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Associations between the Sleep of Children with ADHD and their Mothers

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Associations between the sleep of children with ADHD and their mothers

By

Elizabeth Thorne

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Science
in Human Development and Family Studies
in the School of Human Sciences

Mississippi State, Mississippi

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2015

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This thesis research examines the relation of sleep of children with ADHD and its association with three variables of mother's sleep. Specifically, we examine specific variables of child sleep including sleep duration, sleep onset, and nightwakings and its relation to mother's sleep onset, sleep duration, and sleep quality while controlling for child age. After conducting correlations and hierarchal regressions, data analysis indicated a positive association between child sleep onset and mother's sleep onset, and significant negative relation to mother's sleep duration and sleep quality. Contrary to expectations, children's sleep duration and nightwakings were not associated with any of the mother's sleep variables. After delineating associations between sleep of children with ADHD and their mothers, we provided research implications and in order to promote sleep in this population.

DEDICATION

This thesis is dedicated to my late grandfather, Mr. Arthur Phillip Coleman, and his widow, Mrs. Delcie Pierce Coleman, who constantly encouraged and supported all my academic endeavors. Their constant love and support fostered my desire for pursuit of higher education.

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CHAPTER I

INTRODUCTION

Approximately 11% of children ages 4 to 17 in the United States are diagnosed with attention-deficit/hyperactivity disorder (ADHD; Center for Disease Control [CDC], 2014), making it the most common child psychiatric condition (Gruber et al., 2012). Child diagnoses of ADHD are historically higher (2003-2011 data) in Mississippi compared to the national percentage (CDC, 2014). According to the CDC Behavioral Risk Factor Surveillance System (2008), adults in Mississippi reported the highest rates (13.1-19.3) of insufficient sleep in the United States, even after adjusting for age (CDC, 2013). In conjunction, these staggering statistics underscore the potential importance of delineating associations between child ADHD and parent sleep disruptions, particularly with an at-risk population such as Mississippi.

Research showed that approximately 70% of parents disclosed sleep problems in their child (Sciberras, Fulton, Efron, Oberklaid, & Hiscock, 2011). Sleep disruptions are one of the most common pediatric health issues reported by parents and these rates are even higher in populations of children diagnosed with ADHD (Lycett et al., 2014). Parents of children with ADHD reported a range of sleep disruptions including bedtime resistance (Gruber et al., 2012; Lycett et al., 2014), sleep-onset delay (Gruber et al., 2012; Lycett et al., 2014), night wakings (Gruber et al., 2012; Lycett et al., 2014; Scott et al., 2013), and daytime sleepiness (Gruber et al., 2012; Owens et al., 2013), which may

negatively affect parents' sleep (Meltzer & Mindell, 2007) and function (Carter, 2003). There has been limited research to find the relation between child and parent sleep and its impact on family functioning (Meltzer & Mindell, 2007), but we know that insufficient sleep in parents can lead to psychological distress, maternal health problems, parental conflict, high family stress (Huessler et al., 2013), and harsher parenting practices (Erath & Tu, 2011). Given that a large percentage of mothers reported nighttime care for their children (National Sleep Foundation 2014 Sleep in America Poll), it is likely that sleep disruptions of the child with ADHD influence the sleep of the mother. Understanding these relations is important as sleep disruptions are related to a host of family (Meltzer & Mindell, 2007; Sadeh et al., 2000) and child health outcomes (Sung, Hiscock, Sciberras, & Efron, 2008).

The purpose of this study is to understand associations between the sleep of children with ADHD and their mothers. Specifically, we will examine associations between child sleep (delay, duration, nightwakings) mother's sleep onset, sleep duration, and sleep quality, while controlling for potential confounds (i.e., child gender, ethnicity, socioeconomic status, , and medications of the mother). Results will assist intervention and prevention efforts focused on populations of children with ADHD.

Theoretical Framework

There are two theories that are the cornerstone of this research: The Family Systems Theory (Bowen, 1978) and Dahl's sleep theory (Dahl, 1996). Family Systems Theory views the family as an interconnected system, noting that one relationship within the family affects another dyad within the family (Bowen, 1978). This theory served as a guide for our hypothesis that children's poor sleep will have a negative impact on their

parent's sleep. Additionally, Dahl's (1996) theory lends a framework to understand the impact of regulation problems on sleep as well as how sleep itself may increase regulation problems; both of which may impact maternal and child sleep outcomes.

