Sleep Environments and Sleep Durations in a Sample of Low-Income Preschool Children

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Study Objectives: Sleep duration is commonly studied in children, but less is known about the potential impact of adverse sleep environments, particularly at preschool ages. We examined the frequency of suboptimal sleep environments and tested for associations with sleep duration or nocturnal sleep time among low-income preschool children.

Methods: Parents of Head Start preschoolers in Michigan (Detroit and greater Lansing) completed questionnaires on children's sleep schedules and sleep environments. Respondents indicated how often their children slept in a place "too bright," "too loud," "too cold," or "too hot" on a scale of 1 = never to 5 = always. A suboptimal sleep environment (SSE) was defined when one or more of these conditions were reported for ≥ 1 -2 nights/week. Weeknight sleep duration or reported time that the child went to sleep was regressed on SSE as an explanatory variable, with adjustment for age, race/ethnicity, gender, maternal education, and average daily nap duration.

Results: Among 133 preschool children, mean age was 4.1 ± 0.5 (SD), 48% were male, 39% were white, and 52% were black; 34% of parents had $\leq$ a high school degree. Parents reported that 26 (20%) of the children slept in a SSE ≥ 1 -2 nights per week. In regression models, SSE was associated with 27 minutes shorter sleep duration ($\beta = -0.45$, SE = 0.22, $p = 0.044$) and 22 minutes later time child "fell asleep" ($\beta = 0.37$, SE = 0.19, $p = 0.048$) on weeknights.

Conclusions: Among these Head Start preschool children, environmental challenges to adequate sleep are not uncommon, and they may have consequences. Clinician or preschool assessment of sleep environments may open opportunities to improve sleep at early ages.

Keywords: Sleep, preschool children, environment

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Sufficient sleep is critical for children's overall health, growth, and development.¹ Insufficient sleep is associated with a number of daytime consequences, including lower cognitive performance on intelligence testing and more teacher-reported attention difficulties.^{2,3} In preschool children, inadequate sleep is linked to poor school performance and hyperactive behavior.⁴ However, many US children may be sleep deprived, and this problem can begin even in early childhood.⁵ Although sleep needs of children at specific ages, as opposed to the amounts of sleep that children actually obtain, require additional study and better definition, many preschool-age children do not obtain the 11-13 hours of sleep that are often recommended.⁶

Minority and low-income children may be at particular risk for shorter sleep duration, which could create an important health disparity and public health issue. Minority children tend to sleep less than their white peers.^{7,8} Children living in low socioeconomic status neighborhoods rather than more affluent areas are more likely to obtain insufficient sleep,⁸ report bedtime difficulties,⁷ and have an irregular bedtime routine.⁹ In this context, a better understanding of environmental factors that may affect sleep duration, particularly in minority and low-income children, would be useful.

Despite the importance of getting adequate sleep and the growing recognition of health disparities in sleep, sleep habits of low-income preschool-age children remain understudied. More

BRIEF SUMMARY

Current Knowledge/Study Rationale: Little information exists on the frequency and potential consequences of suboptimal sleep environments among low-income preschool children in the US. The aim of this study was to examine the frequency of potentially challenging sleep environments and to test the hypothesis that they are associated with shorter sleep duration and a later nocturnal sleep time.

Study Impact: Suboptimal sleep environments were reported for 20% of this Head Start preschool sample and were associated with both shorter sleep duration and later sleep times. Clinicians should inquire about the home sleep environments when they see preschool children from low-income settings.

specifically, the impact that a child's basic sleep environment may have on sleep has been scarcely addressed in the literature. To our knowledge, only two Belgian studies have reported on children's environmental exposure to light or noise in the home during sleep.^{10,11} Kahn et al. found that about one-quarter of children slept in an environment with exposure to either noise or light and that these were each associated with poor sleep.¹⁰ Spruyt et al. reported exposure to "intrusive" light in 43.7% of bedrooms and noise in 9.9% of bedrooms; however, they did not test the association of light and noise exposure with poor sleep.¹¹

To our knowledge, no studies have investigated the burden of challenging sleep environments among US preschool-age

Figure 1—Recruitment diagram

children and the potential association with sleep duration. Data on this age group could be particularly important, because increasing evidence suggests that sleep problems at early ages could have lasting, newly emergent, or irreversible consequences years later.¹²⁻¹⁵ Moreover, school readiness established at preschool ages has lasting influence on subsequent achievement.^{16,17} We aimed to better define the frequency of suboptimal sleep environments within a sample of low-income preschool children in Michigan, and to test for associations with shorter sleep duration and a later nocturnal sleep time.

