-income status. Children who went to bed after 9 pm napped more at child care than those who did not go to bed after 9 pm (OR = 2.16 [1.01; 4.6]). Active time allotted for indoor PA decreased the odds that children had an after 9 pm bedtime (OR = 0.9 [0.76; 1.05]). Actual accumulated light PA was positively associated with an after-9 pm bedtime (OR = 1.13 [1.01; 1.25]) as was total PA (OR = 1.11 [1.0; 1.23]) (Table 2). More children who participated in screen time at home had bedtimes after 9 pm than those children who did not participate in screen time at home (OR = 1.31 [1.11; 1.54]) (Table 2). There was no association between bedtime and screen time at the center, outdoor time, or moderate to vigorous PA.

3.4. Nap

Participants slept a mean (SD) of 1.5 (0.8) hours at childcare. Fifteen percent of children did not nap at childcare. White children (OR = 0.25 [0.13; 0.51]) and those identifying as Other race (OR = 0.37 [0.17; 0.79]) were less likely to nap at childcare when compared to Black children (Table 2). Napping was not associated with any other demographic characteristics nor was it associated with PA, allotted time for indoor or outdoor active time, or screen time. The duration of nap sleep was shorter for White ($\beta = -0.37 \pm 0.11$ h, $p < 0.01$), but not children identifying as Other race ($\beta = -0.14 \pm 0.12$ h, $p = 0.22$), when compared to Black children. Child age was also inversely associated with duration of nap sleep ($\beta = -0.13 \pm 0.05$ h per year, $p = 0.02$).

3.5. Nighttime sleep duration

Participants slept a mean (SD) of 9.7 (1.0) hours at night (Table 1). Nighttime sleep varied by race with White children ($\beta = 0.57 \pm 0.14$ h, $p < 0.01$) and children identifying as Other race ($\beta = 0.40 \pm 0.15$ h, $p = 0.01$) sleeping more hours than Black children (Table 2). Nighttime sleep duration did not vary significantly based on child sex, single versus couple status, or low-income status. Children with a bedtime after 9 pm had a shorter nighttime sleep duration ($\beta = -0.92 \pm 0.09$ h, $p < 0.01$) than those who went to bed before 9 pm. Napping in childcare was also inversely associated with nighttime sleep duration ($\beta = -0.15 \pm 0.03$ h/per 30 min nap sleep, $p < 0.01$). Actual accumulated total PA as measured by the accelerometer was inversely associated with nighttime sleep (hours) ($\beta = -0.05 \pm 0.02$ h, $p < 0.01$). Actual accumulated light PA was also inversely associated with nighttime sleep duration ($\beta = -0.06 \pm 0.02$ h, $p < 0.01$). Moderate to vigorous PA, total outdoor time, and total indoor time were not associated with nighttime sleep. Nighttime sleep duration was not associated with screen time.

3.6. Total sleep

Participants' mean (SD) total sleep duration, including nighttime and nap sleep hours, was 11.2 (1.0) hours (Table 1). Total sleep did not vary significantly based on child race, sex, single versus couple status, or low-income status. Children with a bedtime after 9 pm had a shorter total sleep duration ($\beta = -0.66 \pm 0.11$ h, $p < 0.01$) than those who went to bed before 9 pm (Table 2). Total sleep duration was inversely associated with total light PA ($\beta = -0.09 \pm 0.02$ h, $p < 0.01$) and total PA ($\beta = -0.08 \pm 0.02$ h, $p < 0.01$) (Table 2). Total sleep duration was not associated with moderate to vigorous PA, or time allotted for outdoor or indoor activity. Total sleep was inversely associated with screen time at the center ($\beta = -0.19 \pm 0.07$ per 30 min screen time, $p < 0.01$).

4. Discussion

In this study, we found that children's average total sleep duration (11.2 h) was within the range of recommended sleep for this age group (Paruthi et al., 2016). While Black children slept fewer hours at night on average compared to White and Other race children in our sample, more Black children napped at childcare, thus the overall sleep duration was similar. Also, more Black children had a bedtime later than 9 pm than White children. In a previous study of 977 preschool-aged children, the majority of children (n = 600) had bedtimes before 9 pm (Anderson et al., 2016).

In the current study, differences in total sleep by race were modest and differences in nighttime sleep duration were mitigated by napping at childcare. These findings are in line with previous studies examining racial differences in sleep behavior (Bell and Zimmerman, 2010; Williams et al., 2013; Crosby et al., 2005; Lavigne et al., 1999).

Table 2
Sleep behaviors according to demographic characteristics and screen time.