Family systems theory suggests that the family works as a system, therefore what affects one member of the family, affects each member of the family (Bowen, 1978). This guides our hypothesis that if a child with ADHD suffers from sleep problems that the mother's sleep is negatively affected. Meltzer and Mindell (2007) discussed the family sleep cycle in this context explaining that children who may have difficulty sleeping will possibly wake their parent, which compromises parent sleep. When a parent is not gaining sufficient sleep, this may emphasize certain stressors, whether it is at work or in the household, which in turn can exacerbate sleep problems in children (Meltzer & Mindell, 2007; Theule, Wiener, Tannock, & Jenkins, 2013).

Dahl (1996) extensively discussed sleep and its role in regulation and attention, and served as a foundation of this research. From late childhood to early adulthood, the prefrontal cortex (PFC) is maturing, which allows children to appropriately regulate their emotions (Dahl, 1996). When one has suffers from chronic sleep deprivation, the PFC is compromised which alters the motivation for goal directed behaviors, emotion regulation, and cognitive processing (Dahl, 1996). There is continued explanation of the relation of sleep and emotion regulation that indicate poor focused attention, mood deterioration, tiredness, and decreased arousal (Dahl, 1996), which is also identified as symptoms of ADHD (Moreau, Rouleau, & Morin, 2014). Dahl (1996) proposed that inadequate sleep can be linked to physical health problems and psychiatric disorders and explained that sleep has a direct effect on one's ability to perform complex tasks.

We will frequently discuss sleep onset delay or latency, sleep duration (amount), nightwakings, and sleep quality and throughout this thesis. Sleep onset is the process in which one's arousal is gradually reduced (Davis et al., 1937), while sleep duration refers to the amount of sleep one person acquires. Sleep quality is comprised of many facets of sleep, specifically sleep latency, sleep duration, nightwakings, and restfulness from sleep (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989).

CHAPTER II

REVIEW OF THE LITERATURE

According to the National Sleep Foundation (NSF) Sleep in America Poll (2014) and current research, school-aged children get less than the recommended amount of sleep required for optimal functioning (Meltzer & Mindell, 2007; Mindell & Owens, 2003). The link between sleep and functioning may be more robust for children diagnosed with ADHD, as studies have repeatedly shown that children with ADHD have significantly higher sleep disruptions, including sleep onset delay and multiple night wakings (Gruber et al., 2012; Hvolby, Jorgenson, & Bilenberg, 2009; Lycett et al., 2014; Owens et al., 2013). Approximately 25 to 56% of parents reported that their child with ADHD have sleep disturbance (Hansen, Skirbekk, Oerbeck, Wentzel-Larsen, & Kristensen, 2013). Night wakings were reported in 26% of parents of children with ADHD (Hvolby, Jorgensen, & Bilenberg, 2009) while other complaints included bedtime resistance and sleep onset latency (Gruber, et al., 2012; Lycett, et al., 2014). Children who have a hard time settling or who wake during the night (e.g., children diagnosed with ADHD) may also be disrupting their caregivers' sleep (Hvolby et al., 2009). Given that mothers are typically the primary caregiver (Meltzer & Mindell, 2007) and sleep disruptions are common among children with ADHD, it is imperative to delineate the association between sleep of children with ADHD and their mothers.

Sleep

Sleep is defined as a “reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment” (Carskadon & Dement, 2011, p 16). Due to the restoration benefits and prevention of undesired negative outcomes, a third of human life should be committed to sleep (Carter, 2003). Suggested sleep amount varies throughout the lifespan. For instance, it is suggested that children ages 5 to 10 years old obtain 9 to 11 hours of sleep a night, which decreases during adolescence to 8 to 10 hours a night (NSF, 2015). For adults, the NSF (2015) recommended to acquire seven to nine hours of sleep a night. Sleep plays an integral role in maturational processes, and during the primary period of development, sleep is the essential activity of the brain (Dahl, 1996). One of the most common parental complaints is their child’s sleep, which has a substantial influence on the child’s family (Mindell & Owens, 2003).

