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THE ROLE OF SLEEP IN PREDICTING SOCIOEMOTIONAL OUTCOMES IN THE  
TRANSITION TO KINDERGARTEN

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## ABSTRACT

This study sought to determine the impact of sleep health (i.e., sleep latency and sleep minutes) on socioemotional outcomes in kindergarten students during the transition to kindergarten. To complete this study, we utilized the 230-participant study sample from the SIESTA K dataset. The measures for this specific study were taken at two time periods, pre-Kindergarten (K1) and early kindergarten (K2). Sleep latency was measured by self-reported lights out and actigraphy, while sleep minutes were measured utilizing actigraphy. The five socioemotional outcome measures were completed by the kindergartener's teacher. Our results found that both K1 sleep latency and K1 sleep minutes were more predictive of K2 socioemotional outcomes than K2 sleep latency and K2 sleep minutes were. It was concluded that pre-kindergarten good sleep hygiene carries over into the initiation of school. It was also determined that the lack of associations in K2 was due to decreased variability in sleep.

**TABLE OF CONTENTS**

LIST OF TABLES .....	iii
ACKNOWLEDGEMENTS .....	iv
Chapter 1 Introduction .....	1
Chapter 2 Methods .....	5
Chapter 3 Results .....	12
Chapter 4 Discussion .....	17
BIBLIOGRAPHY .....	21

**LIST OF TABLES**

Table 1: Sample Demographics.....	9
Table 2: Variable Descriptives .....	10
Table 3: K1 Sleep Latency on K2 Socioemotional Outcomes .....	13
Table 4: K2 Sleep Latency on K2 Socioemotional Outcomes .....	14
Table 5: K1 Sleep Minutes on K2 Socioemotional Outcomes .....	15
Table 6: K2 Sleep Minutes on K2 Socioemotional Outcomes .....	16

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## **Chapter 1**

### **Introduction**

#### Sleep and Socioemotional Outcomes

Sleep health is an important contributor to socioemotional development in children (Schlieber & Han, 2021). Specifically, sleep impacts emotion and mood which are the major components of socioemotional development. Furthermore, sleep disturbances can cause increases in stress levels, and may impact one's emotional interpretation of certain events, which can make it difficult when in social settings or when trying to interact with others (Worley, 2018). Given individuals tend to process emotional memory during sleep, disturbances during sleep can result in selection and consolidation of negative memories which can lead to decreased mood and emotion (Worley, 2018) and impaired peer engagement (Reschly et al., 2008).

#### Sleep Latency and Socioemotional Outcomes

Sleep latency, which is one of the measures of sleep that will be focused on in this study, is defined as the time between lights out and sleep onset. This measure is complex, yet interesting, as previous studies have found significant associations between sleep latency and night awakenings, depth of sleep, impression of sleep, and desired sleep length (Gaina et al., 2005). This same study found that participants with shorter sleep latency had higher sleep quality (Gaina et al., 2005). Sleep latency itself has not been studied heavily in regard to its impact on certain socioemotional outcomes, but several studies have been performed in regard to the impact of socioemotional issues on sleep latency. For example, in a study done on Norwegian adolescents (12-16) with anxiety disorders, it was found that 64.5% of the study sample had a

sleep latency of more than 1 hour each night (Haugland et al., 2021). This study shows the correlation between anxiety and sleep latency and brings up the question of a potential bidirectional relationship. Similarly, another study found that depressed adolescents reported longer sleep onset. However, this same study found that longer sleep latency was a significant predictor of anxiety diagnoses at age 24, and sleep latency on school nights was a significant predictor of anxiety and depression at age 21 (Orchard et al., 2020). This study shows the importance of sleep latency in relation to later mental health outcomes. Another study found that longer sleep latency was significantly associated with the self-reported presence of and severity of depressive symptoms (Monroe et al., 1992). Furthermore, a study conducted on sleep disturbances in relation to persistent tic disorders and attention-deficit hyperactivity disorder found that those with persistent tic disorders had significantly increased sleep latency. This same study found that sleep latency was significantly higher in those with both persistent tic disorders and attention deficit hyperactivity disorder (Keenan et al., 2021).

There seems to be a gap in the literature on this topic regarding not only the younger population of preschool/new kindergarteners but also in studies looking at the impact of sleep latency on certain outcomes. Much of the literature that has explored the link between sleep and correlates of socioemotional development (e.g., cognitive processing) has focused on adult populations (Swanson et al., 2021). Additionally, regarding sleep latency, much of the literature explores the impact of different mental health measures on sleep latency, rather than the impact of sleep latency on mental health or other socioemotional outcomes (Orchard et al., 2020). The preschool/kindergarten period is critical for socioemotional development (Marcon, 1993) and impaired sleep has been observed at this period (Owens et al., 2000). However, limited research

has explored the possibility of sleep latency being associated with correlates of socioemotional development.