METHODS

General Study Design

For this cross-sectional study, participants were recruited by flyers sent home to all parents with children enrolled in Head Start (federally funded preschool for low-income children) at participating sites in greater Lansing and Detroit, Michigan. Multiple recruitment efforts were made including sending home flyer invitations to attend a monthly parent meeting to “learn how to get a better night sleep” for their child for all families in Lansing and approximately half of the Detroit families. The remaining Detroit families received a flyer to “welcome [parents] to a new school year” and announce the upcoming sleep education program that would be coming to their Head Start later in the school year. Flyers also invited parents to participate in a research study “about their child’s sleep.” For the Detroit sites, parents were also recruited in person during Head Start orientation to attend the upcoming parent meeting either to learn about their child’s sleep or to welcome them to the new school year and to participate in the research study. However, attendance at Head Start orientation was not required for subsequent study participation. Head Start staff also encouraged attendance at the parent meeting.

Surveys were sent home to all parents in advance of the parent meeting and were also available at the beginning of the parent meeting. Although many parents completed the surveys independently at home, additional time to complete them was also given at the beginning of the meeting. All but a small minority ($n = 7$) of

the surveys were collected at the parent meeting prior to the start of the educational program. All parents who provided data analyzed in this report provided written informed consent in person upon arrival to the parent meeting. All families who participated in this study met federal poverty guidelines and none paid Head Start tuition. This survey was approved by the University of Michigan Institutional Review Board, as a first component of a two-phase study in which families could also participate in assessment of a sleep education program. Each parent who completed the initial surveys for the parent study received a \$10 gift card.

Participants

Six Head Start sites in Detroit and 7 sites in the greater Lansing area participated. There were several differences between sites including: (1) Detroit sites were in an urban setting whereas Lansing sites were rural in location, (2) Detroit sites were predominantly black whereas Lansing sites were white, (3) Detroit sites were full-day programs with a scheduled afternoon nap incorporated into the program, whereas Lansing sites were either morning or afternoon half-day programs without a scheduled nap while at school, and (4) Lansing sites were visited in January and February of the school year while Detroit sites were visited in October and November of the school year.

To be eligible, a child had to be enrolled at one of the participating Head Start sites; a parent had to be able to complete the written survey independently and be consented for the study in English. The only exclusion criterion was that the child could not be a foster child for whom the legal signer of consent would be the state. Parents were asked to complete the surveys in reference to their youngest child currently attending Head Start only.

Among 294 Detroit families and 374 greater Lansing families eligible to participate, a total of 152 families consented, including 87 families from Detroit (30%) and 65 families from greater Lansing (17%). Among those who consented, 19 families were excluded from analyses because of incomplete survey responses for child age, child race, or maternal education. Therefore the total sample size for the present analyses was 133 families: 73 from Detroit and 60 from Lansing (**Figure 1**). The large majority of survey respondents were mothers (94% in Lansing and 86% in Detroit).

Table 1—Sample characteristics (n = 133) stratified by site location

Sample Characteristics	Total (n = 133)	Lansing Sites (n = 60)	Detroit Sites (n = 73)	p-value
Child age at time of survey, years ^a	4.1 (0.5)	4.3 (0.5)	4.0 (0.5)	< 0.001
Child gender male ^b	64 (48%)	27 (45%)	37 (51%)	0.51
Child race ^c				< 0.001
White	52 (39%)	52 (87%)	0 (0%)	
Black	69 (52%)	0 (0%)	69 (94%)	
Other	12 (9%)	8 (13%)	4 (6%)	
Child ethnicity Hispanic ^c	5 (4%)	4 (7%)	1 (2%)	0.20
Child Race/Ethnicity White and non-Hispanic ^b	51 (38%)	51 (85%)	0 (0%)	< 0.001
Maternal education ≤ High school ^b	45 (34%)	22 (37%)	23 (32%)	0.53
Weekday nocturnal sleep duration, hours ^a	10.2 (1.0)	10.5 (1.0)	9.9 (0.9)	< 0.001
Weekend nocturnal sleep duration, hours ^a	10.7 (1.1)	10.6 (0.9)	10.8 (1.3)	0.49
Weighted Average Daily Nap Duration, minutes ^d	38 (13-90)	19 (0-30)	60 (38-120)	< 0.001
Weeknight bedtime, h:min ^{a,e}	21:05 (48) ^f	20:53 (48) ^f	21:16 (48) ^f	0.01
Weekday wake time, h:min ^a	7:18 (48) ^f	7:26 (54) ^f	7:11 (48) ^f	0.10
Weekend bedtime, h:min ^{a,e}	21:48 (60) ^f	21:35 (60) ^f	21:52 (54) ^f	0.02
Weekend wake time, h:min ^a	8:30 (78) ^f	8:13 (66) ^f	8:44 (84) ^f	0.02
Poor sleep environment ≥ 1-2 days/week	26 (20%)	8 (14%)	18 (25%)	0.11