Sleep can be accessed via subjective or objective measures. Subjective sleep measures include sleep diaries and questionnaires, while objective sleep measures involve polysomnography and actigraphy. Subjective sleep measures are used in this pilot study and were completed by the parent. By using questionnaires to assess sleep of the parent and child, researchers were able to gain knowledge about individual sleep needs (Moore & Meltzer, 2008), which are not accessible using objective sleep measures. Thus, this pilot study used subjective measures completed by the mother as the age of the children did not allow for consistency in reporters.

Attention deficit-hyperactivity disorder

Symptoms of ADHD may range from inattention, hyperactivity, and impulsivity, which complicate one’s ability to focus and control his or behavior (Medline Plus,

National Institute of Health, 2014). ADHD affects 11% of children in the United States (CDC, 2014). A child who exhibits a pattern of symptoms outside his or her developmental range may likely be diagnosed with ADHD (Medline Plus, National Institute of Health, 2014). Children are most commonly diagnosed by age seven, while some can be diagnosed as early as four years old (CDC, 2014).

For a child to be clinically diagnosed with ADHD, he or she must show six or more symptoms of inattention that are not developmentally appropriate for at least six consecutive months (CDC, 2014). There are two categories of ADHD: inattentive type and hyperactive/impulsive type. Symptoms for inattentive ADHD include the inability to hold attention to detail, which contributes to careless mistakes, inattention when spoken to directly, has trouble organizing, easily distracted, frequently loses important items, forgetful of daily activities, and/or unwilling to partake in tasks that require sustained mental effort (CDC, 2014). For children with hyperactive and impulsive ADHD, the six or more symptoms must include excessive talking, frequent fidgeting, inability to remain seated during expected times, running and climbing at inappropriate times, is not quiet during leisurely activities, interrupting, has trouble waiting their turn, and/or is very restless (CDC, 2014). Along with respective symptoms of inattentive type and hyperactive-impulsive type, the child must show these symptoms in two or more settings prior to age 12. Additionally, the symptoms must interfere with school, work, or social gatherings, and symptoms are not only present during episodes of psychotic disorders, for children who may be diagnosed with a psychotic disorder (CDC, 2014).

ADHD and sleep

Hvolby and colleagues (2009) investigated 321 children and discovered that one third of their parents relayed an unwillingness of children aged 4 to 12 with ADHD to go to bed (i.e. bedtime resistance) and there were common complaints of sleep onset.

Additionally, parents commonly complained of sleep onset problems, with children with ADHD having significantly longer sleep latencies, assessed via subjective measures, as compared to the healthy controls. There was also a substantial difference in bedtime and unsettled sleep in children with ADHD compared to healthy controls. Parents of children with ADHD also reported night waking more frequently than parents of healthy controls.

In a study conducted by Owens and colleagues (2000a), researchers recruited a sample of children 5 to 10 years old who were diagnosed with ADHD ($n=57$) as well as a matched control group ($N=46$), and assessed their sleep using the Children's Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn, 2000b) completed by the parents, and a Self-Sleep Report (SSR) completed by the child. Owens and colleagues (2000a) discovered that the sample of children with ADHD had higher mean totals on all eight subscales of CSHQ and SSR; that is, the higher scores indicated more sleep disturbances in the sample.

Additionally, it has been shown that sleep duration increased for children with ADHD from early childhood as they get older (Scott et al., 2013). This longitudinal study assessed sleep in 173 children from birth to 11 years. Scott and colleagues (2013) found that children diagnosed with ADHD acquired less sleep compared to their peers, as well as increased night wakings. Children diagnosed from age five to nine were shown to have significantly less sleep compared to their peers (Scott et al., 2013). Despite the difference

of sleep duration in children with ADHD compared to their peers, there was no significant difference in daytime sleep duration (Scott et al., 2013).

