THE RELATIONSHIP BETWEEN SLEEP QUANTITY, SLEEP QUALITY, AND DAYTIME EXTERNALIZING BEHAVIORS IN URBAN PRESCHOOL AND TODDLER CHILDREN

By

JAMIE LYNN FLANNERY

A thesis submitted to the

School of Graduate Studies

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Masters of Arts

Graduate Program in Psychology

Written under the direction of

Lauren Daniel, Ph.D.

And approved by

_____

Lauren Daniel, Ph.D.

_____

J.J. Cutuli, Ph.D.

_____

Rufan Luo, Ph.D.

Camden, New Jersey

May 2019

ABSTRACT OF THE THESIS

The relationship between sleep quantity, sleep quality, and daytime externalizing behaviors in urban preschool and toddler children

By JAMIE LYNN FLANNERY

Thesis Director:

Dr. Lauren Daniel

One of the key factors for child cognitive and behavioral functioning is adequate amount of sleep (Touchette et al., 2007). Night awakenings and sleep disordered breathing are two factors that can negatively impact a child's sleep quality (Lavigne et al., 1999). Some research suggests that externalizing behaviors are related to insufficient sleep or poor sleep quality (Lavine et al., 1999; Gottlieb et al., 2003). The current study hypothesized that children with insufficient sleep and poor sleep quality would exhibit more externalizing behaviors. This study also explored the differences in sleep among different ethnic groups. 141 caregivers of children between the ages of 1 and 5 completed three surveys assessing demographic variables, sleep quantity, and sleep quality. Teachers completed two surveys assessing daytime sleepiness and daytime behaviors. On average, the children were reported as receiving 11 hours of 24-hour sleep and a sleep

onset latency of 28.1 minutes. Thirty-four percent of children had one or more-night awakening and 12.1% had high risk symptoms of sleep disordered breathing. After controlling for child sex, teacher report of daytime externalizing behaviors was significantly associated with teacher report of daytime sleepiness (β=0.37, p<.001). However, teacher report of daytime externalizing behavior was not significantly correlated with parent report of 24-hour sleep (β = 0.01, p=.720) or symptoms of sleep disordered breathing (β =0.03, p=.978). There was no difference in daytime externalizing behaviors (F(1,115)=0.64, p=.425,) for the presence (M=2.09, SD=1.13) or absence (M=1.96, SD=1.26) of night awakenings. Controlling for child sex and age, daytime externalizing behaviors were not associated with sleep onset latency (β =-0.00, p=.967). Finally, there were no differences between race/ethnicity and sleep variables. Contrary to hypotheses, teacher report of daytime externalizing behavior was not related to parent report of sleep. Nonetheless, teacher report of daytime sleepiness was strongly positively correlated with daytime externalizing behavior, suggesting that sleepiness may be affecting preschoolers' daytime behaviors. Other studies (Bates et al., 2002; Goodlin-Jones et al., 2009) found similar results, where indicators of poor sleep were not directly related to daytime behavior in preschool children, suggesting that the relationship of sleep and daytime behaviors may be more complex.

Acknowledgements

First, I would like to thank my mentor, Lauren Daniel, for all of her support and guidance. Lauren has been a huge inspiration and has helped me grow as a researcher. Because of her advice, my scientific writing and critical thinking have significantly improved. I would also like to thank Yael Gross. Yael guided me as I transitioned into the graduate program, training me and helping me improve upon consenting families, writing SPSS syntax, and many more valuable skills. I want to thank the past and present undergraduate students in our Pediatric Psychology Lab, including Monique Antoine, Lauren Dynmyer, Milca Madera, D'Angelo Milford, Morgan Pitcock. These students were a great help with contacting families, entering data, and organizing essential lab documents. Next, I would like to thank my thesis committee, J.J. Cutuli and Rufan Luo, for their excellent advice, insightful comments, and thought-provoking questions. Finally, thank you to all of the ELRA families that participated in our study and to all of the staff at ELRA who assisted and supported our project.

Introduction

One of the key factors for child cognitive and behavioral functioning is an adequate amount of sleep (Touchette et al., 2007). Studies have shown that a lack of sleep can negatively impact a child's development during their early years (Sadeh, Gruber, & Raviv, 2003; Zuckerman, Stevenson, & Bailey, 1987). When left untreated, poor sleep habits in early childhood can not only persist into later years (Zuckerman et al., 1987), but can also affect the child's mood (Fallone, Owens, & Deane, 2002), daytime behavior (Goodin-Jones, Tang, Liu, & Anders, 2009; Gregory, & O'Connor, 2012; Lavine et al., 1999; Gottlieb et al., 2003), academic readiness (Jung, Molfese, Beswick, Jacobi-Vessels, & Molnar, 2009), and health by increasing the risk for obesity and diabetes (Taveras, Rifas-Shiman, Oken, Gunderson, & Gilman, 2008; Flint et al., 2007). This study examined the relationship between sleep quality and quantity in children 1-5 years of age and daytime external behaviors.

Pediatric Sleep

Sleep needs vary by age. For toddlers (ages 1-3) the recommended amount of sleep is 11 to 14 hours (Paruthi et al., 2016). For preschoolers (ages 3-5), the recommended amount is 10 to 13 hours (Paruthi et al., 2016). During these ages sleep habits are established (Goodlin-Jones, Burnham, & Anders, 2001). Because parents still have influence over their child's bedtime, it is during this time that parents can help children develop healthy sleeping patterns (Goodlin-Jones et al., 2001). In 2016, Bonuck and colleagues conducted a study to assess parent knowledge of sleep habits for children in Head Start programs. When parents were asked about their child's sleep, 81% of parents reported that they believed that their child received a sufficient amount of sleep (Bonuck et al., 2016). However, 33% of the children did not obtain the recommended

amount of sleep (Bonuck et al., 2016). One reason for this disconnect could be related to the parent's lack of knowledge about child sleep. Because some parents may not be aware of the differences in sleep needs by age, parents may be unlikely to realize that certain sleep practices negatively impact their child (Owens, Jones, & Nash, 2011). Owens and colleagues found that the children whose parents underestimated the amount of sleep their child needed were more likely to have irregular bedtimes and an insufficient amount of sleep.

Another reason for children's lack of sleep may be associated with the parent's lack of knowledge about sleep hygiene (Owens et al., 2011; Mindell, Meltzer, Carskadon, & Chervin 2009). Sleep hygiene is defined as sleep practices that promote an adequate amount of time to sleep and good sleep quality for optimal daytime functioning (Mindell et al., 2009). Such practices include a consistent bedtime with a bedtime routine and not keeping stimulating electronics in the bedroom. Two of the most frequent problems for child sleep are sleep onset and night awakenings, both of which are associated with poor sleep hygiene (Lavigne et al., 1999). These issues are usually interrelated because sleep is a learned behavior (Gottlieb et al., 2003). For example, the child may have difficulties self-soothing if they become accustomed to the parent patting their back until they fall asleep. This becomes a problem when the child learns to only fall asleep when the parent completes these behaviors. Thus, when the child wakes up during the night, they would not be able to fall asleep again until the parent was present once again to pat their back (Mindell et al., 2009). Children typically learn to self-regulate their sleeping patterns during infancy (Goodlin-Jones et al., 2001). However, if the child does not reach this milestone, children are at higher risk of having a later sleep onset in future years (Zuckerman et al., 1987).

When children do not receive an adequate amount of sleep, their sleepiness can manifest in externalizing daytime behaviors (Aronen et al., 2000; Lavine et al., 1999). Such behaviors include inattention, hyperactivity, aggression, and noncompliance (Aronen et al., 2000). In Gregory and O'Connor's (2002) study, sleep problems in children at age 4 predicted aggression and attention problems in adolescence. However, attention and aggression problems in adolescence did not predict sleep problems in previous years. Thus, this study demonstrated that sleep problems led to externalizing behaviors in later years, but externalizing behaviors did not lead to sleep problems (Gregory & O'Connor, 2002). Lack of sleep in toddlers was also associated with an increased amount of externalizing behaviors (Lavine et al., 1999). Toddlers who slept 10 hours or less exhibited higher levels of hyperactivity, noncompliance, and aggression (Lavine et al., 1999). Finally, Aronen et al. (2000) utilized an activity monitor to measure sleep in elementary children. The children who presented lower amounts of sleep displayed higher rates of delinquent behavior, attention problems, and social problems (Aronen et al., 2000).