### Sleep Duration and Socioemotional Outcomes

The other measure that was utilized in this study was nighttime sleep minutes, defined as the minutes that an individual is asleep throughout the night. While sleep minutes specifically is understudied, many studies have found the relevance of sleep duration in association with various aspects of socioemotional outcomes. On the contrary to sleep latency, sleep minutes has a strong amount of previous work and studies done on its impact in preschoolers and young children. One study found significant associations between sleep duration and ego-resilience, PPVT standard score, emotion cause score, and the peer acceptance and social engagement composites – all of which measure cognitive development, self-regulation, and emotions, which are relevant to socioemotional development (Vaughn et al., 2015). Another study done in Chinese preschoolers found that lower sleep duration (less than or equal to 7 hours per day) was associated with lower school readiness, lower scores in emotional maturity and language/cognitive domain, and lower prosocial behaviors (Tso et al., 2015). This same study found that lower sleep duration was associated with high hyperactivity and inattention scores (Tso et al., 2015). In addition to preschoolers, studies have been done looking at sleep duration and its impact on adolescents. One cross-sectional study performed in Alabama found that adolescents who had low sleep minutes and poor sleep quality had higher levels of internalizing symptoms and aggressive behavior (El-Sheikh et al., 2019).

The gaps in the literature regarding sleep minutes seems to be in studies concerning specifically kindergarteners. As stated previously, there are studies concerning preschoolers,



adolescents, and adults, but there are limited findings on sleep minutes and socioemotional outcomes in the transition to kindergarten.

### Current Study

Sleep latency and sleep minutes were selected as the measures to utilize, and the measures are relatively uncorrelated. Therefore, this study will seek to address some of these gaps by exploring specific aims. The first aim will explore the impact of sleep latency in pre-kindergarten (K1) on socioemotional outcomes in the initial transition to kindergarten (K2). The second aim will explore the impact of sleep latency in the transition to kindergarten (K2) on socioemotional outcomes during that transition to kindergarten (K2). The third aim will explore the impact of sleep minutes in pre-kindergarten (K1) on socioemotional outcomes in the initial transition to kindergarten (K2). The fourth study aim will explore the impact of sleep minutes in the transition to kindergarten (K2) on socioemotional outcomes during that transition to kindergarten (K2).

## **Chapter 2**

### **Methods**

#### **Participants**

The Internal Review Board of the Office of Research Protections at Pennsylvania State University approved this study to be carried out. Participants included in this study were enrolled in the Project SIESTA study. This study consisted of kindergarteners and families who were recruited during their kindergarten registration from 3 rural to suburban school districts in southeastern Pennsylvania from April of 2016 through May of 2019. Out of the 1158 that expressed interest, 230 were recruited. The criteria for participants were the parents being 18 years or older, speaking English, and living with their child or children in an independent family unit.

There was stratification by child gender and severity of children's sleep problems within each school district, assessed from parent report during kindergarten registration. The parent report required parents to give preliminary information on a scale from 0 to 2 per item on: difficulty waking up, night waking frequency, bedtime after 9PM, sleep latency, and bedtime onset. These scores were compiled on a 0 to 10 composite index which was then stratified to ensure a sample with a wide range of sleep problems. Additionally, there was random oversampling of racial and ethnic minority families to meet the 20%-25% racial and ethnic minority recruitment goal that is recommended by the National Institute of Health.

For those that completed the full study, the demographic breakdown can be found in Table 1. The kindergarten participant sample includes 109 boys and 112 girls, the majority of

which (74.2%) identified as non-Hispanic white. The families received financial compensation for their participation in the study. Of the 230 participants in the study, sleep latency measures were derived for 206 kindergarteners at K1 and K2. Within the enrolled participant sample, 104 (50.5%) identified as male and 155 (75.2%) identified as white and non-Hispanic. The mean annual family income of the sample was \$80,000-90,000. The median mother's education is "graduated with a bachelor's degree" and father's education is "graduated with an associate degree".

### **Measures**

*Socioemotional Outcomes.* There were 5 main measures utilized to explore socioemotional outcomes in the kindergarten participants. With one exception (the ADHD rating scale), higher scores on each measure indicated better performance.

