ORIGINAL RESEARCH

Correlates of naptime behaviors in preschool aged children

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Purpose: Major changes in the timing, duration, and function of sleep occur during childhood. These changes include the transition from habitual napping to infrequent napping. This transition is likely to reflect, at least in part, neurocognitive development. This study sought to identify factors that discriminate between four groups of children with different teacher-reported responses to naptime in childcare: those who nap (nappers), sometimes nap (transitioners), do not nap (resters), and neither nap, nor lie still (problem nappers).

Methods: Standardized observations of sleep and sleep behaviors, daytime behaviors across a number of domains, and direct neurocognitive assessment of 158 preschool aged children (aged 49–72 months; 54% male) attending childcare centers in Queensland (QLD), Australia, were adopted as part of a large longitudinal study of early childhood, the Effective Early Education Experiences (E4Kids) study. Discriminant function analysis was used to examine how age, parent education, nighttime sleep duration, cognitive functioning, behavior problems, and temperament differentiated the four groups.

Results: Three discriminant functions were identified and defined as maturation (strong loadings of nighttime sleep duration, cognitive function, and age), socioeconomic status (parental education), and behavioral problems (externalizing behavior, temperament, and internalizing behavior). These functions accounted for 62.9%, 32.6%, and 4.5% of the between-groups variance, respectively. Children defined as nappers (n=44) had significantly shorter duration of nighttime sleep, were younger, and had lower cognitive functioning scores than did other groups. Problem nappers, (n=25) were more likely to have parents with lower levels of education than did transitioners (n=41). Standard behavior and temperament measures did not significantly differentiate the groups.

Conclusion: The findings support an interaction between cognitive development, sleep behaviors, and the individual needs and circumstances of children. Further research in this area could make a strong contribution to theory and practice in early childhood education, and a strong contribution to understanding of children's development.

Keywords: napping, children's sleep, sleep behavior, early childhood

Introduction

Sleep plays an essential role in the mental, physical, and emotional lives of children. While sleep is a substrate for the physiology of recovery and growth, it has additional behavioral, social, and cultural meaning. These aspects of sleep can be observed in the behaviors and interactions adopted by children before, during, and after sleep episodes, and most particularly in the behaviors surrounding daytime sleep opportunities.

The majority of children (over 80%) aged 3–6 years in developed economies attend some form of Early Childhood Education and Care (ECEC) service.[1] In

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Australia, these services include long daycare, family day-care and kindergartens, broadly comparable to childcare, kindergarten, or preschool settings in other countries.[2] Scheduled, and often mandated, sleep times are an ubiquitous feature of these services,[3] and constitute a significant feature of a child's early life experience.

Children experience a very clear developmental shift in the distribution of their sleep across the day and night during these preschool years, from predominantly biphasic sleep toward predominantly monophasic sleep.[4,5] This shift represents a significant change in the neural control, or at least the expression, of sleep timing.[6] This shift is also likely to demonstrate a normal developmental trajectory, somewhat analogous to that observed in other domains of neurodevelopment, such as locomotor development and the acquisition of language. Milestones are evident in both of those trajectories, but it is understood that there can be substantial inter-individual variation in the ages at which these are achieved.[7,8] A similar degree of variation between children in their transition away from habitual regular daytime napping might be expected, although it is not clear that this variation is well accommodated by the routines and practices observed in ECEC settings. There is therefore a potential for a mismatch between the sleep needs of the child (where these needs include developmental need, together with acute homeostatic and circadian contributions to sleepability) and the expectations of parent, educators, and other carers.

Despite near-universal provision of daytime "nap-times" in Australian ECEC settings, and similar provision in international reports, eg,[9,10] not all children sleep during these scheduled times.[11] Many studies have categorized children in this context as "nappers and non-nappers", eg,[12] but some have further identified a proportion of children specifically as "problem nappers".[13] This categorization has been adopted in a number of subsequent studies.[14–16] Children have been described as problem nappers if they do not get to sleep at naptime, and display disruptive behaviors or difficulties settling down.[13] The specificity of these behaviors is unclear, and the similarities or differences between "problem napper" behaviors, and other forms of sleep-related problems (eg, nighttime sleep problems) are uncertain.