Sleep Disordered Breathing

Sleep disordered breathing includes a range of respiratory problems that can range from snoring to obstructive sleep apnea (Loughlin et al., 1996). Obstructive sleep apnea occurs when the airways are severely obstructed at night (Potsic, 1989). The most common is hyperplasia of the tonsils or adenoids, which can usually be cured through surgery (Potsic, 1989), and is present in about 4% of pediatric children (Lumeng & Chervin, 2008). Some children suffer from inadequate sleep due to an undiagnosed sleep breathing disorder because the parents are unaware of the signs, and therefore are unlikely to seek out treatment for their child (Owens et al., 2011). For example, when

children snore, it is typically a symptom of a sleep disorder, such as obstructive sleep apnea (Gottlieb et al., 2003). However, when parents were asked questions about child sleep heath, 50% of parents reported that they did not believe that snoring was a sign of poor sleep health (Owens et al., 2011).

When left untreated, sleep disordered breathing can result in behavioral problems and impaired school performance (Chervin, Dillon, Bassetti, Ganoczy, & Pituch, 1997; Gottlieb et al., 2003). Gottlieb and colleagues surveyed parents with children at age 5, inquiring about the child's sleep health and daytime behaviors. The children that exhibited symptoms of sleep disordered breathing possessed strong associations with hyperactivity, inattentiveness, aggressive behaviors, and daytime sleepiness (Gottlieb et al., 2003). While sleep disturbances are high in children diagnosed with Attention Deficit Hyperactive Disorder (ADHD), snoring and daytime sleepiness are significantly linked to inattentiveness and hyperactivity, even with kids who have not been diagnosed with ADHD (Kaplan et al., 1987; Chervin et al., 1997). When the symptoms of sleep disordered breathing were treated, the externalizing daytime behaviors significantly decreased (Huang et al., 2007; Marcus et al., 2013). Thus, Chervin et al. (1997), estimated that 25% of children diagnosed with ADHD could reduce their hyperactive, attentive symptoms if snoring was treated.

Napping and Daytime Sleep

Napping during the day has been found to be beneficial for both children and adults in improving wakefulness and learning performance (Lam, Mahone, Mason, & Scharf, 2011; Dhand, & Sohal, 2006). At 2 years, nearly all children take at least one daytime nap (Ward, Gay, Alkon, Anders, & Lee, 2008). At the ages of 4 or 5, many children cease napping (Ward et al., 2008). However, because some children continue to

have sleep deficiencies during the preschool years, such as not receiving an adequate amount of sleep due to late bedtimes or difficulty staying asleep due to disorders such as sleep apnea, the time in which a child no longer requires a nap is unclear (Lam et al., 2011). One study that utilized an actigraphy demonstrated that 56% of children ages 3 to 5 took naps on three consecutive days and only 10% of the children did not take a nap on any of the three days (Ward et al., 2008). There are no evidence-based guidelines for when and how long children require naps in early childhood (Daniel & Lewin, 2005). Nonetheless, children who are experiencing poor quality sleep due to sleep disorders or children that are not receiving an adequate amount of sleep may benefit from daytime naps (Lam et al., 2011).

Ethnic Differences in Sleep Habits

Co-sleeping is one sleeping behavior that may vary between cultures and has been very controversial (Crabtree et al., 2004; Milan, Snow, & Belay, 2007; Gupta et al., 2016). In some Caucasian/White populations, such as in the United States or Germany, optimal sleep hygiene includes the child sleeping alone in their room (Owens et al., 2011). This practice reflects the individualistic culture by encouraging the child to learn to self-regulate their sleep independently (Morelli, Rogoff, Oppenheim, & Goldsmith, 1992). However, in collectivistic cultures, such as in Asian or Hispanic/Latino cultures, some families do not practice independent sleeping (Morelli et al., 1992; Milan et al., 2007). In collectivistic cultures, sleeping alone is undesired and is avoided within some families, even into adulthood (Morelli et al., 1992). Thus, in these communities, co-sleeping may be a result of culture and rather than the child's poor sleep (Morrelli et al., 1992).

Familism, a concept referring to a strong emphasis on family goals, interconnectedness, and group support, is a strong component in the Hispanic/Latino culture (Calzada, Tamis-LeMonda, & Yoshikawa, 2012). In the Hispanic/Latino culture, the mother-child relationship is especially important (Milan et al., 2007). With the strong familial bonds, members of the family often complete daily activities with each other (Calzada et al., 2012). Co-sleeping may be one way in which this cultural value is transmitted (Milan et al., 2007). Additionally, Ramos, Youngclarke, & Anderson (2007) conducted a study that differentiated between children 5 years old or younger that were solitary sleepers, intentional co-sleepers, and reactive co-sleepers. Intentional co-sleepers were children whose parents chose early in the child's life to co-sleep due to cultural reasons (Ramos et al., 2007). Reactive co-sleepers, on the other hand, were children whose parents chose to co-sleep in response to the child's poor sleeping habits (Ramos et al., 2007). In this study, the parents of intentional co-sleepers were less likely than parents of solitary sleepers and parents of reactive co-sleepers to report their child's sleeping behaviors as problematic (Ramos et al., 2007). Therefore, while co-sleeping may not be recommended for optimal sleeping habits in Caucasian/White populations (Owens et al., 2011), the negative effects of co-sleeping may not be evident in the Hispanic/Latino population (Milan et al., 2007).

Some research suggests that poor sleep hygiene in young children is more prevalent in minority groups, such as African American and Hispanic/Latino children (Hale, Berger, LeBourgeois, & Brooks-Gunn, 2009). Hispanic/Latino and African American children living in low socioeconomic status (SES), urban, and racial/ethnic minority neighborhoods are more likely to have sleep problems and to average lower amounts of sleep for their age range (Hale et al., 2009; Peña et al., 2016). Aspects that

may be influencing this discrepancy may be due to sleep disordered breathing and sleep hygiene (Hale, Berger, LeBourgeois, & Brooks-Gunn, 2009; Crabtree et al. 2005, Lozoff, Askew, & Wolf, 1996). For example, when compared to Caucasian/White children, African American and Hispanic/Latino children were at greater risk of exhibiting sleep-disordered breathing (Hale et al., 2009, Goodwin et al., 2003). Also, Crabtree and colleague's (2004) study found that low SES was strongly linked to many sleep-related behaviors, such as bedtime resistance, parasomnia, and nocturnal awakenings. African American and Hispanic/Latina mothers in low SES and with less than a high school education were 30% less likely to enforce consistent bedtimes and regular bedtime routines when compared to Caucasian/White mothers (Lozoff, Askew, & Wolf, 1996).

Falling asleep alone is another sleep behavior that some research suggests is optimal for children (Owens et al., 2011). In Milan, Snow, and Belay's (2007) study examining ethnic differences in sleep habits, Hispanic/Latino children were more likely to share a bed with their parents than African American and Caucasian/White children. African American children were more likely to share a bed with siblings (Milan et al., 2007). Mindell, and colleagues' (2008) study on sleep hygiene found that children who fell asleep with a parent present had one of the worst sleeping patterns, which was associated with an increase in night awakenings. When parents were in the room at bedtime, infants averaged about 1.7 fewer hours of sleep, and school-aged children were 6 times more likely to wake up during the night (Mindell et al., 2008).

Current Study

Between the ages of 1 to 5, sleep habits are formed. Because parents still have an influence on the child's sleep behaviors during this age, parents have the opportunity to encourage healthy sleeping habits, which can positively affect the child's daytime mood,

behavior, and academic outcomes. Of the literature studying the relationship between sleep quantity, sleep quality, and externalizing behaviors, most of the samples have been primarily Caucasian/White (Gregory and O'Connor, 2002). Several studies have noted that minority groups are at a higher risk of having lower amounts of sleep, higher rates of bedtime resistance, parasomnias, and night awakenings (Goodwin et al., 2003; Hale et al., 2009; Lozoff et al., 1996; Peña et al., 2016). African American and Hispanic/Latino children are also at a higher risk of exhibiting symptoms of a sleep breathing disorder (Gottlieb et al., 2003). Research that has addressed diversity has noted the differences in sleep behaviors (Lozoff et al., 1996; Milan et al., 2007). Thus, it is important to assess if these differences in sleeping behaviors have a negative effect on the child's sleep, or if other differences should be addressed in order to ameliorate the sleep problems in the population.

I. This study aimed to examine the relationship between the amount of sleep and the quality of sleep children received and the daytime externalizing behaviors that follow.
    a) The children who did not receive the recommended amount of sleep for their age would exhibit more externalizing daytime behaviors, such as inattention, noncompliance, and aggression.
    b) The children with a longer sleep onset latency would have more externalizing behaviors.
    c) The children with the presence of night awakenings would have more externalizing behaviors.
    d) The children with more symptoms of sleep disordered breathing would have a higher amount of externalizing behaviors.

II. This study also aimed to further explore the differences between sleep quality in the racial/ethnic minority groups.

    a) (Exploratory) It was hypothesized that co-sleeping would be common in both Hispanic/Latino and African American families. However, based on the cultural values in the Hispanic/Latino culture and research on intentional co-sleeping, we hypothesized that co-sleeping within the Hispanic/Latino racial/ethnic group would not be associated with poor sleep quality.