	Nighttime sleep (hours)[a]			Nighttime and nap sleep (hours)[a]			Bedtime after 9 pm[a]			Napped at center[b]		
	Mean (SD)	beta ± SE	p-Value[c]	Mean (SD)	beta ± SE	p-Value[c]	n_{total}	$n_{after\ 9pm}$	OR (95% CI)[d]	n_{total}	n_{napped}	OR (95% CI)[d]
Demographic characteristics												
Child sex												
Female	9.69 (0.99)	ref.		11.23 (1.04)	ref.		185	118	1.00	185	160	1.00
Male	9.68 (0.94)	−0.042 ± 0.098	0.67	11.17 (1.01)	−0.083 ± 0.107	0.44	174	114	1.15 (0.62; 2.14)	174	145	0.80 (0.42; 1.49)
Child race												
Black	9.34 (0.88)	ref.		11.23 (0.99)	ref.		142	109	1.00	142	136	1.00
White	9.97 (0.92)	0.570 ± 0.136	< 0.01	11.15 (1.03)	0.065 ± 0.158	0.68	159	84	0.46 (0.26; 0.83)	159	120	0.25 (0.13; 0.51)
Other	9.76 (1.02)	0.404 ± 0.150	0.01	11.28 (1.09)	0.180 ± 0.168	0.29	58	39	0.72 (0.34; 1.49)	58	49	0.37 (0.17; 0.79)
Single vs. couple status												
Two parent home	9.79 (0.88)	ref.		11.19 (1.00)	ref.		192	114	1.00	192	157	1.00
One parent home	9.56 (1.04)	−0.077 ± 0.062	0.93	11.22 (1.06)	−0.008 ± 0.127	0.95	167	118	1.00 (0.58; 1.73)	167	148	0.74 (0.36; 1.54)
CACFP												
Eligible	9.51 (1.01)	ref.		11.22 (1.06)	ref.		203	149	1.00	203	185	1.00
Not eligible	9.92 (0.85)	0.044 ± 0.137	0.75	11.17 (0.98)	−0.008 ± 0.155	0.96	156	83	0.65 (0.37; 1.14)	156	120	0.95 (0.45; 1.98)
Screen time												
Total screen time at center	9.69 (0.96)	−0.077 ± 0.062	0.21	11.20 (1.03)	−0.189 ± 0.072	0.01	359	232	1.05 (0.89; 1.25)	359	305	0.84 (0.65; 1.07)
Total screen time at home	9.68 (0.97)	−0.045 ± 0.029	0.13	11.20 (1.03)	−0.042 ± 0.032	0.20	359	232	1.31 (1.11; 1.54)	359	305	0.97 (0.81; 1.16)
Bedtime and napping												
Bedtime												
Before 9 pm	10.35 (0.82)	ref.		11.57 (1.06)	ref.					127	95	1.00
After 9 pm	9.33 (0.84)	−0.922 ± 0.093	< 0.01	11.00 (0.95)	−0.663 ± 0.109	< 0.01				232	210	2.16 (1.01; 4.59)
Nap sleep	9.69 (0.96)	−0.154 ± 0.034	< 0.01									
Physical activity												
Actual accumulated PA by accel												
Total light	9.68 (0.97)	−0.059 ± 0.021	< 0.01	11.20 (1.03)	−0.09 ± 0.022	< 0.01	358	231	1.13 (1.01; 1.25)	358	305	0.98 (0.87; 1.10)
Total MVPA	9.68 (0.97)	0.062 ± 0.118	0.60	11.20 (1.03)	−0.077 ± 0.131	0.56	358	231	0.88 (0.52; 1.49)	358	305	0.80 (0.42; 1.51)
Total LMVPA	9.68 (0.97)	−0.051 ± 0.020	0.01	11.20 (1.03)	−0.083 ± 0.021	< 0.01	358	231	1.11 (1; 1.23)	358	305	0.97 (0.86; 1.10)
Total center time allotted for PA												
Total active time outdoors	9.69 (0.97)	0.015 ± 0.041	0.71	11.20 (1.03)	−0.007 ± 0.056	0.91	359	232	1.06 (0.9; 1.26)	359	305	1.10 (0.67; 1.81)
Total active time in gym	9.69 (0.97)	0.068 ± 0.045	0.13	11.20 (1.03)	0.095 ± 0.057	0.10	359	232	0.81 (0.7; 0.94)	359	305	0.88 (0.61; 1.25)
Total time allotted (outdoors + gym)	9.69 (0.97)	0.064 ± 0.039	0.10	11.20 (1.03)	0.064 ± 0.049	0.19	359	232	0.9 (0.76; 1.05)	359	305	0.94 (0.72; 1.23)

Abbreviations: SD, standard deviation; SE, standard error; OR, odds ratio; CI, confidence interval; CACFP, Child and Adult Care Food Program; PA, physical activity; MVPA, moderate and vigorous physical activity; LMVPA, light, moderate, and vigorous physical activity.