The Attention Deficit Hyperactivity Disorder Rating Scale (ADHD; DuPaul et al., 1998) was used to look ADHD in Kindergarten students. This scale contains statements such as "often fidgets or squirms in seat" and "is easily distracted", and the teacher rates the student between "not at all" and "very much". The 14-item School Readiness Questionnaire (SRQ; Bierman et al., 2008) was utilized by teachers to explore each kindergartener's school readiness through things such as self-regulation, motivation, and compliance. This questionnaire contained statements such as "this child really enjoys school" and "this child can follow the rules and routines that are part of the school day", and the teacher rates the student between "strongly disagree" and "strongly agree". The Child Behavior Questionnaire (TCBQ; Werthamer-Larsson et al., 1991) was utilized by teachers to assess kindergarteners' behavior in the classroom, such as aggression, emotional regulation, internalizing behaviors, and prosocial behaviors, which are strong indicators of socioemotional outcomes. This questionnaire contains statements such as the

child “invites others to play” and “breaks things on purpose”, and the teacher rates the child between “almost never” and “almost always”. The 28-item Student Teacher Relationship Survey (STRS; Pianta, 2001) was utilized by teachers to illustrate the kindergartener’s relationship with the teacher, such as closeness and conflict, which are determinants of socioemotional outcome. This survey contains statements such as “I share an affectionate, warm relationship with this child” and “If upset, this child will seek comfort from me”, and the teacher rates this statement between “definitely does not apply” and “definitely applies”. Lastly, the 29-item Learning Behavior Scale (LBS; McDermott et al., 2002) was utilized by teachers to illustrate the kindergartener’s learning behavior, including enthusiasm, persistence, and frustration in the classroom, which is also indicative of socioemotional outcome. This scale contains statements such as “displays reluctance to tackle new tasks” and “too unenergetic for interest or effort”, and the teacher rates the child between “often applies” and “rarely applies”.

*Sleep Health.* Sleep latency and sleep minutes were utilized to measure sleep health in each participant. Higher values of sleep latency indicate poorer sleep health, while lower values indicate better sleep health. On the other hand, higher values of sleep minutes indicate better sleep health while lower values of sleep minutes indicate poorer sleep health. Sleep latency measures the time from parental reported lights out, until the kindergartener fell asleep based on the actigraphy. The measures of sleep latency consisted of an average value for sleep latency over the week of K1 data collection and the week of K2 data collection. Sleep minutes measures the minutes that the child is asleep over the duration of sleep; this was based off of the actigraphy. The measures of sleep minutes consisted of an average value for sleep minutes over the week of K1 data collection and the week of K2 data collection.

## Study Design and Procedures

Each participant was studied for one week during four measurement occasions over the duration of the kindergarten year. The present study focused on the first two measurement occasions (K1 and K2). The first study period, K1, was the “Pre-K” period during July/August, before the school year began. The second study period, K2, was the “Early Transition” period during September/October, in the beginning of the school year. Teacher measures were collected during the one week in each period that the sleep measures were also being collected. A Spectrum Plus Actiwatch (Philips Healthcare, Murrysville, PA) was worn on each kindergartener’s wrist for the duration of the study period and was used to measure sleep minutes, and along with parent reported “lights out” to assess sleep latency at both K1 and K2. The socioemotional outcomes were measured using a variety of surveys/questionnaires.

To analyze sleep latency, the top and bottom third of the distribution of the sleep latency measures were taken and separated into “low sleep latency” and “high sleep latency”. In K1, the mean sleep latency of the sample was 36.17 minutes (SD = 28.40). The “low sleep latency” group of K1 consisted of 67 participants who had a sleep latency of 20.38 minutes or less. The “high sleep latency” group of K1 consisted of 68 participants who had a sleep latency of 35.79 minutes or more. The “low sleep latency” group of K2 consisted of 64 participants who had a sleep latency of 16.13 minutes or less. The “high sleep latency” group of K2 consisted of 65 participants who had a sleep latency of 28.86 minutes or more.

To analyze sleep minutes, the top and bottom third of the distribution of the sleep minutes measures were taken and separated into “low sleep minutes” and “high sleep minutes”. The “low sleep minutes” group consisted of 72 participants who had sleep minutes of less than 512 minutes per night in K1 and less than 521 minutes per night in K2. The “high sleep minutes”

group consisted of 72 participants who had sleep minutes of greater than 539 minutes per night in K1 and greater than 543 minutes per night in K2.

**Table 1.**

**Sample Demographics**

Target Child Characteristics, %

White	76.9%		
African American	7.7%		
Asian American	0.9%		
Native American	0.5%		
Two or More Races	12.2%		
Other Race	1.8%		
Hispanic	8.6%		
Child Gender	50.7% female		
School District	<u>District 1</u> 39.8%	<u>District 2</u> 26.2%	<u>District 3</u> 33.9%

Caregivers in Home, %

	<u>Living with Partner</u>	<u>Not living with partner</u>
Two parents participating	76.0%	0.0%
Only mother participating	17.2%	5.4%
Mother and grandparent participating	0.0%	1.4%
	<u>Mother, %</u>	<u>Father, %</u>
< High school diploma	1.8%	2.4%
High school diploma/GED	29.8%	37.2%
Associate's degree	15.6%	15.2%
Bachelor's degree	27.1%	28.7%
Master's degree	19.7%	12.2%
Doctoral or Law degree	6.0%	4.3%
	<u>Mean (SD)</u>	<u>Range</u>
Mother Age	34.63 (4.95)	23-55
Father Age	36.95 (6.28)	23-67

Table 2.