Methods

Participants

Caregivers of 141 children, ranging in the ages of 1 to 5, who attended the Early Research Learning Academy (ELRA) at Rutgers University-Camden, participated in this study. In order to qualify for this study, caregivers must have been able to complete measures in either English or Spanish. Most caregivers were the biological parent (95%) and were either African American (43.3%) or Hispanic (51.1%). Average age of caregivers was 31.5 years (SD=9.02). About half of caregivers' (50.4%) highest obtained degree was a high school diploma/GED. Fifty-six percent of caregivers were single and 37.6% were married or living together. As reported by the caregiver, most children were either African American (40.4%) or Hispanic (39.7%). The average age of the children was 4.01 (SD=1.05). Full list of demographic information can be found in Table 1.

Surveys were also collected from the teachers of the children, whose caregivers consented to the study. Teachers completed surveys about the children's daytime sleepiness and daytime behaviors.

Procedure

In this cross-sectional study, potential participants were recruited by acquiring the attendance sheet for the infant, toddler, and preschool programs at ELRA to achieve a sample of children between the ages of 1 and 5. Those who qualified for the study were approached at the daycare by a research assistant during drop off, pick up, and during daycare events. In order to maintain consistency, there was a script for the research assistants to follow when approaching families. Scripts were available in both English and Spanish. For the caregivers that could only speak Spanish, a research assistant that was a native Spanish speaker was utilized to discuss the study. Each of the research assistants were female undergraduate psychology and health sciences majors at Rutgers University-Camden. Research assistants reviewed the consent form with the participants to make sure caregivers understand the purpose, the length, the potential risks and benefits, and compensation for participating in the study. After consenting, the participants completed surveys on an iPad via Qualtrics. If caregivers were unable to finish the survey in person, families were given an option to either schedule another time to complete the study, or a link was sent to caregivers via email to allow caregivers to continue completing surveys at a later time.

For those that did not have time to complete the surveys during pick up, drop off, or daycare events, research assistants gave the families the option to complete the surveys at home, online. An email, containing a link, brought the caregiver to the survey via Qualtrics. After being directed to Qualtrics, the participants viewed the IRB consent form, which was offered in either English or Spanish. Those who choose to sign and date the consent form continued onto the demographic questionnaire, and then to the subsequent surveys. This study took about 30 minutes to complete. For those who were unable to complete surveys online, a paper version of the surveys was administered. All

participants that completed the survey, whether in person or online, received a physical $10 gift card for either 7-Eleven or Walmart. For those that completed the survey online, a thank you email was sent, with a reminder of the next available time in which the research assistants would be at ELRA to give the caregiver their gift card. All gift cards that were distributed were recorded in a log to keep track of which participants have been compensated.

After surveys were finished by the caregivers, teachers were asked to complete surveys about the child's daytime behaviors. These surveys were given to teachers in paper form, to complete during work hours. Since ELRA is an institute dedicated to research, teachers are allotted time each day to participate in research studies. Thus, teachers used this time to complete the two short measures for the children whose caregivers completed and consented to the study. Teachers did not receive compensation for completing the surveys since participating in research studies is listed as part of their job requirement.

This study was approved by the IRB. There was no perceived harm. However, if participants felt uncomfortable answering certain questions, they were given the option to skip the question. If participants acknowledged that their child had severe sleep issues, research assistants would refer caregivers to the Children's Hospital of Philadelphia Sleep Center.

Measures

This study was a part of a larger study. Thus, only three out of the seven caregiver measures were utilized. Both teacher measures were used in this study. The dependent variables in this study were the externalizing behaviors, such as hyperactivity,

noncompliance, and aggression. The independent variables were the amount of sleep, the quality of sleep (the presence or absence of sleep disordered breathing symptoms, the presence or absence of night awakenings, and sleep onset), and race (Latino, Black, or Caucasian/White).

Caregiver Measures

All caregiver reports were available in either English or Spanish. Measures used in this study had pre-existing Spanish measures. These measures were back translated by a native Spanish speaking undergraduate research assistant. The measures were then translated back to Spanish by Para-Plus, a translation company.

Demographic Information. Caregivers were asked to report information about their age, race/ethnicity, education, employment, and marital status. Participants were also asked about their child's age, sex, and ethnicity.

Brief Infant/Child Sleep Questionnaire (BCSQ; Sadeh, 2004) assessed the child's sleeping habits. This questionnaire has 30 items inquiring about the child's sleep times, night awakenings, how much time the child is awake during the night, the sleep environment, and child's sleep problems, as perceived by the parent. This questionnaire is a mix of self-report (e.g., How much total time does your child spend sleeping during the night?) and multiple choice (e.g., Where does your child sleep most of the time? In his/her own room, in parents' room, in siblings' or other person's room, in another room of the house, other). This measure has been found to have good reliability (Cronbach's α=0.72). The validity of this survey is moderate. This questionnaire has been found to be significantly correlated with actigraphy (Kushnir & Sadeh, 2013). However, the parent's reports of the child's sleep tend to underestimate sleep onset time and overestimate the total amount of sleep (Kushnir & Sadeh, 2013). For this study, specific questions were

utilized to assess the quantity (e.g. How much total time does your child spend sleeping during the night?) and quality (e.g. How many times does your child typically wake during the night?) of the child's sleep.

Sleep Disordered Breathing Subscale of the Pediatric Sleep Questionnaire (SDBS; Chervin et al., 2000) is a measure used to detect sleep disordered breathing symptoms. Caregivers were asked a series of yes or no questions relating to the child's sleeping habits (e.g., When sleeping, does your child snore loudly? Yes, no, don't know). This measure has been found to have good validity in young children and when compared to an overnight polysomnography; it has had been reliable in predicting symptoms of sleep disordered breathing in children (Chervin et al., 2000). A subscale was used in this study, utilizing 15-items, which had a Cronbach's α of 0.69. A composite score was calculated by the number of positive responses (yes=1) divided by the number of positive and negative responses (no=0). If the participant chose 'don't know,' their answer would be considered missing and this question was removed from the denominator. A total score greater than 0.33 was used to indicate that the child was at high risk of a sleep-related breathing disorder.

Teacher Measures

Student records. Parental income was collected from ELRA's student records.

*The Teacher Daytime Sleepiness Questionnaire (*TDSQ; Owens et al., 2000) is a 10-item questionnaire that assessed the child's daytime behaviors that are reflective of the child's daytime sleepiness and daytime naps within the past week. It was originally designed for a sleep clinic, but was then modified, based off of clinical experience and literature review (Owens et al., 2000). Such behaviors include difficulties staying awake, yawning, and complaining about being tired. This measure was completed by the primary

teachers. This teacher measure has been typically used for school-aged children, but has been adapted for infants and toddlers for this study. The teachers were asked to rate how often does the child exhibits the daytime sleepiness behaviors as 'never or rarely (less than once per week),' 'Sometimes (at least once per week),' or 'usually (everyday).' The items were scored on a three-point scale, with higher scores indicating greater daytime sleepiness. This questionnaire had good reliability (Cronbach's α=0.67). The scores for the different items can differentiate between the different problem sleepers and the non-problem sleepers consistently, indicating good validity (Owens et al., 2000).

Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) is a 25-item questionnaire that assessed the emotional and behavioral problems in young children. The measure assessed emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. These components were used to assess how poor sleep habits were related to daytime behavior. Teachers were asked to rate the child's behaviors as "not true," "somewhat true," or "certainly true." The SDQ has been compared to the Child Behavior Checklist (CBCL). The SDQ has been well validated and had been found to be significantly correlated with detecting internal and external behavioral problems in young children, equal to the CBCL (Goodman & Scott 1999). The SDQ also has been found to be better at detecting inattention and hyperactivity than the CBCL (Goodman & Scott 1999). This measure also has the added benefit of being able to be completed in only about 5 minutes. The SDQ had good reliability (Cronbach's α=0.70). Items were scored from zero to two. The total difficulties score was calculated by summing the scores, which ranged from zero to 40. Scores greater than 15 indicate abnormal behavior. Items could also be grouped by externalizing and internalizing

behaviors. Each of these groups have a score ranging from 0 to 20. Scores greater than 11 indicate abnormal behavior.