Symptoms of ADHD, such as inattention and hyperactivity, are very similar to symptoms of inadequate sleep (Chiang et al., 2010; Kirov et al., 2012; Owens, 2005; Stein, Weiss, & Hlavaty, 2012). For example, moodiness and aggression, which are common symptoms of sleep disruptions, can be confused with ADHD (NSF, n.d.). Children with sleep disturbances are also more likely to exhibit symptoms of oppositional behaviors, inattentiveness, hyperactivity, and impulsivity (NSF, 2014), and inadequate sleep may exacerbate ADHD symptoms (Efron et al., 2014). Additional symptoms of sleep disturbances caused daytime fatigue, altered mood, short attention span, and undesired behavior (Gruber et al., 2012), which are comparable to ADHD symptoms (Chiang et al., 2010). Unfortunately, children with ADHD are more likely to experience chronic sleep problems (Hansen et al., 2013). Research has indicated that resolving sleep issues may reduce ADHD symptoms (Dahl, 1996; Meltzer & Montgomery-Downs, 2011; Owens, 2005).

Child sleep disruptions and parent sleep

As previously discussed, ADHD and sleep are highly correlated with each other. That is, the majority of parents of children diagnosed with ADHD disclosed sleep problems in their children (Lycett et al., 2014; Sciberras et al., 2011) that range from difficulty falling asleep, night waking, bedtime resistance (Gruber et al., 2012; Lycett et al., 2014; Owens et al., 2013; Stein et al., 2012). Since sleep problems exacerbated ADHD symptoms (Efron et al., 2014), parents of children with ADHD are more likely to

experience marital conflict, psychological distress, and poor maternal health (Huessler et al., 2013).

Children who had trouble sleeping commonly woke their mother, which disrupted her sleep (Meltzer & Westin, 2011). Furthermore, 70% parents of children with ADHD reported sleep problems in their child (Sciberras et al., 2011). These sleep problems included sleep onset delay, night waking, bedtime resistance (Gruber et al., 2012; Lycett et al., 2014) and morning/daytime fatigue (Hvolby et al., 2009). Additional research of parent reports supported the conclusion that sleep in ADHD children is significantly lower as compared to their typically developing peers (Owens et al., 2000a), and these sleep problems may have caused psychological distress in parents (Huessler et al., 2013; Hvolby et al., 2009), decreased caregivers' mental health (Sciberras et al., 2011), caused high family stress and parental conflict (El-Sheikh, Kelly, Buckhalt, & Hinnant, 2010, Huessler et al., 2013). However, research on *why* parents of children with ADHD may have experienced these outcomes is not clear.

There has been limited research on the connections between children and parents' sleep (Brand, Gruber, Hatzinger, Beck, & Holsboer-Trachsler, 2009), specifically mothers' sleep amount (Meltzer & Mindell, 2007). Sleep disruptions of children may lead to sleep problems in mothers, due to the mother's primary caregiving role (Kryger, 2004). Children with ADHD typically required more oversight than their typically developing peers, so when these children did not obtain adequate sleep, it is likely their parents were not obtaining enough sleep either (Meltzer & Westin, 2011). Furthermore, a child's sleep disruptions may be caused by his or her parent's daytime functioning (Meltzer & Westin, 2011). A sample of parents of children age 5 to 14 years with ADHD ($n = 27$) whose

children obtained insufficient sleep were assessed using the Depression Anxiety Scale and work attendance within the last six months. These data indicated that having a child with ADHD who exhibits poor sleep may alter the parent's mental health and increase their stress (Hvolby et al., 2009; Sciberras et al., 2011). There was an indication that parents' symptoms of poor sleep may have disrupted the sleep of children ages 4 to 12 (Hvolby et al., 2009), further exacerbating the problem.

Covariates

To increase the rigor of the study, we examined possible covariates that have been found in the literature to be related to sleep. That is, we examined the following potential confounds: child age, child gender, ethnicity, socioeconomic status, and whether or not the mother reported taking sleep medication. As children get older, their sleep durations decrease (NSF, 2015). Children also become more autonomous and independent as they age, which requires less supervision from the parents (Meltzer & Westin, 2011).

Additionally, there has been inconsistent research analysis on the impact of child age on ADHD symptoms (Biederman, Mick, & Faraone, 2000). Biederman and colleagues (2000) conducted a longitudinal study to analyze if age was significantly associated with ADHD symptoms. Their data yielded significant results that age was associated with the decline in total ADHD symptoms. However, there were outcomes where subjects continued to struggle with ADHD symptoms for more severe cases of ADHD (Biederman et al., 2000).