## Variable Descriptives

	<i>M</i>	<i>SD</i>	Minimum	Maximum
Sleep Latency, in minutes				
K1	36.17	28.40	5.64	171.36
K2	27.36	19.14	3.58	119.60
Sleep Time, in minutes				
K1	526.89	34.08	435.29	606.83
K2	531.11	29.53	408.07	595.71
Socioemotional Outcomes				
Learning Behavior Scale	50.73	8.99	5	58
School Readiness Questionnaire	69.00	13.58	14	84
ADHD Rating Scale	8.59	9.36	0	40
Child Behavior Questionnaire	99.93	18.49	33	130
Student Teacher Relationship Score	139.80	14.65	93	161

Note. *M* represents mean. *SD* represents standard deviation. K1 represents the “Pre-K” period. K2 represents the “Early Transition” period.

## **Statistical Analyses**

Descriptive statistics were utilized to describe the measures of the study. To test aim 1, a one-way analysis of variance (ANOVA) was conducted to explore the association between K1 sleep latency and each K2 socioemotional measure. To test aim 2, a one-way ANOVA was conducted to explore the association between K2 sleep latency and each K2 socioemotional measure. For each of these, a one-way analysis of variance was used to compare the group with low latency to the group with high latency. To test aim 3, a one-way ANOVA was conducted to explore the association between K1 sleep minutes and each K2 socioemotional measure. To test aim 4, a one-way ANOVA was conducted to explore the association between K2 sleep minutes and each K2 socioemotional measure.



## Chapter 3

### Results

#### **K1 Sleep Latency and K2 Socioemotional Development in Kindergarten Children**

As evident in Table 3, for K1, all socioemotional measures were significantly associated with sleep latency. Those in the low sleep latency group performed significantly better on the Learning Behavior Scale than the high sleep latency group ( $F(1,133) = 10.69, p < .005$ ). Additionally, those in the low sleep latency group performed significantly better on the School Readiness Questionnaire than the high sleep latency group ( $F(1,133) = 11.05, p < .005$ ). Regarding the ADHD Rating Scale, the low sleep latency group performed significantly better than the high latency group ( $F(1,133) = 5.14, p < .05$ ). Regarding the Child Behavior Questionnaire, the low sleep latency group performed significantly better than the high latency group ( $F(1,133) = 6.16, p < .05$ ). Regarding the Student Teacher Relationship Survey, the low sleep latency group performed significantly better than the high latency group ( $F(1,133) = 8.77, p < .005$ ).

**Table 3.****K1 Sleep Latency on K2 Socioemotional Outcomes**

	Low sleep latency (n = 67)			High sleep latency (n = 69)		
	n	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>
ADHD Scale	67	6.58*	8.14	68	9.94	8.14
School Readiness Questionnaire	67	72.15***	10.92	68	65.16	12.92
Child Behavior Questionnaire	66	103.66*	16.11	69	96.35	18.01
Student Teacher Relationship Survey	66	143.15**	12.19	69	135.89	15.96
Learning Behavior Scale	67	53.13***	6.56	68	48.55	9.46

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . n represent number of participants. *M* represents mean. *SD* represents standard deviation.

**K2 Sleep Latency and K2 Socioemotional Development in Kindergarten Children**

As evident in Table 4, K2 had significant associations but conspicuously lower in number than associations in K1. Those in the low sleep latency group performed significantly better on the Learning Behavior Scale than the high sleep latency group ( $F(1,128) = 5.047, p < .05$ ).

Additionally, those in the low sleep latency group performed significantly better on the School Readiness Questionnaire than the high sleep latency group ( $F(1,128) = 10.29, p < .005$ ).

Regarding the ADHD Rating Scale ( $F(1,128) = 1.78, p > .05$ ), the Child Behavior Questionnaire

( $F(1,128) = 3.59, p > .05$ ), and the Student Teacher Relationship Survey, findings were not significant ( $F(1,128) = 2.45, p > .05$ ).

**Table 4.**

**K2 Sleep Latency on K2 Socioemotional Outcomes**

	Low sleep latency (n = 65)			High sleep latency (n = 66)		
	n (%)	<i>M</i>	<i>SD</i>	n (%)	<i>M</i>	<i>SD</i>
ADHD Scale	65 (50)	7.83	9.46	65 (50)	10.03	9.33
School Readiness Questionnaire	65 (50)	71.94**	11.06	65 (50)	64.72	14.38
Child Behavior Questionnaire	64 (49.23)	103.22	19.55	66 (50.76)	96.90	18.45
Student Teacher Relationship Survey	64 (49.23)	141.44	14.55	66 (50.76)	137.20	16.22
Learning Behavior Scale	65 (50)	52.06*	7.52	65 (5)	48.66	9.61

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . n represent number of participants. *M* represents mean. *SD* represents standard deviation.