Analytic Plan

SPSS was used to analyze the resulting data. Alpha was set to .05. The shape of the data was visually inspected for abnormalities within the distribution. The SDQ and the TDSQ were transformed using a square root transformation. An inverse transformation was used on the SDBS. I utilized mean substitution for missing data. If more than half of a survey was not complete, that participant's data was not included in analyses. I calculated the average caregiver age, race/ethnicity, marital status, relationship to the child and socioeconomic status. The child's age, race/ethnicity, sex, was also computed. Other descriptives that were obtained included how many adults and children were in the household and the child's sleep location. The following inferential statistics were computed:

- Hypothesis 1: The children that did not receive the recommended amount of sleep would have more externalizing daytime behaviors, such as hyperactivity, noncompliance, and aggression.
    - Amount of sleep was computed by combining the child's reported hours of nighttime sleep and daytime sleep. All toddler and preschool children at ELRA have scheduled naps. To validate the amount of night time sleep, questions from the BCSQ (What time does your child go to sleep; What time does your child wake up?) were computed. In order to validate the frequency of daytime naps, questions (During the past week, how often does the child take daytime naps?) from the TDSQ survey would be utilized.

    - Daytime behaviors were computed by utilizing the externalizing behaviors score from the SDQ.
    - Multiple linear regression was used to analyze the relationship between amount of sleep and daytime behaviors.
- Hypothesis 2a: Children with a longer sleep onset would have more externalizing behaviors, such as aggression, noncompliance, and hyperactivity than the children with a sufficient amount of sleep.
    - Sleep onset was computed by using the parent's response to a question from the BCSQ (How long does it take for your child to fall asleep?).
    - Multiple linear regression was used to analyze the relationship between sleep onset and daytime externalizing behaviors.
- Hypothesis 2b: The children with a presence of night awakenings would have more externalizing behaviors.
    - Presence or absence of night awakenings was computed by dichotomizing a question from the BCSQ (How many times does your child wake up during the night?).
    - ANCOVA was used to examine the difference of externalizing daytime behaviors between children that had a presence of night awakenings and those that had none.
- Hypothesis 2c: The children with more symptoms of sleep disordered breathing would have a higher amount of externalizing behaviors.
    - Symptoms of sleep disordered breathing were computed via SDBS.
    - Multiple linear regression was utilized to analyze the relationship between symptoms of sleep disordered breathing and daytime externalizing behaviors.

- Hypothesis 3: There would be a difference between sleep quality among the different racial groups.
    - ANCOVA was used to analyze the difference in sleep quality between African American children and Hispanic/Latino children.

Results

Preliminary Analyses

Frequency, means, and standard deviations of child 24-hour sleep, nighttime sleep, presence of night awakenings, sleep onset latency, symptoms of sleep disordered breathing, and externalizing daytime behaviors are presented in Table 2. Since a large part of the sample was made up of preschool children, analyses were conducted for the entire sample, toddler sample, and preschool sample. Of the toddler sample, 34.6% received less than the recommended 11 to 14 hours of sleep and 27.8% of preschoolers were reported as having less than the recommended 10 to 13 hours of sleep (Hirshkowitz et al., 2015). Since all preschool and toddler children at ELRA have a scheduled nap time, we also calculated the total amount of sleep during the night to account for some of the variability of sleep quantity within the sample. In the full sample, children were reported having an average of 8.81 hours (SD=2.61) of night time sleep. For toddlers, the average was 8.36 (SD=2.58) and for preschoolers, the average was 8.90 (SD=2.62). 34.0% of all children (42.3% toddler, 32.2% preschool) had at least one night awakening. 12.1% of children (7.60% toddlers, 13.1% preschoolers) were reported as being at high risk of having a sleep disordered breathing. Table 3 displays a comparison between the sleep variable descriptives in the current and in a national sample.

Overall, the total sample had an average of 5.63 (SD=4.99, Range=0.00-20.0) on the SDQ externalizing behaviors subscale, which is comprised of questions about

hyperactivity, inattentiveness, and conduct problems. On the hyperactivity-inattentiveness subscale, a score of seven or more indicates that the child is exhibiting a high rate of hyperactivity behaviors. In the full sample, 22.0% of children had a score of seven or more on the hyperactivity subscale. Fourteen percent of all children had a score of 5 or more on the conduct subscale, which indicates that the child was reported as having a high rate of conduct problems. The averages of both the hyperactivity and the conduct subscale are similar to the national average for their age group: in the 2001 National Health Survey, 15.0% of children aged 4-7 had high difficulties in inattention-hyperactivity and 19.0% of children aged 4-7 years were reported as having high difficulties in conduct problems (Bourdon et al., 2005).

We examined if demographic variables influenced dependent variables to determine the need for covariates in analyses. Male children (M=2.24, SD=1.17) had significantly more daytime externalizing behaviors (t(139)=-2.00, p=.047) than female children (M=1.79, SD=1.33). When examining the relationship between sleep and daytime externalizing behaviors, sex would be entered into models as a covariate. Child's age was significantly associated with the child's sleep onset latency (r=.58, p<.001). Child age was controlled for in analyses containing sleep onset latency.

Sleep Quantity and Daytime Externalizing Behaviors

Table 5 includes the regression analyses among primary variables. After controlling for child sex, parent report of child 24-hour sleep was not significantly correlated with teacher report of externalizing behaviors (F(2,138)=2.05, R=0.17, R^2=0.03, p=.720). This result was consistent for both the toddler (F(2,23)=0.68, R=0.24, R^2=0.06, p=.336) and preschool (F(2,112)=3.15, R=0.23, R^2=0.05, p=.584) groups. To account for the lack of variability between daytime naps, a linear regression was

conducted to analyze the relationship between night time sleep and daytime externalizing behaviors. This relationship was not significant in the total (F(2,138)=2.47, R=0.19, R^2=0.03, p=.336), toddler (F(2,23)=0.23, R=0.14, R^2=0.02, p=.763) or preschool (F(2,112)=3.15, R=0.24, R^2=0.06, p=.303) groups.

Sleep Quality and Daytime Externalizing Behaviors

After controlling for child sex, symptoms of sleep disordered breathing were not significantly associated with daytime externalizing behaviors in the entire (F(2,138)=1.99, R=0.17, R^2=0.03, p=.974), toddler (F(2,23)=0.79, R=0.14, R^2=0.02, p=.752), or the preschool samples (F(2,112)=3.02, R=0.23, R^2=0.05, p=.820). Sleep onset latency was not associated with daytime externalizing behaviors (F(3,136)=1.35, R=0.17, R^2=0.03, p=.908) after controlling for child sex and age. Again, this was consistent in both the toddler (F(3,22)=0.33, R=0.21, R^2=0.04, p=.571) and preschool (F(3,110)=2.37, R=0.25, R^2=0.04, p=.529) populations.

To examine the influence of night time awakenings on daytime externalizing behaviors, an ANCOVA was conducted. After controlling for sex, there was no difference in daytime externalizing behaviors (F(1,115)=0.64, p=.425, ηp^2 =0.006) for the presence (M=2.09, SD=1.13) or absence (M=1.96, SD=1.26) of night awakenings. In the toddler sample, externalizing behaviors (F(1,18)<0.01, p=.994, ηp^2 <0.001) were not significantly influenced by the presence (M=2.05, SD=1.25) or absence (M=1.95, SD=1.29) of night awakenings. Again, there was no difference between presence (M=2.11, SD=1.15) or absence (M=1.96, SD=1.39) of night awakenings on daytime externalizing behaviors (F(1,94)=.57, p=.452, ηp^2 =0.006).

Sleep Quality and Race/Ethnicity

Table 6 displays the results of the ANCOVA, used to examine the differences between racial/ethnic groups and child 24-hour sleep, sleep onset latency, teacher report of daytime sleepiness, and teacher report of daytime externalizing behaviors. There were no significant differences between the racial/ethnic groups and the outcome variables in the toddler, preschool, or full sample. Post-hoc analyses were conducted to examine if there were any differences between the African American, Hispanic/Latino, and the biracial children and sleep quality. These results are displayed in Table 7. None of these post-hoc analyses were significant. Finally, there was no significant difference between racial/ethnic groups and the presence or absence of night awakenings ($\chi^2(3)=4.53$, $p=.210$), which was also true for the toddler ($\chi^2(3)=3.07$, $p=.381$) and preschool ($\chi^2(2)=4.70$, $p=.096$) samples.

Teacher Report of Daytime Sleepiness

Post-hoc analyses were conducted to examine if teacher report of daytime sleepiness was associated with teacher report of daytime externalizing behaviors. A regression analysis was conducted to examine the relationship. After controlling for child sex, teacher report of daytime sleepiness was significantly associated with daytime externalizing behaviors ($F(2,138)=13.9$, $R=0.41$, $R^2=0.17$, $p<.001$). This association remained significant for the toddler ($F(2,23)=3.14$, $R=0.46$, $R^2=0.21$, $p=.024$) and preschool (a $F(2,112)=10.9$, $R=0.40$, $R^2=0.16$, $p<.001$) populations. Further analyses showed that caregiver report of night time sleep was not significantly associated with teacher report of daytime sleepiness in the full ($r=0.24$, $p=.779$), toddler ($r=0.21$, $p=.298$), or preschool ($r=-0.02$, $p=.859$) samples.