In the context of developmentally normal transition away from the need for a daytime nap, and potential inflexibility in the provision of nap opportunities (including timing, duration, expectation of sleep, and the degree to which a nap is mandatory), two broad interpretations of this phenomenon are raised. The first is that children identified as "problem nappers" genuinely manifest a behavioral difficulty that is either specific to sleep times or reflects a general behavioral disposition.[15] This might be observed as a unique behavioral profile distinguishing such children from others in the same environment. The second is that this conceptualization of "problem nappers" might to some extent capture children in the midst of a normal transition away from the need for a habitual or routine daytime nap, or somewhere past that point, who are reacting in a to-be-expected fashion to the requirement to lie still and attempt sleep.[17] This possibility might be observed as an association between sleep-time behaviors and other developmental indicators, especially indicators of neurocognitive development.

The differences between children who do and do not nap in childcare are not known, nor are the characteristics of children who might present with behavioral difficulties associated with naptime. The aim of this study was to examine the social and neurodevelopmental correlates associated with nap-time behaviors observed in children aged 4–6 (an age group in transition from regular napping). Specifically, we aimed to describe the neurodevelopmental, behavioral, and demographic characteristics that differentiate children who sleep during scheduled naptimes, those who sleep only "sometimes" during scheduled naptimes, those that lie quietly during naptime despite not napping, and those children who do not or cannot lie quietly during nap times.

Methods

Study design and participants

Aspects of these data and methods have been reported previously.[3] Data were collected as part of a larger longitudinal prospective study, the Effective Early Education Experiences (E4Kids) study, which examined the effects of early education and care (ECEC) on long-term development in a representative sample of early childhood program provision in Australia.[18] The rooms were located in Brisbane (metropolitan; n=121 rooms) and Mt Isa (rural; n=9 rooms), QLD, Australia. Observations were conducted during 2011. At this time, a total of 239 of the E4Kids cohort were still attending childcare programs. Of the initial 239 children for which observation and teacher report data was collected, the following exclusions were made: parent report data unavailable (n=68); outside the preschool age range (>6 years; n=1); no scheduled sleep

rest time in childcare service (n=6); missing data on the items that were used to create the napping groups (n=4; ie, data missing on the educator-reported napping and sleep-time behaviour items such that group membership could not be determined); and >50% missing data (n=2) on relevant study variables. The final sample was 158 children (M_{age}=58.89 months, SD=3.94, range=49–72 months; n=86 male [54.4%]).

Measures

Nighttime sleep duration
Children's nighttime sleep duration via parent report. Two items from the questionnaire were included in the present study; "On a typical night, when does the study child usually go to sleep?" and "On a typical morning, when does the study child usually wake up?" An overall night-time sleep duration value (hours) was calculated as the difference between sleep onset time and sleep wake time.

Cognitive functioning
The Woodcock Johnson III[19] is a normed, validated, and frequently used measure of cognition and designed for children from age two. The Brief Intellectual Ability (BIA) Scale was used in the current study to assess children's cognitive ability. The overall BIA score was based on the average across three WJIII subscales: (a) Verbal Comprehension, (b) Concept Formation, and (c) Visual Matching, which represents an individual's verbal ability, thinking ability, and efficiency in performing cognitive tasks. The tests were administered by trained research psychologists at each ECEC setting. Test scores were age corrected against population norms.

Socioeconomic status
Parental education was used as a proxy for socioeconomic status, which was calculated from the average of the following two items: 1) "what is the highest level of education you have completed" and 2) "what is the highest level of education your partner has completed?" Reponses were scored on an 8-point scale (0=no schooling or did not complete primary school; 1=primary school or equivalent; 2=year 10 or equivalent; 3=year 12 or equivalent; 4=tertiary certificate or equivalent; 5=diploma or equivalent; 6=university bachelor degree or equivalent; 7=postgraduate university degree).