**K1 Sleep Minutes and K2 Socioemotional Development in Kindergarten Children**

As shown in Table 5, K1 sleep minutes had several significant associations with K2 socioemotional outcomes. Those in the high sleep minutes group performed significantly better

on the ADHD Scale ( $F(1,143) = 10.76, p < .005$ ), Child Behavior Questionnaire ( $F(1,143) = 7.85, p < .05$ ), and the Student Teacher Relationship Survey ( $F(1,143) = 5.55, p < .05$ ). In regard to the School Readiness Questionnaire ( $F(1,145) = .007, p > .05$ ) and the Learning Behavior Scale ( $F(1,145) = .008, p > .05$ ), findings were not significant, although the differences between low and high sleep minute groups on the Learning Behavior Scale approached significance ( $p = .06$ ) and were in the predicted direction.

**Table 5.**

**K1 Sleep Minutes on K2 Socioemotional Outcomes**

	Low sleep minutes			High sleep minutes		
	n	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>
ADHD Scale	72	11.35***	10.41	72	6.33	7.74
School Readiness Questionnaire	72	66.07	11.96	72	69.32	16.04
Child Behavior Questionnaire	71	95.16**	17.46	73	103.44	17.97
Student Teacher Relationship Survey	71	135.84*	17.14	73	142.01	14.14
Learning Behavior Scale	72	48.93	9.48	72	51.89	9.34

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . n represent number of participants. *M* represents mean. *SD* represents standard deviation.

## K2 Sleep Minutes and K2 Socioemotional Development in Kindergarten Children

As shown in Table 6, K2 sleep minutes had no significant associations with K2 socioemotional outcomes ( $p$ 's > .05).

**Table 6.**

### K2 Sleep Minutes on K2 Socioemotional Outcomes

	Low sleep minutes			High sleep minutes		
	n	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>
ADHD Scale	72	9.38	10.14	74	7.81	8.60
School Readiness Questionnaire	72	68.79	12.09	74	68.59	16.66
Child Behavior Questionnaire	72	98.11	18.01	74	99.89	19.68
Student Teacher Relationship Survey	72	138.36	15.86	74	140.57	15.09
Learning Behavior Scale	72	50.58	8.94	74	50.45	9.92

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . n represent number of participants. *M* represents mean. *SD* represents standard deviation.

## **Chapter 4**

### **Discussion**

This study supported the hypothesis that better sleep health (i.e., lower sleep latency and longer nighttime sleep minutes) would predict better socioemotional outcomes in kindergarten students. Furthermore, it was found that both sleep latency and sleep minutes in K1 collection was more predictive of socioemotional outcomes in K2 collection than concurrent K2 sleep latency and sleep minutes. This study builds off of previous findings that shorter sleep duration and poorer sleep quality were related to socioemotional development in toddlers (Morales-Muñoz et al., 2020). This study effectively showed the relationship between sleep latency, sleep minutes, and socioemotional development in kindergarten aged students.

The results indicated that both K1 sleep latency and sleep minutes were more related to K2 outcomes than K2 sleep latency and sleep minutes. This suggests that pre-kindergarten good sleep hygiene carries over into the initiation of school. Intervention should occur before school begins to get kindergarteners into a good sleep routine, which will likely persist after the child transitions into kindergarten. An early establishment of a sleep routine before school begins makes the transition to kindergarten more easily absorbable and less chaotic, thus making the start of school less disruptive to the sleep routine. Another explanation for the stronger associations from K1 as compared to K2 is the increased variability of sleep measures at K1. The weaker associations at K2 can thus be explained by the convergence of sleep and lower variability. Lower variability means that at K2 collection, many children were sleeping

differently than they were sleeping at K1. The lower variability is likely due to the fact that because K2 collection was at the initial transition to kindergarten, many of the children likely had a similar bedtime and were also waking up at the same time. Lower variation (i.e., decreased standard deviation) in the K2 data makes it more difficult to find associations, which may help explain the lack of significant associations in the K2 results.

In this study, sleep was identified as being associated with socioemotional outcomes in kindergarten students. There are explanatory mechanisms that explain the findings that sleep is related to socioemotional outcomes. Many individuals do not experience optimal sleep, which can impede one's attention, learning and memory, emotional reactivity, executive functioning, and overall functioning (McCoy & Strecker, 2011). Better sleep is instrumental in healthy brain development, cognitive function, the ability to regulate emotions, and behavior (Tarokh et al., 2016). The factors such as attention, emotional reactivity, learning, and behavior are all factors that make up socioemotional development. The studies mentioned above help explain the mechanism behind better sleep being predictive of better outcomes in kindergarten adjustment.