Finally, we examined if there was a difference between caregiver's belief that the child's sleep was a problem (or not) on teacher report of daytime sleepiness. A t-test was

used to examine this relationship. In the entire sample ($t(138)=0.761$, $p=.448$), toddler ($t(24)=-1.51$, $p=.144$) and preschool ($t(112)=1.51$, $p=.134$) samples, teacher report of daytime sleepiness was not significantly different when the caregiver reported that sleep was ($M_{full}=1.819$, $SD_{full}=0.863$; $M_{toddler}=2.03$, $SD_{toddler}=0.564$; $M_{preschool}=1.73$, $SD_{preschool}=0.962$) or was not ($M_{full}=1.93$, $SD_{full}=0.863$; $M_{toddler}=1.59$, $SD_{toddler}=0.796$; $M_{preschool}=1.99$, $SD_{preschool}=0.695$) a problem.

Discussion

In this cross-sectional design, we surveyed caregivers of preschool- and toddler-aged children to assess if sleep quality and quantity influenced daytime externalizing behaviors. Sleep problems, such as sleep onset latency and night awakenings are a common issue in preschool and toddler children (Lavigne et al., 1999). Some research suggests that there is a relationship between daytime externalizing behaviors and an insufficient amount of sleep or poor sleep quality in children (Gottlieb et al., 2003; Lavine et al., 1999; Komada et al., 2011).

On average, this sample of children appeared to have a longer sleep onset latency, a shorter night-time sleep, and more parents considered their child's sleep to be a problem than the national sample (Mindell et al., 2009). About 7.0% of toddlers and 13.0% of preschoolers were at high risk of having sleep-disordered breathing. In previous studies, the prevalence of pediatric sleep disordered breathing reported by parents ranged from 4.10 (Spruyt et al., 2006) to 11.1% (Archbold, Pituch, Panahi, & Chervin, 2002). Therefore, the symptoms of sleep-disordered breathing seem to be slightly higher than this estimation. While these sleep quality estimations are higher than the national average, they are consistent with the literature that examined sleep in children of an ethnic/racial minority (Crabtree et al., 2004; Peña et al., 2016). In previous studies,

children of ethnic minority status were at risk of having a higher bedtime resistance, night awakenings, and sleep-disordered breathing when compared to non-Hispanic White children (Crabtree et al., 2004; Peña et al., 2016).

In our third hypothesis, we aimed to examine the relationship between race/ethnicity and sleep. Overall, there was no significant difference between sleep variables among ethnic/racial groups. However, this may be due to similarities between the cultures. For example, previous studies have reported that co-sleeping is common in both the African American and Hispanic/Latino cultures (Milan et al., 2007; Hale et al., 2009).

We also found that teacher report of daytime sleepiness was strongly associated with teacher report of daytime externalizing behaviors, suggesting that daytime sleepiness may exacerbated daytime externalizing behaviors within raters. These results highlight that an intervention to target daytime sleepiness may be beneficial in improving daytime behaviors. Since the children at ELRA receive a consistent, scheduled daytime nap, some of the influences of sleep on daytime externalizing behaviors may have been reduced. Considering the children's nighttime sleep was low and their sleep quality variables were higher than average, these children are at a higher risk of having an increase of behavioral problems as they transition to kindergarten, when daytime naps are no longer offered.

Contrary to our main hypotheses, teacher report of daytime externalizing behaviors was not significantly related to parent report of sleep. In the first hypothesis, it was predicted that parent report of 24-hour sleep would be associated with teacher report of daytime externalizing behaviors. In this sample, 24-hour sleep was not significantly associated with daytime externalizing behavior. Further analyses were conducted to

examine if night-time sleep was related to daytime behavior, but these analyses were not significant. In the second hypothesis, it was predicted that sleep quality variables would influence daytime externalizing behaviors. Parent report of symptoms of sleep-disordered breathing, sleep onset latency, and presence (or absence) of night awakenings was not significantly associated with teacher report of daytime externalizing behaviors.

Studies with similar sample size have found significant associations between sleep and daytime externalizing behaviors in young children (Bélanger et al., 2015, Hatzinger et al., 2009, Lavine et al., 1999). For example, Bélanger and colleagues (2015) examined sleep within 64 families and found that sleep duration was significantly related to daytime externalizing behaviors, when reported by the mother. Hatzinger and colleagues (2009) had a sample size of 102 preschool children and found a positive association between conduct and sleep problems. However, results have been inconsistent: these studies also found non-significant results (Hatzinger et al., 2010; Bates et al., 2002; Goodlin-Jones et al., 2009). Some found non-significant associations between sleep duration and daytime externalizing behaviors (Hatzinger et al., 2010; Bates et al., 2002; Goodlin-Jones et al., 2009). Hall and colleagues examined sleep and daytime behavior in 58 toddlers. In their study, night awakenings were not significantly correlated with attention and hyperactivity. With a sample of 62 preschoolers, sleep onset latency was not significantly associated with daytime behavior. Finally, Wada and colleagues' (2013) study examined sleep and behavior in preschool children. The results of their study revealed that snoring and sleep onset latency were not related to hyperactivity. Studies with more positive and consistent results had substantial sample sizes, such as 8,950 (Sharf et al., 2013), 1,746 (Komada et al., 2011), and 3,019 (Gottlieb et al., 2003). In the current study, the effect sizes of these analyses were all very small. For example,

approximately 3% of the variance in the daytime externalizing behaviors was explained by 24-hour sleep. Therefore, a larger sample may be needed to detect a significant effect across raters. Furthermore, sleep duration, night awakenings, sleep onset latency, and sleep disordered breathing may explain a small portion of the influence on daytime externalizing factors. Other factors, such as parental effortful control, or self-regulation, and chaos in the home may have a larger effect on behavior. For example, in one study, researchers found a significant pathway from parent's effortful control and household chaos to child externalizing behaviors (Valiente, Lemery-Chalfant, & Reiser, 2007).

While we did not find any significant results between parent report of child's sleep and teacher report of daytime behavior, others have suggested that poor sleep habits in young childhood predicts behavioral problems in later years (Gregory & O'Connor, 2002). In Gregory and O'Connor's (2002) study, sleep problems in children at age 4 predicted aggression and attention problems in adolescence. Additionally, if left untreated, sleep problems can persist into later years (Zuckerman et al., 1987), which can affect health (Taveras et al., 2008) and academics (Jung et al., 2009). Thus, targeting a child's sleep habits may provide a more opportune way to intervene, when compared to other influences, such as single-parent households and income.

Limitations and Future Directions

One strength of this study is that multiple reporters were utilized to report on the child's sleep and behaviors. Having multiple reporters creates an opportunity to gain different perspectives. Another strength was that the majority of our sample was comprised of families from a racial/ethnic minority background. Many studies examining sleep and daytime behaviors have had few Hispanic/Latino families. This is one of the

few studies that have examined sleep and daytime externalizing behaviors in a primarily African American and Hispanic/Latino population.

One limitation of this study is the sample size. For our main analyses examining the relationship between sleep and daytime externalizing behavior, our observed power ranged from 0.22 to 0.50 in our full sample. Since the power ranges from small to medium, our sample size may explain why our main findings were non-significant. Some of the studies that have found positive results had very large sample sizes (Sharf et al., 2013; Komada et al., 2011; Gottlieb et al., 20031).

There were also methodological limitations. First, this study utilized caregiver-report measures for child sleep. Caregiver-report of child sleep could have resulted in a social desirability effect to provide positive results: parents may wish to respond to questions to express behaviors that are culturally accepted (Chung & Monroe, 2003). Therefore, parents may have expressed that their children exhibited sleep behaviors that they believe reflect adequate sleep hygiene. Also, reports of sleep onset latency may have been increased for caregivers that share a bed or room with the child. These caregivers may have a heightened awareness of the length of time a child takes to fall asleep compared to caregivers who do not bed share. Also, caregiver report of child sleep behaviors may not be the most accurate (Mindell et al., 2009). Future studies should evaluate the relationship between daytime externalizing behaviors and sleep while using objective measures, such as an actigraphy. Second, our measures did not include questions about intentional co-sleeping. Co-sleeping is common in the Hispanic/Latino culture and may not be reflective of poor sleep health within their culture. Thus, room/bed sharing may pose as an interesting confound and may affect the accuracy of parent report.

We did find a significant association between teacher report of daytime sleepiness and teacher report of daytime behavior. However, this may be a result of reporter bias in teacher report. In a study conducted by Paavonen and colleagues (2009), nighttime sleep duration was significantly related to externalizing behaviors, but only when reported by parents and not teachers. These results may imply a potential bias in reporting behaviors when aware of sleep status. The results of the current study may reflect this. When examining the relationship between teacher report of daytime sleepiness and caregiver report of child sleep, there were no significant associations. Even when caregivers expressed that they considered their child's sleep to be a problem, teacher report of daytime sleepiness was not related.