Behavior
The Strengths and Difficulties Questionnaire – Caregiver report SDQ;[20] is a brief instrument for screening behavioral and emotional adjustment problems for ages 3–16 year olds. Twenty-five items cover five domains of child behavior "over the last six months or this school year"; emotional symptoms, conduct problems, hyperactivity, peer relationship problems, and prosocial behavior. Responses were measured on a 3-point Likert-like scale: (1) not true, (2) somewhat true, (3) certainly true. Example scale items include "constantly fidgeting or squirming" and "restless, overactive, cannot stay still for long". This study reports the internalizing (ie, combined emotional symptoms and peer relationships domains; 10 items) and externalizing (ie, combined conduct problems and hyperactivity domains; 10 items) subscales due to our low-risk/general population sample. The SDQ was completed by the parent.

Temperament
Child temperament was measured using the Short Temperament Scale for Children (STSC);[21] scores across 12 items encompassing three domains (sociability, persistence, and inflexibility) of the STSC were averaged to provide a single Easy-Difficult Temperament Score, in which higher scores reflect a more easy temperament style (scale 0–5; Cronbach's α=0.76). The STSC was completed by the parent.

Data analysis
The data were analyzed using SPSS version 22. Missing data were examined using a Missing Values Analysis, which revealed that missing data were minimal and missing completely at random (MCAR; Little's MCAR test, p=0.063). Expectation–maximization was used to impute missing data via the SPSS version 22 Missing Values Analysis. A discriminant function analysis was used to determine how well age, parental education, BIA, night-time sleep duration, behavior, and temperament, discriminated between the four napping groups. Significance was evaluated at α=0.05 using two-sided tests.

Groups
Children were classified into one of four groups based on teacher ratings of their habitual napping behavior on two items: 1) "Does this child usually sleep during day sleep time and 2) Does this child have difficulty lying quietly at sleep time". Response options for both items were never, rarely, sometimes, often, and always. The given group labels are subjective interpretations of the different napping behaviors reported by teachers. Children were classified as nappers (n=44) if their teacher rated them as "often" or "always"

sleeping during sleep/rest time; children were classified as transitioners (n=41) if their teacher rated them as "sometimes" sleeping during sleep/rest time. This label was based on a hypothesized behavioral characteristic of the developmental stage between biphasic and monophasic sleep (ie, skipping naps is thought to indicate a transition away from napping, although longitudinal studies of this process are lacking); children were classified as resters (n=48) if their teacher rated them as "never" or "rarely" sleeping during sleep/rest time, and rated them as "never" or "rarely" having difficulty lying quietly during sleep/rest time. Children who "sometimes" "had difficulty lying quietly at sleep time" were also included in the resters group. Children were classified as problem pappers (n=25) if their teacher rated them as "never" or "rarely" sleeping during sleep/rest time, and rated them as "often" or "always" having difficulty lying quietly during sleep/rest time.

Results

The descriptive statistics for the predictor variables according to groups are displayed in Table 1, along with the univariate ANOVA results.

Discriminant function analysis

A discriminant function analysis was used to determine which variables discriminated between the different napping types. The discriminant function analysis revealed 3 discriminant functions, Λ=0.678, χ^2 (21, N=158)=58.84, p<0.001. After controlling for the first function, the second and third functions combined still significantly discriminated between groups, Λ=0.861, χ^2 (12, N=158) =22.68, p=0.031. After controlling for the first and second functions, the third function did not significantly discriminate between groups, Λ=0.981, χ^2 (5, N=158)=2.88, p=0.719. The first, second, and third functions accounted for 62.9% (Rc^2=0.21) and

32.6% (Rc^2=0.12), and 4.5% (Rc^2=02) of the between-group variance, respectively.

The correlations between the predictor variables and the discriminant function scores indicated that nighttime sleep duration (r=0.84), BIA (r=0.46), and age (r=0.45) loaded most strongly onto Function 1; parental education (r=0.80) loaded most strongly onto Function 2; and, externalizing behaviour (r=0.76), temperament (r=−0.41), and Internalizing behaviour (r=0.33) loaded most strongly onto Function 3. Given these correlations, Function 1 was labeled maturation due to the age and cognitive function loadings, Function 2 was labeled socioeconomic status, and Function 3 was labeled behavioral problems. The structure matrix is presented in Table 2.

To test which groups differed significantly on each function, follow-up one-way ANOVAs and post hoc tests using Dunnett's T3 multiple comparisons (due to unequal group sizes) were conducted on the discriminant scores from the functions. The omnibus F revealed that there was a significant difference between the groups on both Function 1 [F(3,154)=13.58, p<0.001] and Function 2 [F(3, 154)=2.95, p=0.034), but not Function 3 [F(3, 154)=0.98, p=0.405].