The results from this study help support the mechanism of self-regulation as a key factor to school readiness. Self-regulation encompasses factors such as emotional regulation, the ability to pay attention and maintain focus, social engagement, and active reflection (Blair & Raver, 2015). Studies have found that sleep is a strong predictor of self-regulation (Breitenstein et al., 2020). Self-regulation is typically altered by parenting; however, sleep can influence the impact that parenting has on self-regulation (Julian et al., 2019). The study by Julian et al. found that negative parenting only resulted in decreased self-regulation when the child had decreased nighttime sleep, suggesting that decreased sleep increases susceptibility to negative parenting

(Julien et al., 2019). Overall, this supports the importance of sleep in developing and moderating children's self-regulation. Another study found that lower sleep minutes (i.e., less than 7 hours per night) was associated with reduced school readiness, specifically in regard to self-regulation, learning skills, socioemotional development, and physical/motor development (Jackson et al., 2021). Another study found that sleep problems and self-regulation in early childhood are predictive of school adjustment (Williams et al., 2016). These studies support the idea that the children who sleep better and have been sleeping better since before the start of school (K1) have better self-regulation, which is why they have better socioemotional outcomes in their transition to kindergarten. Moreover, studies have found that self-regulation is the foundation for better academic performance later in life Blair & Raver found that contributing factors to self-regulation, such as executive functioning, is just as important as intelligence in regard to early academic success in both math and reading (Blair & Raver, 2015). They further found that self-regulation is especially important in academic success regarding motivation, engagement, and stress (Blair & Raver, 2015). The impact of self-regulation on academic outcomes in the transition to kindergarten could be further explored with this data utilizing the academic measures collected in this study.

This study did provide an adequate test of the hypothesis; however, some study limitations should be considered. The study did not consider various covariates, such as socioeconomic status, which could be beneficial in analysis given findings that show a relationship between lower family socioeconomic status and impaired sleep within adolescents (Lewien et al., 2021). Another covariate that could be considered is race, as studies have found racial and ethnic disparities in regard to sleep duration and sleep quality (Johnson et al., 2019). Another limitation of the study is that the "lights out" aspect of sleep latency is self-reported,



thus there is possibility for flawed data, such as participants not accurately recalling the time of lights out. Furthermore, each of the five socioemotional outcome measures are based on the teacher's subjective evaluation. Thus, there is the possibility of bias in consideration of these measures.

The findings of this study can be built upon for further research in several aspects. First, the impact of sleep hygiene on sleep health warrants further exploration, as one study found a significant association between a bedtime routine and increased sleep duration as well as decreased sleep latency (Hall & Nethery, 2019). Additionally, further research could be done to determine the reasoning behind why K1 sleep is more predictive of socioemotional outcomes than concurrent sleep. Research could also look at the K3 and K4 data collection to determine whether K1 sleep is still more predictive than concurrent sleep later in the school year. Moreover, further research could be done looking at how other sleep parameters, such as sleep fragmentation, impact socioemotional outcomes in kindergarten students. Lastly, as mentioned previously, the impact of sleep on academic outcomes in the transition to kindergarten could be studied to see how sleep, self-regulation, socioemotional outcomes, and overall academic outcomes are related. The findings from a study looking at all four factors could potentially result in sleep intervention being used as an academic tool in young children.

## BIBLIOGRAPHY

- Bierman, K.L., Domitrovich, C.E., Nix, R.L., et al. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development, 79*(6), 1802-17. doi: 10.1111/j.1467-8624.2008.01227.x.
- Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual review of psychology, 66*, 711–731.  
<https://doi.org/10.1146/annurev-psych-010814-015221>
- Breitenstein, R.S., Hoyniak, C.P., McQuillan, M.E., Bates, J.E. (2021). Sleep and self-regulation in early childhood. *Advances in Child Development and Behavior. 60*,111-137.
- DuPaul, G. J., Power, T. J., Anastopoulos, A. D., & Reid, R. (1998). *ADHD Rating Scale-IV: Checklists, norms, and clinical interpretation*. New York: Guilford.
- El-Sheikh, M., Saini, E. K., Gillis, B. T., & Kelly, R. J. (2019). Interactions between sleep duration and quality as predictors of adolescents' adjustment. *Sleep Health, 5*(2), 180-186.
- Gaina, A., Sekine, M., Kanayama, H. et al. (2005). Short-long sleep latency and associated factors in Japanese junior high school children. *Sleep and Biological Rhythms 3*, 162–165. <https://doi.org/10.1111/j.1479-8425.2005.00185.x>
- Hall, W. A., & Nethery, E. (2019). What does sleep hygiene have to offer children's sleep problems? *Paediatric respiratory reviews, 31*, 64–74.  
<https://doi.org/10.1016/j.prrv.2018.10.005>
- Haugland, B., Hysing, M., Baste, V., Wergeland, G. J., Rapee, R. M., Hoffart, A., Haaland, Å.