Notes: Associations for screen time, nap sleep, and physical activity shown for a 30 min period.

[a] Models adjusted for child sex, child race, child age, CACFP status, single vs. couple status, day of the week and hours of daylight as appropriate.

[b] Models adjusted for child sex, child race, child age, CACFP status, single vs. couple status, and hours of daylight as appropriate.

[c] p-Value from linear mixed effects regression with center as random effect.

[d] Odds ratio and 95% confidence interval from generalized estimating equation (logit link function) with center as cluster.

Specifically, Crosby et al. found that Black children aged 3–8 years old took more and longer duration naps and slept less at night than non-Hispanic White children, but that the total sleep duration for the 24-hour period was the same between groups (Crosby et al., 2005). The current study adds to the body knowledge, as it extends these findings to a population recruited and observed within a childcare setting. Alternatively, in a longitudinal study of the association between race/ethnicity and sleep curtailment (i.e. shortened sleep compared to age-specific average sleep duration) with 1288 children, investigators found that Black, Hispanic, and Asian children were more likely to experience sleep curtailment from infancy to mid-childhood than White children (Peña et al., 2016). In other words, minority children experienced shorter total sleep duration than White children even considering daytime sleep.

Total PA, as measured by the accelerometer, was inversely associated with nighttime and total sleep duration; however the difference was not of practical importance. For example, children slept two to four fewer minutes at nighttime per every 30 min of additional total PA; the direction of the association, though small, is similar to some of the current literature, though the literature is mixed (Hager et al., 2016; Williams et al., 2014; Olds et al., 2011; Pesonen et al., 2011).

Total PA was also associated with a bedtime after 9 pm. Allotted indoor PA was associated with decreased odds of an after 9 pm bedtime. This finding may be due to seasonal effects such that indoor PA occurs as a result of colder temperatures and increased precipitation which, in turn, could be conducive to earlier bedtimes. Further, earlier sunset times during winter months could also be associated with earlier bedtimes. Contrary to our hypothesis, nighttime sleep and bedtime were not associated with time allotted for outdoor play at the child-care center.

Screen time at home was associated with a later bedtime, which has been demonstrated in the literature (Hill et al., 2016). Though there is evidence to support the negative association between screen time and sleep behaviors, we did not find that screen time at home was associated with nighttime or total sleep duration. This may be due to the fact that this is a cross-sectional study and we did not capture measures of sleep quality.

4.1. Limitations and strengths

There are both strengths and limitations that should be recognized when considering the results of this study. While this study does include a large cohort of children across 30 childcare centers, participation was limited to children enrolled in full-day childcare, which could limit the generalizability of the results. Further, though this study used multiple methods of data collection allowing for a more accurate estimate of the outcome, this was a twenty four hour snapshot of the sleeping habits and activity levels of children; we cannot know if these results are reflective of all days of the week or reflect patterns of usual behavior.

4.2. Conclusions

Though total sleep duration for the children in this study was within the recommended range, this was achievable due to naptime at child-care. This was particularly true for Black children who more often had bedtimes after 9 pm. Napping has been shown to benefit young children (i.e. reduced stress, increased attention span, and alertness) however, there is evidence that napping does not provide equal benefits to nighttime sleep (Taheri, 2006; Ward et al., 2008; Weissbluth, 2015). Bell and Zimmerman found that fewer hours of nighttime sleep was associated with increased odds of overweight and obesity, while naptime sleep was not; thus, concluding that nighttime and naptime sleep might have different functions (Bell and Zimmerman, 2010). It may also be that nighttime and nap time sleep serve as proxies of different underlying factors (i.e. SES, culture, noise, light exposure, housing quality, air quality, etc.) that are common causes of differences in sleep patterns and risk of obesity. For instance, in a study of 240 toddlers from low-income families, nighttime sleep duration was associated with sleep context (i.e., sharing sleep space, variable bedtime location, lack of bedtime routines) (Hager et al., 2016). Taken together, these findings have implications for children in schools where nap is not provided, particularly minority children. A recent international study of > 10,000 children ages zero to five found that structured routines around bedtime improved nighttime sleep duration (Mindell et al., 2015). Studies that explore the effect of nighttime versus nap time sleep on child health and well-being are needed. Further, future research should explore sleep patterns and their effects within populations of children that are not enrolled in childcare. Specific attention to the interaction of sociodemographic factors, their relationship with bedtime practices, and their effect on sleep outcomes is needed.

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Conflict of interest

Authors have indicated they have no potential conflicts of interest to disclose.

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