On Function 1, nappers (centroid =−0.77) scored significantly lower than did transitioners (centroid =0.014; M difference=−0.68, p=0.024, 95% CI [−1.30, −0.06]), resters (centroid =0.515; M difference= −1.23, p<0.001, 95% CI [−1.80, −0.66]), and problem nappers (centroid =0.338; M difference=−1.20, p<0.001, 95% CI [−1.78, −0.61]). No other significant between group differences were found on Function 1.

On Function 2, problem nappers (centroid −0.73) scored significantly lower than did transitioners (centroid =0.42; M difference=0.72, p=0.034, 95% CI [0.38, 1.40]), but not nappers (centroid =−0.10; M difference=0.35, p=0.730,

Table I Univariate one-way ANOVA

Predictor variables	Nappers n=44	Transitioners n=41	Resters n=48	Problem nappers n=25	F	Λ
Age in years	57.36 (4.24)	59.56 (3.66)	59.65 (3.53)	59.00 (4.05)	3.33*	0.939
Parent education	4.82 (1.36)	5.57 (1.16)	5.51 (0.96)	4.60 (1.33)	6.02**	0.895
BIA scale	445.17 (11.09)	451.06 (12.16)	451.90 (10.66)	450.39 (10.56)	3.26*	0.940
Sleep duration	10.50 (0.56)	10.76 (0.56)	11.06 (0.56)	11.16 (0.49)	10.84***	0.826
Temperament	2.96 (0.70)	3.16 (0.81)	3.32 (0.81)	3.07 (0.59)	2.15	0.960
Internalizing	2.77 (2.65)	2.39 (2.19)	2.25 (2.19)	3.20 (2.71)	0.94	0.982
Externalizing	5.61 (3.44)	4.77 (4.13)	3.42 (2.99)	5.04 (3.53)	3.18*	0.942

Notes: Λ=Wilk's Lambda. *p<0.05. **p< 0.01 ***p<0.001. df=3, 145.
Abbreviation: BIA, Brief Intellectual Ability.

Table 2 Discriminant function structure matrix

Predictor	Function 1 Maturation	Function 2 SES	Function 3 Behavioural problems
Sleep duration	**0.840***	−0.387	0.019
BIA scale	**0.461***	0.171	0.324
Age	**0.447***	0.239	0.402
Parent education	0.317	**0.802***	−0.110
Externalizing	−0.408	−0.207	**0.758***
Temperament	0.347	0.214	**−0.406***
Internalizing	−0.090	−0.316	**0.334***

Note: Bolded values load onto the respective functions.
Abbreviation: BIA, Brief Intellectual Ability.

95% CI [−0.39, 1.09]) or resters (centroid =0.11; M difference=0.55, p=0.139, 95% CI [−0.10, 1.21]), indicating that problem pappers came from a significantly lower socioeconomic status background than did the transitioners. No other group differences were found on Function 2. These findings are presented visually in Figure 1.

Classification

Overall, 52.5% of the original cases were correctly classified (Kappa =0.32, p<0.001), indicating that the model's statistical predictive ability was above chance with a "fair" degree of accuracy.[22] At the individual group level, 63.6% of nappers, 36.6% of transitioners, 66.7% of resters, and 32% of problem Nappers were correctly classified. The "leave-one-out" cross validation method revealed that 46.2% of cross-validated grouped cases were correctly classified, indicating good generalisability of the solution.

Discussion

This study is among the first to examine the neurodevelopmental correlates of napping behavior in children. The results revealed that nappers and non-napping children could be discriminated by a range of neurodevelopmental and demographic characteristics, but not discriminated by temperament or behavioral characteristics. Overall, the results revealed that nappers were younger, had poorer cognitive functioning, and shorter nighttime sleep duration than non-nappers (ie, resters and problem pappers) and children who were transitioning away from napping (ie, transitioners). These factors point to the importance of maturational factors, including changes in the distribution of sleep across the day and nighttime hours. In addition, we found that socioeconomic status differentiated between some of our napping groups; specifically, non-nappers who had difficulty lying still were from families of likely lower socioeconomic status than children who were transitioning away from napping.