Finally, nesting within classrooms may have influenced our data. However, we did not have a large enough sample to conduct multilevel modeling. For this statistical test, a minimum sample size is required to achieve an accurate account of the regression coefficient and their standard errors (Raudenbush & Bryk, 2001). In this sample, nineteen different teachers were reporting on the child's daytime behavior and daytime sleepiness. Models with less than 20-25 groups may not provide accurate estimates of the regression coefficient. Further, one study demonstrated that analyses with less than 50 groups could produce biased results (Hox & Mass, 2002).

The relationship between sleep and externalizing behaviors may be more complex. Thus, one aspect of sleep quality, such as sleep onset latency, may not be enough to predict daytime behavior. In one study, researchers found that when examining sleep duration and daytime behavior, there was no relationship (Bates et al., 2002). However, when the authors included bedtime variability into the equation, they found that inconsistencies with bedtime predicted an increase in daytime externalizing

behaviors. Further, they found that family stress could be influencing variability in the child's sleep schedule.

Consistent with other studies, we found that there was a significant effect of sex on daytime externalizing behaviors, with boys exhibiting higher rates of daytime externalizing behaviors (Bélanger et al., 2015). Bélanger and colleagues (2015) argued that this difference might be due to boys' tendencies to be more physically active, to show less irritation tolerance, and to have greater difficulty regulating emotions. When preschool- and toddler-aged girls are tired, their lack of sleep may manifest in the form of internalizing behaviors. Therefore, future studies should also examine the relationship between sleep and internalizing behaviors.

Conclusions

In this high-risk population, the children received less than ideal sleep quantity and quality. Contrary to hypotheses, teacher report of daytime externalizing behavior was not related to parent report of sleep. Nonetheless, teacher report of daytime sleepiness was strongly positively correlated with daytime externalizing behavior, suggesting that sleepiness may be negatively affecting preschoolers' daytime behaviors. Other studies (Bates et al., 2002; Goodlin-Jones et al., 2009) found similar results, where indicators of poor sleep were not directly related to daytime behavior in preschool children, suggesting that the relationship of sleep and daytime behaviors may be more complex. In this age group, the effects of sleep may be too subtle for teachers to observe in daytime behaviors. However, poor sleep in young childhood may lead to more observable behavioral problems in later years (Gregory & O'Connor, 2002).

Table 1

Family Demographics

Caregiver			
		N	%
Relationship to child	Biological Parent	134	95.0
	Step-parent	2	1.40
	Grandparent	4	2.80
Race/ethnicity	African American	61	43.3
	Asian or Pacific Islander	1	0.70
	Hispanic/Latino	72	51.1
	White/Caucasian	1	0.70
Age	20-29	61	43.3
	30-39	55	39.0
	40-49	8	5.70
Highest Degree	None	6	4.30
	High School Diploma/ GED	71	50.4
	Associate's	14	9.90
	Vo-tech	8	5.70
	Bachelor's	27	19.1
	Graduate Degree	12	8.50
Marital Status	Single	79	56.0
	Married/ Living together	53	37.6
	Separated or Divorced	7	5.00
Income	$0-$10,000	28	19.9
	$10,000-$20,000	18	12.8
	$20,000-$30,000	25	17.7
	$30,000-$40,000	37	26.2
	$40,000-$50,000	15	10.6
	More than $50,000	18	12.8
Others living in home	Yes	103	73.0
	No	36	25.5

Other adults in home	0-1	50	35.5
	2-3	50	35.5
	4-6	3	2.10
Other children in home	0-1	41	29.0
	2-3	53	37.6
	4-6	9	6.30
	Child		
Sex	Male	69	48.9
	Female	71	50.4
Race/ethnicity	African American	57	40.4
	Hispanic/Latino	56	39.7
	White/Caucasian	1	0.70
	Biracial: African American and Hispanic/Latino	24	17.0
	Other/Missing	3	2.10
Age (years)		4.01	1.05
	Toddler	2.50	0.77
	Preschool	4.35	0.77

Table 2
Sleep Variable Descriptives

		Total		Toddler		Preschool	
		M	SD	M	SD	M	SD
24-hour sleep	hours	11.0 [6.00-17.0]	2.24	11.4 [8.00-13.5]	3.01	11.4 [6.00-17.0]	3.10
Night time sleep	hours	8.81 [4.50-13.5]	2.61	8.81 [7.00-11.3]	2.58	8.90 [4.50-13.5]	2.62
Sleep Onset Latency	minutes	28.1 [0.00-120.0]	23.2	37.7 [0.00-120.0]	32.3	37.8 [0.00-99.0]	32.3
Daytime Sleepiness		4.19 [0.00-14.0]	2.76	3.62 [1.00-6.00]	2.48	4.32 [0.00-14.0]	2.81
		N	%	N	%	N	%
Night Awakenings	None	83	58.9	13	50.0	70	60.9
	1 or more	48	34.0	11	42.3	37	32.2
SDBS	Low risk	124	87.9	24	92.3	100	87.0
	high risk	17	12.1	2	7.70	15	13.0
Sleep Location	His/her room	72	51.1	10	38.5	62	53.9
	Parent's Room	51	36.2	11	42.3	40	34.8
	Sibling's room	15	10.6	4	15.4	11	9.60
Bed Location	Own Bed	99	70.2	15	57.7	84	73.0
	Parent's Bed	32	22.7	8	30.8	24	20.9
	Sibling's Bed	9	6.4	2	7.70	7	6.10
Consider Sleep a Problem	Yes	32	22.7	10	38.4	10	19.2
	No	107	75.9	16	61.5	91	79.1

Table 3
Sleep variables compared to national average[a]

		Toddler				
		Current		National		
		M	SD	M	SD	*p*
Total sleep at night	Hours	8.81	2.58	9.80	1.70	.016[b]
Sleep onset latency	Minutes	37.7	32.3	16.4	16.0	.002[c]
		N	%	N	%	
Night awakenings	None	13	50.0		53.6	.962[d]
	1 or more	11	42.3		46.4	
Consider sleep a problem	Yes	10	38.4		10.5	<.001[e]
	No	16	61.5		89.5	
		Preschool				
		Current		National		
		M	SD	M	SD	*p*
Total sleep at night	Hours	8.90	2.62	9.60	1.50	.006[f]
Sleep onset latency	Minutes	37.8	32.3	17.4	16.7	<.001[g]
		N	%	N	%	
Night awakenings	None	70	60.9		64.4	.817[h]
	1 or more	37	32.2		35.6	
Consider sleep a problem	Yes	10	19.2		10.2	.062[i]
	No	91	79.1		89.8	

Notes. [a]Mindell et al. 2009
[b]$t(21)=-2.62$
[c]$t(25)=3.36$
[d] $\chi^2<0.01$
[e] $\chi^2=21.5$
[f]$t(108)=-2.80$
[g]$t(114)=-6.30$
[h] $\chi^2=0.05$
[i] $\chi^2=3.49$

Table 4
Sleep variable bivariate correlations

	2	3	4	5	6
1. 24-hour sleep	0.82**	0.07	0.03	-0.01	-0.04
2. Nighttime sleep		0.00	0.03	-0.08	0.02
3. Sleep onset latency			-0.14[a]	-0.02	-0.06
4. SDBS				0.00	0.13
5. Externalizing behaviors					0.37**
6. TDSQ					