Boys are more notably diagnosed with ADHD, while girls experienced more severe symptoms of ADHD (Gaub & Carlson, 1997). Statistically, ADHD diagnosis comparing males to females is 3:1 (Gaub & Carlson, 1997). Additionally, research has

found that girls tend to sleep longer and have reduced sleep quality in comparison to boys (Gaina, Sekine, Hamanishi, Chen, & Kagamimori, 2005; Sadeh, Raviv, & Gruber, 2000).

Therefore, we examined child gender as a possible control variable.

Previous research has indicated that sleep may vary in ethnic and cultural backgrounds. Specifically, African Americans have been known to have poorer sleep quality compared to Caucasians (Durrence & Lichstein, 2006). Ethnicity and cultural differences has also shown to play a role in ADHD and the interpretation of ADHD symptoms (Bussing, Schoenberg, Rogers, Zima & Angus, 1998; Dwivedi & Banhatti, 2005). Research has shown that there is a higher prevalence of ADHD among African American children compared to Caucasians and Hispanics, while Hispanics had the lowest prevalence of ADHD (Cuffe, Moore, McKeown, 2005). African American parents are more likely to refer to their ADHD child as having behavior problems, as compared to Caucasian parents (Bussing et al., 1998) and there was a notable gap in the literature regarding African Americans and ADHD services (Cuffe et al., 2005). Due to the amount of African Americans who participated in our study and the differences shown in previous research, we deemed it important to control for ethnicity in the analyses.

Persons who live in poverty are more commonly exposed to a chaotic household due to noise, crowding, and neighborhood crime (Evans & Kim, 2013), as well as more family conflict, harsh parenting, and maternal depression (Evans & Kim, 2013). Thus, we examined socioeconomic status through the medical insurance provider identified.

We collected data regarding the use of sleep medication of mothers. If mothers were using sleep medications, it could affect multiple domains of sleep. Thus, we examined for medications of the mother as a possible control variable.

Given the high rates of ADHD, the links between parent-child sleep, and the effects of poor sleep on parenting and functioning, this study aimed to examine the relation between the sleep of children with ADHD. Specifically, conducted multiple regressions between variables of child sleep (i.e., sleep onset, sleep duration, and nightwakings) and mother sleep (i.e., sleep onset, sleep duration, and sleep quality).

CHAPTER III

METHODS

This study utilized a quantitative research method to delineate the relation of sleep between children with ADHD and their mothers. First, we describe the sample. Then the procedures and measures are explicated. Lastly, we discuss the research design and hypotheses.

Participants

Participants in this study were 42 mothers or maternal guardians of children aged 5 to 15 years ($M = 9.83$ years; $SD = 2.40$ years; 69% males) with ADHD recruited from a pediatric clinic in the rural South. The sample consisted of Caucasian (69%) and African American (31%) participants. Not all participants indicated their romantic relationship status, but of the 24 who answered the question, the majority of them reported that they were married (58%) or living with a partner (13%). Medical insurance carrier/status was used as a proxy for socioeconomic status and indicated the sample as diverse (59% covered by Medicaid or uninsured; 41% covered by private or military provided insurance).

Procedures

This study was part of a larger investigation examining health, sleep, and regulation problems in children and their parents. Only the procedures pertinent to the

current study are detailed. The study was approved by the institution's Internal Review Board (IRB) and the physician/owner of the pediatric clinic.

Flyers were distributed at a children's clinic in the rural South to mothers of children who have been previously diagnosed with ADHD. The staff at the pediatric clinic, as well as graduate assistants, provided the mothers with an information letter that explained the procedures of the research participation requirements, benefits of the study (i.e. compensation, sleep hygiene products), and researchers' contact information. Interested mothers were eligible for the study if they had a child diagnosed with ADHD. Only one child per family was able to participate. If there was more than one child in the household who was diagnosed with ADHD, researchers selected the youngest child.

Mothers who were interested in participating signed IRB approved consent forms and provided their phone number and mailing address. Researchers recruited 84 mothers at the children's clinic, however, 42 mothers (50%) completed and returned the surveys. Mothers had the option of taking the survey home to complete or having the survey mailed to her. If the mother chose to bring the folder back, it was picked up by the researcher and taken to the locked filing cabinet in a researcher's office. If they are mailed the survey folders, they received a self-addressed stamped envelope to return the folder upon completion. In case of illiteracy, we offered to administer the questionnaires via interview. Once the mothers returned the surveys, she was compensated \$10 for her participation.