The finding that children who were still napping during scheduled naptimes performed more poorly on tests of cognitive functioning than do children who were no longer napping or transitioning away from napping is consistent with some previous reports.[23] However, findings on the relationship between cognitive functioning and napping have been mixed,[1] and a broad view remains that sleep, and specifically naps, act in an important way to consolidate new learning.[24] The necessity and benefit of napping for younger
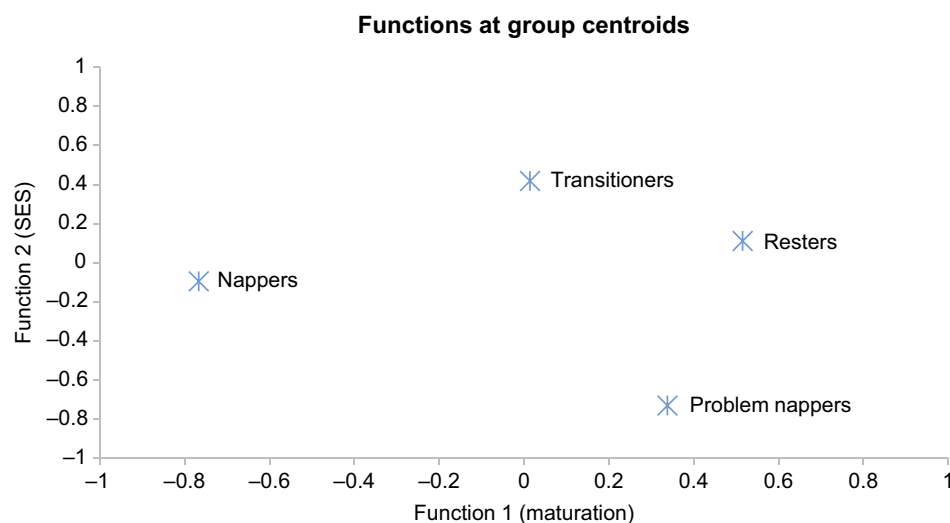
Functions at group centroids

Figure 1 Depiction of group centroids on the discriminant functions.

children seem clear, but as children age, sleep consolidation is associated with, reflects, or even drives brain maturation, consistent with a changing function of sleep over time.

The finding that non-nappers had longer nighttime sleep duration than did nappers is consistent with previous reports,[3,10,25,26] and reiterates the reciprocal links between nighttime and daytime sleep.[27] Collectively, these findings may be consistent with a maturation hypothesis, which suggests that napping cessation represents a developmental milestone in early childhood.

The finding that parental education (as a proxy for socioeconomic status) was lower for problem nappers than for transitioners suggests that there may be direct or indirect demographic influences contributing to differences in napping behaviors in preschool children. This socioeconomic dimension to variability in napping type might act through differences in 24 hr routines (eg, more or less prescriptive or stable home routines), choices around parental work schedules that contribute to the pattern of attendance, differences in family-level modeling of sleep behaviors, or other social constructs.

In our sample, 16.5% of preschoolers were classified as problem nappers, but these children did not demonstrate any increased difficulties in general behavior and temperament outside of the nap period compared to the other groups. Rather, these children displayed behavioral difficulties specific to nap times. This finding questions the conceptualization of "problem napper", defined in the previous literature[13–16] to have a more difficult temperament in general (ie, higher negative affect, lower effortful control) than non-problem nappers.[13] While these contrasting findings may be due to differences in group classification, our data remain consistent with the possibility that this group is typically developing children who are transitioning away from napping or no longer have the need to nap. Their behavior around nap times may be better described as "restless" and understood more neutrally as an expected behavior at this period in their development.

In this study's sample, 26% of children were classified as transitioners, or children who sometimes slept during daytime sleep opportunities. This group may reflect a transition phase between biphasic and monophasic sleep, or some other state consistent with intermittent or irregular napping. It remains possible that this group is more influenced by environmental factors, and that this group may include children taking an opportunity to nap when they otherwise would not.