- T., & Bjaastad, J. F. (2021). Sleep Duration and Insomnia in Adolescents Seeking Treatment for Anxiety in Primary Health Care. *Frontiers in Psychology, 12*, 638879.
- Jackson, D. B., Testa, A., & Semenza, D. C. (2021). Sleep duration, bedtime consistency, and school readiness: Findings from the 2016 to 2018 national survey of children's health. *Journal of Developmental and Behavioral Pediatrics, 42*(7), 561-568.  
doi:<http://dx.doi.org/10.1097/DBP.0000000000000937>
- Johnson, D. A., Jackson, C. L., Williams, N. J., & Alcántara, C. (2019). Are sleep patterns influenced by race/ethnicity - a marker of relative advantage or disadvantage? Evidence to date. *Nature and science of sleep, 11*, 79–95. <https://doi.org/10.2147/NSS.S169312>
- Julian, M. M., Leung, C., Rosenblum, K. L., LeBourgeois, M. K., Lumeng, J. C., Kaciroti, N., & Miller, A. L. (2019). Parenting and toddler self-regulation in low-income families: What does sleep have to do with it? *Infant mental health journal, 40*(4), 479–495.  
<https://doi.org/10.1002/imhj.21783>
- Keenan, L., Sherlock, C., Bramham, J., & Downes, M. (2021). Overlapping sleep disturbances in persistent tic disorders and attention-deficit hyperactivity disorder: A systematic review and meta-analysis of polysomnographic findings. *Neuroscience and biobehavioral reviews, 126*, 194–212. <https://doi.org/10.1016/j.neubiorev.2021.03.018>
- Lewien, C., Genuneit, J., Meigen, C., Kiess, W., & Poulain, T. (2021). Sleep-related difficulties in healthy children and adolescents. *BMC pediatrics, 21*(1), 82.  
<https://doi.org/10.1186/s12887-021-02529-y>
- Marco, C.A., Wolfson, A.R., Sparling, M., & Azuaje, A. (2012) Family Socioeconomic Status and Sleep Patterns of Young Adolescents. *Behavioral Sleep Medicine, 10*(1), 70-80. DOI: [10.1080/15402002.2012.636298](https://doi.org/10.1080/15402002.2012.636298)

- Marcon, RA (1993) Socioemotional versus academic emphasis: Impact on kindergartners' development and achievement. *Early Child Development and Care*, 96(1), 81-91. DOI: [10.1080/0300443930960108](https://doi.org/10.1080/0300443930960108)
- McCoy, J. G., & Strecker, R. E. (2011). The cognitive cost of sleep lost. *Neurobiology of learning and memory*, 96(4), 564–582. <https://doi.org/10.1016/j.nlm.2011.07.004>
- McDermott PA, Leigh NM, Perry MA. (2002). Development and validation of the preschool learning behaviors scale. *Psychology in the Schools*, 39(4), 353-65. doi: 10.1002/pits.10036.
- Monroe, S. M., Thase, M. E., & Simons, A. D. (1992). Social factors and the psychobiology of depression: Relations between life stress and rapid eye movement sleep latency. *Journal of Abnormal Psychology*, 101(3), 528–537. <https://doi.org/10.1037/0021-843X.101.3.528>
- Morales-Muñoz, I., Lemola, S., Saarenpää-Heikkilä, O., Kylliäinen, A., Pölkki, P., Paunio, T., Broome, M. R., & Paavonen, E. J. (2020). *Parent-reported early sleep problems and internalising, externalising and dysregulation symptoms in toddlers*. *BMJ Paediatrics Open*. <https://bmjpaedsopen.bmj.com/content/4/1/e000622>
- Orchard, F., Gregory, A.M., Gradisar, M. and Reynolds, S. (2020), Self-reported sleep patterns and quality amongst adolescents: cross-sectional and prospective associations with anxiety and depression. *Journal of Child Psychology and Psychiatry*, 61, 1126-1137. <https://doi.org/10.1111/jcpp.13288>
- Owens, J. A., Spirito, A., McGuinn, M., & Nobile, C. (2000). Sleep habits and sleep disturbance in elementary school-aged children. *Journal of Developmental and Behavioral Pediatrics*, 21(1), 27-36.