Values give are mean (SD), median (Q1-Q3), or n (%). Some n's are slightly smaller for some variables due to non-response of occasional items (range 119-133). ^aT-test, ^b χ^2 , ^cFisher exact test, and ^dWilcoxon tests were used. ^eParents were asked to report time child "fell asleep," which is reported as bedtime here. ^fStandard deviation is reported in minutes.

Measures

A sleep environment survey created for this study asked parents how frequently their child slept in specific environmental conditions that were "too loud," "too bright," "too hot," or "too cold" (**Appendix**). These sleep environment questions were selected based in part on published clinical recommendations on sleep environmental factors thought to be important for children's sleep.¹ Questions were written at a 7th grade or lower reading level and reviewed by several sleep and behavioral experts, community sleep educators, and Head Start staff for appropriateness. Questions were also piloted for clarity with approximately 100 other Head Start parents prior to use in this study. Response options were "Never: 0 nights/week," "Rarely: 1-2 nights/week," "Occasionally: 3-4 nights/week," "Frequently: 5-6 nights/week," or "Always: 7 nights/week."

Parents reported the typical time their child "fell asleep" and "woke up" on weekdays and weekends over the past 2 months. Parents also reported the weekly frequency of their child's daytime naps (0, 1-2, 3-4, 5-6, or 7 days per week) and the length of a typical nap. Basic demographic information included the child's date of birth, gender, race/ethnicity and maternal education level.

Statistical Analysis

Statistical analysis was performed using SAS 9.3 (SAS Institute, Cary, NC). The primary explanatory variable in analyses was sleep environment. To create a single sleep environment variable, response options for each of the 4 sleep environment items were dichotomized as "Never" vs. "Rarely (1-2 nights per week) or more," and children were categorized as having a comparatively "suboptimal sleep environment" if ≥ 1 of the 4 questions was answered affirmatively. Reduction in this manner to a binary variable was performed because an ordinal scale would have been

highly skewed, and we targeted a sensitive cut-point in part to ensure that the sample of affected children would not prove too small for analysis. The primary outcome was average weeknight sleep duration, calculated from reported times that the child "fell asleep" and "woke up" on weeknights and weekdays. We focused the present analysis on weeknight sleep duration, and time the child fell asleep on weeknights as a secondary outcome, because these should have less variability than weekend schedules and should be more pertinent for daytime consequences in the school setting. A weighted average daily nap duration was calculated as (typical nap duration) × (typical number of naps per week) / 7.

T-tests, χ^2 , and Wilcoxon tests were used as appropriate to assess differences in participant characteristics by site location. We similarly assessed differences in participant characteristics, at the Lansing sites only, between participants and all Head Start enrollees, as we were able to obtain from the Head Start program aggregate data for demographic variables of child gender, race, and education level. To test the hypotheses that suboptimal sleep environment (yes/no) is associated with shorter weeknight nocturnal sleep duration and later time asleep on weeknights, we first used unadjusted linear regression models for our sample of 133 participants. Next, we adjusted these models for potential confounders including child age, gender, race/ethnicity (white and non-Hispanic vs. non-white or Hispanic), and maternal education (≤ high school [HS] degree or equivalent vs. more). Since nocturnal sleep duration can be affected by daytime napping, we also controlled for weighted average daily nap duration in our final adjusted model.