This study undertook a novel multivariate approach to understanding the neurodevelopmental correlates of napping cessation; however, a number of limitations should be kept in mind when interpreting these findings. The sample consisted of children between the ages of 4 and 6 years attending licensed daycare centers in Australia. It is unknown whether these results generalize to younger children, to children from different cultural contexts, or to children receiving care outside these settings. By confining our study to childcare settings with scheduled naptimes we were able to remove the influence of a range of potential confounds (including wide variation in daytime practices and environments) by holding the napping context constant. Daytime nap behaviors are likely to represent an interaction between developmental factors and environmental factors including the constraints of routines and scheduling within childcare environments. The role of attendance at childcare, and the patterns of attendance across the week, in directly influencing nap behaviors should be determined at the child level in future studies. Our groups were defined on the basis of educator report, and the nighttime sleep duration was measured via parent-report in increments of 30 mins. As such, the accuracy of these classifications may be less reliable than if measured using objective measurement. Further, subjective assessment of nighttime sleep duration (parent report) and napping behavior (educator report) precluded the assessment of possible sleep disorders (eg, obstructive sleep apnea, parasomnias) in this cohort, which may influence napping behavior. Missing data, such as that from parent reports of sleep at home, may introduce biases that also limit interpretation and generalizability of the findings. The use of continuous objective measurement of habitual sleep, such as actigraphy, may provide a partial alternative to observer report of children's sleep.

Finally, this study was cross sectional, and the study design means that we cannot disentangle the direction of the associations between the variables and napping type, and the term "predictors" is used here only in the statistical sense. Prospective studies that examine the timing, nature, and duration of the transition from biphasic to monophasic sleep are needed to better understand the mechanisms of causality.

Conclusion

We challenge the standard practice of scheduling naptimes for all children throughout the preschool period. Although 30% of the observed children did sleep during naptime, most never napped or only napped sometimes. We hypothesize that the shift away from napping is underpinned by a major developmental change in the

neurobiology of sleep–wake control, and in the neurocognitive functions of sleep.

As such, sleep transition might be seen as a developmental milestone analogous to walking and talking, with the need to be responsive to individual changes in need, purpose, and patterns of daytime sleep in developing children. This possibility should be tested directly in longitudinal studies across the early years that measure these developmental dimensions concurrently.

Approvals

Full ethical approval was received from the Human Research Ethics Committee of the Queensland University of Technology. Written informed consent was received from parents and childcare staff. The research was conducted in accordance with the Declaration of Helsinki.

Acknowledgments

Author contributions

All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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References