Notes. *$p<.05$, **$p<.001$, [a]$p<.10$

Table 5
Daytime Externalizing Behavior Multiple Linear Regression Analyses

	Total				
				95% Confidence Interval for *B*	
	B	*SE B*	β	Lower	Upper
Model 1					
Child sex	-0.40*	0.20	0.17	-0.80	-0.01
24-hour sleep and child Sex	-0.02	0.06	-0.03	-0.143	0.10
Model 2					
Child sex	-0.40*	0.20	-0.17	-0.80	-0.01
Nighttime sleep and child Sex	-0.07	0.07	-0.08	-0.21	0.07
Model 3					
Child age	-0.03	-0.10	-0.03	-0.23	0.17
Child sex and child age	-0.42*	0.21	-0.17	-0.82	-0.00
Sleep onset latency, child sex, child age	0.00	0.00	0.00	-0.01	0.01
Model 4					
Child sex	-0.40*	0.20	-0.17	-0.80	0.00
SDBS and child sex	0.03	1.00	0.00	-1.96	2.02
Model 5					
Child sex	-0.40*	0.19	-0.17	0.09	0.23
TDSQ and child sex	0.60**	0.13	0.37	0.35	0.85
	Toddler				
Model 1					
Child sex	0.57	0.54	0.21	-0.59	1.63
24-hour sleep and child Sex	0.16	0.17	0.22	-0.18	0.51
Model 2					
Child sex	0.34	0.21	0.06	-0.37	0.50
Nighttime sleep and child Sex	0.07	0.21	0.06	-0.37	0.50
Model 3					
Child age	0.08	0.36	0.05	-0.67	0.82
Child sex and child age	0.29	0.51	0.12	-0.76	1.24
Sleep onset latency, child sex, child age	-0.01	0.01	-0.14	-0.02	0.01
Model 4					
Child sex	0.30	0.50	0.124	-0.74	1.34
SDBS and child sex	-0.77	2.42	-0.07	-5.77	4.23
Model 5					
Child sex	0.03	0.46	0.01	-0.93	0.99
TDSQ and child sex	0.22*	0.09	0.46	0.03	0.41
	Preschool				
Model 1					
Child sex	-0.55*	0.22	-0.22	-1.00	-0.11
24-hour sleep and child Sex	-0.04	0.07	-0.05	-0.17	0.09
Model 2					
Child sex	-0.54*	0.22	-0.22	-1.00	-0.10
Nighttime sleep and child Sex	-0.08	0.08	-0.10	-0.23	0.07
Model 3					
Child age	-0.12	0.15	-0.08	-0.42	0.17
Child sex and child age	-0.59*	0.23	-0.24	-1.04	-0.14
Sleep onset latency, child sex, child age	0.00	0.01	0.06	-0.01	0.02
Model 4					

Child sex	-0.55*	0.22	-0.22	-0.99	-0.11
SDBS and child sex	0.25	1.11	0.02	-1.10	2.45
Model 5					
Child sex	-0.51*	0.21	-0.21	-0.93	-0.10
TDSQ and child sex	0.15**	0.04	0.36	0.31	0.86

Notes. *$p<.05$, ** $p<.001$

Table 6
Race/Ethnicity ANCOVA

Total Sample				
	df	*F*	ηp^2	*p*
24-hour sleep	3	0.31	0.007	.817
SDBS	3	0.50	0.011	.680
Sleep Onset	3	1.90	0.041	.132
TDSQ	3	0.16	0.004	.925
SDQ	3	2.41	0.051	.071
Toddler				
24-hour sleep	3	0.81	0.104	.502
SDBS	3	1.19	0.145	.339
Sleep Onset	3	2.93	0.205	.059
TDSQ	3	0.77	0.305	.059
SDQ	3	1.93	0.224	.158
Preschool				
24-hour sleep	2	0.82	0.015	.442
SDBS	2	0.03	0.001	.973
Sleep Onset	2	0.08	0.001	.923
TDSQ	2	0.16	0.003	.853
SDQ	2	1.95	0.035	.147

Table 7
African American, Hispanic/Latino, Biracial ANCOVA

Total Sample				
	df	*F*	ηp^2	*p*
24-hour sleep	2	0.32	0.005	.711
SDBS	2	0.34	0.005	.735
Sleep Onset	2	1.48	0.022	.230
TDSQ	2	0.01	0.000	.992
SDQ	2	1.84	0.027	.162
Toddler				
24-hour sleep	2	1.15	0.099	.336
SDBS	2	1.44	0.120	.260
Sleep Onset	2	2.24	0.183	.132
TDSQ	2	0.95	0.084	.400
SDQ	2	1.59	0.137	.228
Preschool				
24-hour sleep	2	0.82	0.015	.442
SDBS	2	0.03	0.001	.973
Sleep Onset	2	0.08	0.001	.923
TDSQ	2	0.16	0.003	.853
SDQ	2	1.95	0.035	.147

References

Amschler, D. H., & McKenzie, J. F. (2005). Elementary students' sleep habits and teacher observations of sleep-related problems. *Journal of School Health*, *75*(2), 50-56.

Archbold, K. H., Pituch, K. J., Panahi, P., & Chervin, R. D. (2002). Symptoms of sleep disturbances among children at two general pediatric clinics. *The Journal of Pediatrics*, *140*(1), 97-102.

Aronen, E. T., Paavonen, E. J., Fjällberg, M., Soininen, M., & Törrönen, J. (2000). Sleep and psychiatric symptoms in school-age children. *Journal of the American Academy of Child & Adolescent Psychiatry*, *39*(4), 502-508.

Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., &Stockton, L. (2002). Sleep and adjustment in preschool children: Sleep diary reports by mothers relate to behavior reports by teachers. *Child Development, 73*(1), 62-75.

Bélanger, M. È., Bernier, A., Simard, V., Desrosiers, K., & Carrier, J. (2018). Sleeping toward behavioral regulation: Relations between sleep and externalizing symptoms in toddlers and preschoolers. *Journal of Clinical Child & Adolescent Psychology*, *47*(3), 366-373.

Bonuck, K. A., Schwartz, B., & Schechter, C. (2016). Sleep health literacy in head start families and staff: exploratory study of knowledge, motivation, and competencies to promote healthy sleep. *Sleep Health: Journal of the National Sleep Foundation*, *2*(1), 19-24.

Crabtree, V. M., Korhonen, J. B., Montgomery-Downs, H. E., Jones, V. F., O'Brien, L. M., & Gozal, D. (2005). Cultural influences on the bedtime behaviors of young children. *Sleep Medicine*, *6*(4), 319-324.

Calzada, E. J., Tamis-LeMonda, C. S., & Yoshikawa, H. (2013). Familismo in Mexican and Dominican families from low-income, urban communities. *Journal of Family Issues*, *34*(12), 1696-1724.

Chervin, R., Dillon, J., Bassetti, C., Ganoczy, D., & Pituch, K. (1997) Symptoms of sleep disorders, inattention, and hyperactivity in children. *Pediatrics and Sleep, 20*(12), 1185-1192.

Chervin, R. D., Hedger, K., Dillon, J. E., Pituch, K. J. (2000) Pediatric sleep questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems. *Sleep Medicine, 1*(1), 21-35.

Chung, J., & Monroe, G. S. (2003). Exploring social desirability bias. *Journal of Business Ethics*, *44*(4), 291-302.

Daniel, L. C., & Lewin, D. S. (2005, January). A survey of pre-kindergarten and

kindergarten napping policy in the United States. *Sleep*, *28*, A102-A102.

Fallone, G. P., Owens, J. A., & Deane, J. (2002). Sleepiness in children and adolescents: Clinical implications. *Sleep Medicine Reviews, 6*(4), 287-306.

Flint, J., Kothare, S. V., Zihlif, M., Suarez, E., Adams, R., Legido, A., & De Luca, F. (2007). Association between inadequate sleep and insulin resistance in obese children. *The Journal of Pediatrics*, *150*(4), 364-369.

Goodlin-Jones, B. L., Burnham, M. M., Gaylor, E. E., & Anders, T. F. (2001). Night waking, sleep-wake organization, and self-soothing in the first year of life. *Journal of Developmental and Behavioral Pediatrics: JDBP*, *22*(4), 226-233.

Goodlin-Jones, B., Tang, K., Liu, J., & Anders, T. F. (2009). Sleep problems, sleepiness and daytime behavior in preschool-age children. *Journal of Child Psychology and Psychiatry*, *50*(12), 1532-1540.

Goodman, R. (1997). The Strengths and Difficulties Questionnaire: a research note. *Journal of Child Psychology and Psychiatry, 38*(5), 581-586.

Goodman, R., & Scott, S. (1999). Comparing the Strengths and Difficulties Questionnaire and the Child Behavior Checklist: is small beautiful?. *Journal of Abnormal Child Psychology*, *27*(1), 17-24.

Goodwin, J. L., Babar, S. I., Kaemingk, K. L., Rosen, G. M., Morgan, W. J., Sherrill, D. L., & Quan, S. F. (2003). Symptoms related to sleep-disordered breathing in white and Hispanic children: the Tucson Children's Assessment of Sleep Apnea Study. *Chest*, *124*(1), 196-203.

Gottlieb, D. J., Vezina, R. M., Chase, C., Lesko, S. M., Heeren, T. C., Weese-Mayer, D. E., ... & Corwin, M. J. (2003). Symptoms of sleep-disordered breathing in 5-year-old children are associated with sleepiness and problem behaviors. *Pediatrics, 112*(4), 870-877.

Gregory, A. M., & O'Connor, T. G. (2002). Sleep problems in childhood: A longitudinal study of developmental change and association with behavioral problems. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(8), 964-971.

Gupta, R., Kandpal, S. D., Goel, D., Mittal, N., Dhyani, M., & Mittal, M. (2016). Sleep-patterns, co-sleeping and parent's perception of sleep among school children: Comparison of domicile and gender. *Sleep Science*, *9*(3), 192-197.