RESULTS

Table 1 shows participant characteristics for the entire sample and for each location (Detroit vs. Lansing). The mean

child age was 4.1 (SD 0.5) years (range 2.9 to 5.2 years), with children at the Lansing sites being older by a few months, on average, than those at the Detroit sites ($p < 0.001$). Approximately half (48%) of the children were male. Overall, 39% of the children were white, 52% were black, and 8% were biracial or other. Children at the Lansing sites were predominantly white (87%), whereas children at the Detroit sites were 94% black ($p < 0.001$). Overall, 34% of the mothers had a high school (HS) degree/equivalent or less, with no statistically significant difference between sites. About half (49%) of the mothers had some college education, 8% had a 2-year degree, 8% had a 4-year degree, and 2% had more than a 4-year degree.

Aggregate data (not shown) available from Lansing sites suggested that the survey respondents were similar to all preschool families enrolled at the participating Lansing Head Start sites with regard to child gender and race ($p > 0.05$). However, survey respondents were more educated than aggregate families (63% mothers with $> HS$ degree vs. 49% parents with $> HS$ degree; $p = 0.04$).

Figure 2—Percentage of children sleeping at least 1-2 nights per week in different sleeping environments.

No statistical difference was noted between Lansing and Detroit.

Sleep Duration and Schedules

On average, children were reported to obtain 10.2 (SD 1.0) h of sleep on weeknights and 10.7 (SD 1.1) h of sleep on weekends. Overall, 83% of children took naps and of those, the mean nap duration was 1.6 (SD 1.0) h on 3.4 (SD 2.6) days per week. The distribution of the weighted average daily nap duration variable was skewed to the right with a median nap time of 38 min (IQR 13-90 min) per day. In regard to children's sleep schedules, children were reported to fall asleep on average at 21:05 (SD 48 min) on weekdays and at 21:48 (SD 60 min) on weekends. Children woke up on average at 07:18 (SD 48 min) on weekdays and slept about an hour later on weekends waking up at 08:30 (SD 78 min).

As shown in **Figure 2**, parents reported that their child slept in an environment at least one night per week that was "too loud" (14%), "too bright" (8%), "too hot" (12%), or "too cold" (3%). In total, 20% of parents reported that their child slept in an environment that was either "too loud," "too bright," "too hot," or "too cold" ≥ 1 -2 nights per week.

Association between Suboptimal Sleep Environment and Sleep Duration or Nocturnal Sleep Time

Associations of sleep environment with weeknight sleep duration are shown in **Table 2**. Suboptimal sleep environment was associated with a shorter sleep duration in the unadjusted model ($p = 0.022$), as well as when controlling for child age, gender, race/ethnicity, and maternal education, (Model 1, $p = 0.046$). This association persisted after weighted average daily nap duration was taken into account: children with a suboptimal sleep environment slept 27 fewer minutes than did children without a suboptimal sleep environment (Model 2, $p = 0.044$). Of the covariates, only white and non-Hispanic child race/ethnicity was associated with longer weeknight sleep duration in the unadjusted model ($p = 0.001$) and Model 1 ($p = 0.005$), and trended toward significance in the fully adjusted Model 2 ($p = 0.059$).

Associations of sleep environment with time child fell asleep are shown in **Table 3**. Suboptimal sleep environment was associated with a later time to fall asleep in the unadjusted model ($p = 0.025$), after child age, gender, race/ethnicity, and maternal education were taken into account (Model 3, $p = 0.038$). This association persisted after weighted average daily nap duration was also taken into account: children with a suboptimal sleep

Table 2—Unadjusted and adjusted models with weeknight nocturnal sleep duration as the outcome

Predictors	Unadjusted models n = 131		Adjusted Model 1 ^b n = 131		Adjusted Model 2 ^c n = 126	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Poor sleep environment (≥ 1 -2 days/week vs never)	-0.50 (0.22)	0.022	-0.43 (0.21)	0.046	-0.45 (0.22)	0.044
Child age, years	0.15 (0.16)	0.343	0.01 (0.16)	0.937	-0.02 (0.17)	0.921
Maternal education ($\leq$ high school vs. greater)	-0.01 (0.18)	0.953	-0.07 (0.18)	0.695	-0.07 (0.19)	0.726
Race/Ethnicity (white and non-Hispanic vs. non-white or Hispanic)	0.57 (0.17)	0.001	0.53 (0.18)	0.005	0.41 (0.21)	0.059
Gender (female vs. male)	0.17 (0.17)	0.343	0.08 (0.17)	0.640	0.09 (0.17)	0.603
Weighted average daily nap, hours ^a	-0.26 (0.10)	0.011			-0.15 (0.11)	0.204

^an = 126. ^bModel 1 has weeknight sleep duration as the primary outcome with poor sleep environment as the primary explanatory variable, adjusted for child age, maternal education, race/ethnicity and gender. ^cModel 2 has weeknight sleep duration as the primary outcome with poor sleep environment as the primary explanatory variable, adjusted for child age, maternal education, race/ethnicity, gender, and weighted average daily nap duration.