- Paruthi, S., Brooks, L.J., D'Ambrosio, C., Hall, W.A., Kotagal, S., Lloyd, R.M., Malow, B.A., Maski, K., Nichols, C., Quan, S.F., Rosen, C.L., Troester, M.M., Wise, M.S. (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.
- Pianta, R.C. *Student-Teacher Relationship Scale: Professional manual*. Odessa (FL): Psychological Assessment Resources, Inc.; 2001.
- Reschly, A.L., Huebner, E.S., Appleton, J.J. and Antaramian, S. (2008). Engagement as flourishing: The contribution of positive emotions and coping to adolescents' engagement at school and with learning. *Psychology in the Schools*, 45(5). 419-431.  
<https://doi.org/10.1002/pits.20306>
- Schlieber, M., & Han, J. (2021) The Role of Sleep in Young Children's Development: A Review. *The Journal of Genetic Psychology*, 182(4), 205-217. DOI: 10.1080/00221325.2021.1908218
- Swanson, L. M., Hood, M. M., Hall, M. H., Kravitz, H. M., Matthews, K. A., Joffe, H., Thurston, R. C., Butters, M. A., Ruppert, K., & Harlow, S. D. (2021). Associations between sleep and cognitive performance in a racially/ethnically diverse cohort: the Study of Women's Health Across the Nation. *Sleep*, 44(2), zsaa182.  
<https://doi.org/10.1093/sleep/zsaa182>
- Tarokh, L., Saletin, J. M., & Carskadon, M. A. (2016). Sleep in adolescence: Physiology, cognition and mental health. *Neuroscience and biobehavioral reviews*, 70, 182–188.  
<https://doi.org/10.1016/j.neubiorev.2016.08.008>
- Tso, W., Rao, N., Jiang, F., Li, A. M., Lee, S.-lun, Ho, F. K.-wing, Li, S. L., & Ip, P. (2015).

- Sleep duration and school readiness of Chinese Preschool Children. *The Journal of Pediatrics*, 169, 266-271.
- 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. DOI: [10.1080/15402002.2013.845778](https://doi.org/10.1080/15402002.2013.845778)
- Werthamer-Larsson L, Kellam S, Wheeler L. (1991). Effect of first-grade classroom environment on shy behavior, aggressive behavior, and concentration problems. *American Journal of Community Psychology*, 19(4), 585-602. doi: 10.1007/BF00937993.
- Williams, K. E., Nicholson, J. M., Walker, S., & Berthelsen, D. (2016). Early childhood profiles of sleep problems and self-regulation predict later school adjustment. *British Journal of Educational Psychology*, 86(2), 331-350. doi: <http://dx.doi.org/10.1111/bjep.12109>
- Wolfson, A. R., & Carskadon, M. A. (2003). Understanding adolescents' sleep patterns and school performance: a critical appraisal. *Sleep medicine reviews*, 7(6), 491–506. [https://doi.org/10.1016/s1087-0792\(03\)90003-7](https://doi.org/10.1016/s1087-0792(03)90003-7)
- Worley S. L. (2018). The Extraordinary Importance of Sleep: The Detrimental Effects of Inadequate Sleep on Health and Public Safety Drive an Explosion of Sleep Research. *P & T: a peer-reviewed journal for formulary management*, 43(12), 758–763.

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Eberly College of Science, Schreyer Honors College  
Bachelor of Science, General Science (Biological Sciences and Health Professions Option)  
Minors in Human Development and Family Studies, Diversity and Inclusion in Health and Human Development  
University Park, PA  
*Aug 2018 to May 2022*

**RESEARCH EXPERIENCE**

Project SIESTA  
College of Health and Human Development, Department of Human Development and Family Studies  
Addiction, Health, Adolescence (AHA!) Lab  
Annenberg School for Communication, University of Pennsylvania  
MC<sup>2</sup> Chronic Conditions Health Equity Lab  
Rory Meyers College of Nursing, New York University  
University Park, PA  
*Aug 2019 to May 2022*  
Philadelphia, PA  
*June 2021 to Aug 2021*  
Philadelphia, PA  
*June 2021 to May 2022*

**ACTIVITIES**

Presidential Leadership Academy  
The Pennsylvania State University  
University Park, PA  
*Aug 2019 to May 2022*  
Clinic Intern  
University Health Services  
University Park, PA  
*Jan 2021 to May 2022*  
Minorities in Schreyer  
Founder and President  
University Park, PA  
*Jan 2020 to May 2022*  
Student Minority Advisory and Recruitment Team  
Public Relations Chair (2019-2020)  
University Park, PA  
*Aug 2018 to May 2022*  
Dean's Student Advisory Board  
Schreyer Honors College  
University Park, PA  
*Aug 2020 to May 2022*  
Scholar Alumni Society Board  
Schreyer Honors College, Subcommittee for Diversity, Equity, and Inclusion  
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## **HONORS AND AWARDS**

Bunton Waller Undergraduate Fellowship Program  
Melville Barr Alumni Memorial Scholarship  
George H Deike Scholarship  
W&K Donato Honors Scholarship  
Petersen Scholarship  
Priem Scholarship in Health and Human Development  
Weaver and Sutherland Scholarship  
University Park 4 Year Provost Award  
E. & A. Talbert Open Doors Scholarship  
Academic Excellence Scholarship  
Maley Family Honors Scholarship  
Slep Honors Scholarship in Health and Human Development  
Schumacher Honors Scholarship  
J.W. Van Dyke Memorial Scholarship  
R.E. Abraham Award