1. Thorpe K, Staton S, Sawyer E, Pattinson C, Haden C, Smith S. Napping, development and health from 0 to 5 years: a systematic review. *Arch Dis Child*. 2015;100:615–622. doi:10.1136/archdischild-2014-307241
2. Tayler C, Ishimine K, Cloney D, Cleveland G, Thorpe K. The quality of early childhood education and care services in Australia. *Aust J Early Child*. 2013;38:13.
3. Staton SL, Smith SS, Pattinson CL, Thorpe KJ. Mandatory naptimes in child care and children's nighttime sleep. *J Dev Behav Pediatr*. 2015;36:235–242. doi:10.1097/DBP.0000000000000157
4. El-Sheikh M, Arsiwalla DD, Staton L, Dyer WJ, Vaughn BE. Associations between preschoolers' daytime and nighttime sleep parameters. *Behav Sleep Med*. 2013;11:91–104. doi:10.1080/15402002.2011.625460
5. Galland BC, Taylor BJ, Elder DE, Herbison P. Normal sleep patterns in infants and children: a systematic review of observational studies. *Sleep Med Rev*. 2012;16:213–222. doi:10.1016/j.smrv.2011.06.001
6. Jenni OG, Carskadon MA. Sleep behavior and sleep regulation from infancy through adolescence: normative aspects. *Sleep Med Clin*. 2012;7:529–538. doi:10.1016/j.jsmc.2012.06.002
7. Gerber RJ, Wilks T, Erdie-Lalena C. Developmental milestones: motor development. *Pediatr Rev*. 2010;31:267–276. doi:10.1542/pir.31-7-267
8. Conti-Ramsden G, Durkin K. Language development and assessment in the preschool period. *Neuropsychol Rev*. 2012;22:384–401. doi:10.1007/s11065-012-9208-z
9. Fukuda K, Sakashita Y. Sleeping pattern of kindergartners and nursery school children: function of daytime nap. *Percept Mot Skills*. 2002;94:219–228. doi:10.2466/pms.2002.94.1.219
10. Ward TM, Gay C, Anders TF, Alkon A, Lee KA. Sleep and napping patterns in 3-to-5-year old children attending full-day childcare centers. *J Pediatr Psychol*. 2008;33:666–672. doi:10.1093/jpepsy/jsm102
11. Staton SL, Smith SS, Thorpe KJ. "Do I really need a nap?": the role of sleep science in informing sleep practices in early childhood education and care settings. *Transl Issues Psychol Sci*. 2015;1:32. doi:10.1037/tps0000011
12. Akacem LD, Simpkin CT, Carskadon MA, et al. The timing of the circadian clock and sleep differ between napping and non-napping toddlers. *PLoS One*. 2015;10:e0125181. doi:10.1371/journal.pone.0125181
13. Ward TM, Gay C, Alkon A, Anders TF, Lee KA. Nocturnal sleep and daytime nap behaviors in relation to salivary cortisol levels and temperament in preschool-age children attending child care. *Biol Res Nurs*. 2008;9:244–253. doi:10.1177/1099800407310158
14. Hall M, Levenson J, Hasler B. Sleep and emotion. In: *The Oxford Handbook of Sleep and Sleep Disorders*. The Oxford University Press; 2012:131–149.
15. Hall W, Scher A, Zaidman-Zait A, Espezel H, Warnock F. A community-based study of sleep and behaviour problems in 12-to 36-month-old children. *Child Care Health Dev*. 2012;38:379–389. doi:10.1111/j.1365-2214.2011.01252.x
16. Scher A, Hall WA, Zaidman-Zait A, Weinberg J. Sleep quality, cortisol levels, and behavioral regulation in toddlers. *Dev Psychobiol*. 2010;52:44–53. doi:10.1002/dev.20410
17. Pattinson CL, Staton SL, Smith SS, Sinclair DM, Thorpe KJ. Emotional climate and behavioral management during sleep time in early childhood education settings. *Early Child Res Q*. 2014;29:660–668. doi:10.1016/j.ecresq.2014.07.009

18. Tayler C, Cloney D, Adams R, Ishimine K, Thorpe K, Nguyen TKC. Assessing the effectiveness of Australian early childhood education and care experiences: study protocol. *BMC Public Health*. 2016;16:1. doi:10.1186/s12889-016-2985-1

19. Woodcock RW, McGrew KS, Mather N, Schrank F. *Woodcock-Johnson III NU Tests of Achievement*. Rolling Meadows (IL): Riverside Publishing; 2001.

20. Goodman R. The strengths and difficulties questionnaire: a research note. *J Child Psychol Psychiatry*. 1997;38:581–586.

21. Prior M, Sanson A, Smart D, Oberklaid F. *Pathways from Infancy to Adolescence: Australian Temperament Project 1983–2000*. Melbourne (Australia): Australian Institute of Family Studies; 2000.

22. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33:159–174. doi:10.2307/2529310

23. Kurdziel L, Duclos K, Spencer RM. Sleep spindles in midday naps enhance learning in preschool children. *Proc Natl Acad Sci*. 2013;110:17267–17272. doi:10.1073/pnas.1306418110

24. Sandoval M, Leclerc JA, Gómez RL. Words to sleep on: naps facilitate verb generalization in habitually and nonhabitually napping preschoolers. *Child Dev*. 2017;88:1615–1628. doi:10.1111/cdev.12723

25. Lam JC, Mahone EM, Mason TB, Scharf SM. The effects of napping on cognitive function in preschoolers. *J Dev Behav Pediatr*. 2011;32:90. doi:10.1097/DBP.0b013e318207ecc7

26. Staton SL, Smith SS, Hurst C, Pattinson CL, Thorpe KJ. Mandatory nap times and group napping patterns in child care: an observational study. *Behav Sleep Med*. 2017;15(2):129–143.

27. Stein MA, Mendelsohn J, Obermeyer WH, Amromin J, Benca R. Sleep and behavior problems in school-aged children. *Pediatrics*. 2001;107: e60–e60.