Table 3—Unadjusted and adjusted models with bedtime as the outcome

Predictors	Unadjusted Models n = 131		Adjusted Model 3 ^b n = 131		Adjusted Model 4 ^c n = 126	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Poor sleep environment (≥ 1 -2 days/week vs never)	0.41 (0.18)	0.025	0.38 (0.18)	0.038	0.37 (0.19)	0.048
Child age, years	-0.24 (0.13)	0.069	-0.18 (0.14)	0.192	-0.19 (0.14)	0.179
Maternal education ($\leq$ high school vs. greater)	0.18 (0.15)	0.231	0.19 (0.15)	0.200	0.22 (0.16)	0.169
Race/Ethnicity (white and non-Hispanic vs. non-white or Hispanic)	-0.31 (0.15)	0.039	-0.22 (0.15)	0.152	-0.25 (0.18)	0.160
Gender (female vs. male)	-0.22 (0.14)	0.123	-0.15 (0.14)	0.296	-0.16 (0.15)	0.288
Weighted average daily nap, hours ^a	0.05 (0.09)	0.572			-0.06 (0.10)	0.541

^an = 126. ^bModel 3 has weeknight bedtime as the primary outcome with poor sleep environment as the primary explanatory variable, adjusted for child age, maternal education, race/ethnicity and gender. ^cModel 4 has weeknight bedtime as the primary outcome with poor sleep environment as the primary explanatory variable, adjusted for child age, maternal education, race/ethnicity, gender, and weighted average daily nap duration.

environment fell asleep 22 min later than did children without a suboptimal sleep environment (Model 4, $p = 0.048$). Of the covariates, only white, and non-Hispanic child race/ethnicity was associated with an earlier time to fall asleep in the unadjusted model ($p = 0.039$), but this variable did not retain significance in the adjusted models.

Detroit vs. Lansing Site Differences

A number of differences in sleep duration and schedules were noted between Detroit and Lansing sites. For example, Lansing children slept longer on weeknights than did Detroit children (mean = 10.5 vs. 9.9 h, $p < 0.001$), while Detroit children had longer weighted average daily naps than did Lansing children (median = 1.0 vs. 0.3 h, $p < 0.001$). Lansing children also fell asleep earlier than did the Detroit children on weekdays (mean = 20:53 vs. 21:16, $p = 0.01$) and weekends (mean = 21:52 vs. 21:35, $p = 0.02$). Lansing children also had earlier rise times than Detroit children on weekends (mean = 8:13 vs. 8:44, $p = 0.02$). There were no significant differences in sleep environments between Lansing and Detroit. Site differences could not be distinguished from potential differences based on race/ethnicity because almost all students in Detroit were black and almost all in Lansing were white.

DISCUSSION

This cross-sectional study of 133 low-income preschoolers in Southeast Michigan suggests that 20% sleep in a suboptimal sleep environment at least 1-2 nights per week, and that this exposure is associated with a nocturnal sleep duration that is 27 minutes shorter, on average, and with falling asleep 22 minutes later on weeknights. As adequate sleep duration during childhood is widely believed to be a prerequisite for healthy cognitive, behavioral, and physical development, our data raise the possibility that modifiable adverse sleep environments may provide an often overlooked, yet worthwhile target for intervention.

The frequency of suboptimal sleep environments found in this study represents some of the first data from low-income US preschool-age children. In our study, 14% of children slept in an environment that was “too loud” at least one night per week. This is similar to previous reports that 9.9% to 23% of

Belgian school children slept in a loud environment.^{10,11} We found that 8% of children slept in an environment that their parents reported to be “too bright” at least one night per week. In contrast, 26% to 44% of Belgian school children slept in a room that was bright.^{10,11} Our US low-income preschool-age sample differs from the previous samples of Belgian school-age children, who were not low-income overall. Spruyt et al. collected their sleep information in June, while our surveys were collected in the fall and winter months, and extended daylight hours at the end of spring may have increased the percentage of children who sleep in rooms that are too bright. Additionally, Spruyt found that urban children in comparison to rural children had a higher frequency of the environment being too bright, which may demonstrate differences in neighborhood environments in Belgium versus the US. Finally, the Belgian studies did not comment on the frequency of children who slept in an environment that was too hot or too cold. Therefore, our findings add to the minimal existing literature on the topic of suboptimal sleep environments during childhood. Our finding that a suboptimal sleep environment is associated with shorter sleep duration and falling asleep later also extends findings from Spruyt et al., the only group to study this previously, as they found that excessive noise or light exposure was associated with poor sleep as defined by sleep onset latency longer than 30 minutes and at least one nocturnal arousal occurring at least two nights/week.¹⁰