Hall, W. A., Scher, A., Zaidman-Zait, A., Espezel, H., & Warnock, F. (2012). A community-based study of sleep and behaviour problems in 12-to 36-month-old children. *Child: care, health and development*, *38*(3), 379-389.

Hale, L., Berger, L. M., LeBourgeois, M. K., & Brooks-Gunn, J. (2009). Social and demographic predictors of preschoolers' bedtime routines. *Journal of*

Developmental and Behavioral Pediatrics, *30*(5), 394-402.

Hatzinger, M., Brand, S., Perren, S., Stadelmann, S., von Wyl, A., von Klitzing, K., & Holsboer-Trachsler, E. (2010). Sleep actigraphy pattern and behavioral/emotional difficulties in kindergarten children: association with hypothalamic-pituitary-adrenocortical (HPA) activity. *Journal of Psychiatric Research*, *44*(4), 253-261.

Hox, J. J., & Maas, C. J. M. (2002). Sample sizes for multilevel modeling. In J. Blasius, J. J. Hox, E. de Leeuw, & P. Schmidt (Eds.), *Social Science Methodology in the New Millennium: Proceedings of the Fifth International Conference on Logic and Methodology* (2nd ed.). Opladen, Germany: Leske + Budrich.

Huang, Y. S., Guilleminault, C., Li, H. Y., Yang, C. M., Wu, Y. Y., & Chen, N. H. (2007). Attention-deficit/hyperactivity disorder with obstructive sleep apnea: a treatment outcome study. *Sleep Medicine*, *8*(1), 18-30.

Jung, E., Molfese, V. J., Beswick, J., Jacobi-Vessels, J., & Molnar, A. (2009). Growth of cognitive skills in preschoolers: Impact of sleep habits and learning-related behaviors. *Early Education and Development*, *20*(4), 713-731.

Kaplan, B. J., McNicol, J., Conte, R. A., & Moghadam, H. K. (1987). Sleep disturbance in preschool-aged hyperactive and nonhyperactive children. *Pediatrics*, *80*(6), 839-844.

Komada, Y., Abe, T., Okajima, I., Asaoka, S., Matsuura, N., Usui, A., ... & Inoue, Y. (2011). Short sleep duration and irregular bedtime are associated with increased behavioral problems among Japanese preschool-age children. *The Tohoku Journal of Experimental Medicine*, *224*(2), 127-136.

Kushnir, J., & Sadeh, A. (2013). Correspondence between reported and actigraphic sleep measures in preschool children: the role of a clinical context. *Journal of Clinical Sleep Medicine, 9*(11), 1147.

Lam, J. C., Mahone, E. M., Mason, T. B., & Scharf, S. M. (2011). The effects of napping on cognitive function in preschoolers. *Journal of Developmental and Behavioral Pediatrics*, *32*(2), 90-97.

Lavigne, J. V., Arend, R., Rosenbaum, D., Smith, A., Weissbluth, M., Binns, H. J., & Christoffel, K. K. (1999). Sleep and behavior problems among preschoolers. *Journal of Developmental & Behavioral Pediatrics*, *20*(3), 164-169.

Loughlin, G. M., Brouillette, R. T., Brooke, L. J., Carroll, J. L., Chipps, B. E., England, S. J., ... & Haddad, G. G. (1996). Standards and indications for cardiopulmonary sleep studies in children. *American Journal of Respiratory and Critical Care Medicine*, *153*(2), 866-878.

Lozoff, B., Askew, G. L., & Wolf, A. W. (1996). Cosleeping and early childhood sleep problems: effects of ethnicity and socioeconomic status. *Journal of*

Developmental & Behavioral Pediatrics, *17*(1), 9-15.

Lumeng, J. C., & Chervin, R. D. (2008). Epidemiology of pediatric obstructive sleep apnea. *Proceedings of the American Thoracic Society*, *5*(2), 242-252.

Marcus, C. L., Moore, R. H., Rosen, C. L., Giordani, B., Garetz, S. L., Taylor, H. G., ... & Paruthi, S. (2013). A randomized trial of adenotonsillectomy for childhood sleep apnea. *New England Journal of Medicine*, *368*(25), 2366-2376.

Milan, S., Snow, S., & Belay, S. (2007). The context of preschool children's sleep: racial/ethnic differences in sleep locations, routines, and concerns. *Journal of Family Psychology*, *21*(1), 20-28.

Mindell, J. A., Meltzer, L. J., Carskadon, M. A., & Chervin, R. D. (2009). Developmental aspects of sleep hygiene: Findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep medicine, 10*(7), 771-779.

Morelli, G. A., Rogoff, B., Oppenheim, D., & Goldsmith, D. (1992). Cultural variation in infants' sleeping arrangements: Questions of independence. *Developmental Psychology*, *28*(4), 604-613.

Owens, J. A., Spirito, A., McGuinn, M., & Nobile, C. (2000). Sleep habits and sleep disturbance in elementary school-aged children. *Journal of Developmental & Behavioral Pediatrics*, *21*(1), 27.

Owens, J. A., Jones, C., & Nash, R. (2011). Caregivers' knowledge, behavior, and attitudes regarding healthy sleep in young children. *Journal of Clinical Sleep Medicine*, *7*(4), 345.

Paruthi, S., Brooks, L. J., D'Ambrosio, C., Hall, W. A., Kotagal, S., Lloyd, R. M., ... & Rosen, C. L. (2016). Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine*, *12*(6), 785-786.

Peña, M. M., Rifas-Shiman, S. L., Gillman, M. W., Redline, S., & Taveras, E. M. (2016). Racial/ethnic and socio-contextual correlates of chronic sleep curtailment in childhood. *Sleep*, *39*(9), 1653-1661.

Potsic, W. P. (1989). Sleep apnea in children. *Otolaryngologic Clinics of North America*, *22*(3), 537-544.

Raudenbush, S. W., Bryk, A., Cheong, Y. F., & Congdon, R. (2001). Hierarchical linear and nonlinear modeling 5.04. *Lincolnwood, IL: Scientific Software International*.

Ramos, K. D., Youngclarke, D., & Anderson, J. E. (2007). Parental perceptions of sleep problems among co-sleeping and solitary sleeping children. *Infant and Child Development*, *16*(4), 417-431.

Sadeh, A. (2004). A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. *Pediatrics*, *113*(6), e570-e577.

Sadeh, A., Gruber, R., & Raviv, A. (2003). The effects of sleep restriction and extension on school-age children: What a difference an hour makes. *Child development*, *74*(2), 444-455.

Scharf, R. J., Demmer, R. T., Silver, E. J., & Stein, R. E. (2013). Nighttime sleep duration and externalizing behaviors of preschool children. *Journal of Developmental & Behavioral Pediatrics*, *34*(6), 384-391.

Spruyt, K., O'Brien, L. M., Coxon, A. M., Cluydts, R., Verleye, G., & Ferri, R. (2006). Multidimensional scaling of pediatric sleep breathing problems and bio-behavioral correlates. *Sleep Medicine*, *7*(3), 269-280.

Taveras, E. M., Rifas-Shiman, S. L., Oken, E., Gunderson, E. P., & Gillman, M. W. (2008). Short sleep duration in infancy and risk of childhood overweight. *Archives of Pediatrics & Adolescent Medicine*, *162*(4), 305-311.

Touchette, É., Petit, D., Séguin, J. R., Boivin, M., Tremblay, R. E., & Montplaisir, J. Y. (2007). Associations between sleep duration patterns and behavioral/cognitive functioning at school entry. *Sleep*, *30*(9), 1213-1219.

Valiente, C., Lemery-Chalfant, K., & Reiser, M. (2007). Pathways to problem behaviors: Chaotic homes, parent and child effortful control, and parenting. *Social Development*, *16*(2), 249-267.

Vaughn, B. E., Elmore-Staton, L., Shin, N., & El-Sheikh, M. (2015). Sleep as a support for social competence, peer relations, and cognitive functioning in preschool children. *Behavioral Sleep Medicine*, *13*(2), 92-106.

Wada, K., Nakamura, K., Tamai, Y., Tsuji, M., Watanabe, K., Ando, K., & Nagata, C. (2013). Associations of endogenous melatonin and sleep-related factors with behavioral problems in preschool Japanese children. *Annals of Epidemiology*, *23*(8), 469-474.

Ward, T. M., Gay, C., Alkon, A., Anders, T. F., & Lee, K. A. (2008). Nocturnal sleep and daytime nap behaviors in relation to salivary cortisol levels and temperament in preschool-age children attending child care. *Biological research for nursing*, *9*(3), 244-253.

Zuckerman, B., Stevenson, J., & Bailey, V. (1987). Sleep problems in early childhood: continuities, predictive factors, and behavioral correlates. *Pediatrics*, *80*(5), 664-671.