Although a difference of about half an hour in sleep duration, time of going to sleep, or sleep latency may not seem at first glance to be substantial, research on consequences for key neurobehavioral and metabolic outcomes linked to sleep suggest that sleep differences of this magnitude, based on suboptimal vs. better sleep environments, could have profound implications, especially when considered over chronic periods of time and on a population scale.¹⁸⁻²⁰ For example, in one experimental study, children randomized to only 5 days of sleep extension slept 27 minutes longer on average, and experienced improved alertness, emotional lability, and restless-impulsive behavior, as assessed by teachers who were masked to treatment group.²¹ Conversely, in another study, boys subjected to an average of 46 minutes of sleep restriction for only one week showed deterioration of attention, speech perception, and executive function.²²

We also found a difference in sleep patterns between the Detroit and Lansing children, with children in Lansing having longer nocturnal sleep duration and shorter weighted average daily nap duration, as compared to children in Detroit. Although comparisons between the two locations were not a main objective of our study, we were surprised to find such differences in sleep patterns between the Detroit and Lansing samples. The differences may reflect nap schedules in the full versus half-day preschool programs and previously reported cultural differences in naps. Although the daytime nap typically is eliminated during the preschool years for most children, cultural influences may affect the age at which the daytime nap is weaned.⁹ Specifically, minorities tend to wean the daytime nap at a later age.²³ In our study, the largely black sites in Detroit reported more daytime naps than did the Lansing sites, which were largely white.

Our study does have several limitations that reflect the challenges of community-based research with children in low-income populations. Our response rates of 21% to 29% were good, in this setting, possibly as a result of efforts to maximize participation. However, respondents still represented a minority of targeted families, the overall sample size was limited, and the study was restricted to low-income preschoolers in one US state region. These factors limit generalizability of conclusions, especially to other socioeconomic groups, ages, and locations. Survey respondents in Lansing, compared to non-respondents, were more educated than Lansing Head Start parents overall, and may well have differed on other unmeasured characteristics. However, aggregate data reflected highest level of education of either parent, while our survey asked about highest maternal education level, which could account for some of the noted difference between our sample and the aggregate sample. The fact that parents were asked to complete written surveys independently also may have limited the sample to parents with a high enough literacy level to complete the surveys. Additionally, our recruitment efforts may have biased our sample to appeal to parents with more concerns regarding their child's sleep. Furthermore, as our study was not a randomized controlled trial of sleep environments, our findings cannot prove causality. Finally, all measures were based on parent reports. Our study included reported time the child falls asleep but did not include bedtime. This means that we cannot know whether suboptimal sleep environments were associated with later bedtimes or longer sleep latencies after bedtime. Future studies that include more objective evaluation of sleep latency, sleep duration, and sleep times, if not also sleep environments, could be illuminating.

Nonetheless, our current results do suggest a surprisingly low frequency of exposure to a suboptimal sleep environment in a low-income sample of preschoolers in Southeast Michigan. At the same time, however, those children who do have suboptimal sleep environments in comparison to their peers appear to be at risk for shorter nocturnal sleep duration and for falling asleep later. Identification of the underlying reasons may be helpful as we seek to address health disparities in sleep. Future studies that incorporate objective measures of sleep environment characteristics and associated daytime consequences are needed to better understand issues that could have significant public health implications. In the meantime, amidst commonly expressed concern that children do not obtain sufficient sleep,

evaluation for the possibility of suboptimal sleep environments could offer new opportunities for clinicians and preschool staff to identify needs and improve sleep at early ages.

APPENDIX

Sleep Environment Questionnaire

Parents were asked to rate how frequently their child slept in a specific environment from never to always.

Please rate how often your child

...sleeps in a place that is loud or noisy.

...sleeps in a place that is too bright.

...during the summer, sleeps in a place that is too hot.

...during the winter, sleeps in a place that is too cold.

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