Measures

Children's sleep

The Children's Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn, 2000b) was completed by the mothers about her child's sleep. This instrument consisted of eight subscales that assessed children's sleep behavior and the following were used for this study: sleep onset delay, sleep duration, and night wakings. These specific subscales were selected due to its relevance to the study. Sleep onset delay was assessed via one question that requested participants indicate how many times in a week the child falls asleep in 20 minutes. The sleep duration subscale was comprised of three questions which assessed the child's sleep amount (e.g., how many times a week the child sleeps too little). Using Cronbach's alpha to test the reliability test of our sample yielded $\alpha = .72$, which was slightly lower than the test clinical sample (.79; Owens et al., 2000b). The night wakings subscale consisted of three questions regarding how often the child moved to other's bed at night, woke during the night, and if the child woke more than once during the night; $\alpha = .78$, which exceeded minimum levels of Owens and colleagues (2000b) obtaining $\alpha = .44$. Mothers rated each of these questions using a three-point Likert-type scale; usually (5-7 times a week), "sometimes (2-4 times a week)," or "rarely (0-1 times a week)," with higher scores representing more problematic sleep. The CSHQ is a valid and reliable measure of sleep for children aged 4-12 (Owens et al., 2000b).

Mother's sleep

The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989) was used to assess sleep onset, sleep duration, and sleep quality of

mothers. This measure is noted in the literature as a tool which allows for identification of “good” and “poor” sleepers and those with a notable sleep disturbances. Participants were asked to report their typical bed and wake times and the length of time it usually takes for them to fall asleep. Additional questions included “During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes,” “During the past month, how often have you taken medicine to help you sleep,” and “During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity.” Mothers were able to select four possible answers ranging from “not during the past month” to “three or more times a week.” Additional questions included was “During the past month, how would you rate your sleep quality overall” with answers ranging from “very good” to “very bad.” The 19-item instrument was divided into seven subscales for scoring; however, for our research we only used three of the seven subscales to assess sleep onset, sleep duration, and sleep quality. Individual subscale scores range from 0 to 3 from no difficulty to severe difficulty, respectively. After adding all subscale scores, researchers obtained a global score, which ranges from “0” (little to no difficulty), to “21” (severe difficulties). Individuals who obtain a global score higher than five are considered to be poor sleepers (Buysse et al., 1989). Additionally, participants report their average bedtime and wake times. The PSQI is a valid and reliable measure (Buysse et al., 1989), and the reliability for our sample using Cronbach’s alpha was .76, which is lower than Buysse and colleagues’ (1989) reliability ($\alpha=.83$).

Demographics

Demographic variables known to be related to the main study variables were assessed. Specifically, mothers indicated the ethnicity and age of both herself and her child. Additionally, mothers reported on their child's medical diagnosis and medications of the child and his or her mother. Insurance status and carrier were also reported to serve as a socioeconomic status indicator.

Research design and hypothesis

Using a cross-sectional design, multiple regressions were conducted which examined the sleep (i.e., sleep onset, duration, night wakings) of children with ADHD as a predictor of mothers' self-reported sleep (i.e., sleep onset, sleep duration, sleep quality). Our propositions were consistent with a family systems perspective (Bowen, 1978) and prior studies supportive of links between child and parent sleep (Meltzer & Mindell, 2007; Meltzer & Montgomery-Downs, 2011). The hypotheses are detailed in the following paragraphs.

We predicted a significant positive relation between child sleep onset and mother sleep onset, given that previous research indicated that mothers have the primary responsibility of putting children to bed (Meltzer & Westin, 2011) and sleep onset latency of the child may delay the mother's sleep onset. Similarly, the longer it takes for the child to fall asleep, the less opportunity for sleep the mother has, which could decrease her sleep duration. Hence, we hypothesize a significant positive association between child sleep onset and mother sleep duration, as a higher sleep duration score was indicative of shorter sleep. Additionally, we do not make a prediction of the direction or significance of the relation between child sleep onset and mother sleep quality. Given that research

suggests that sleep deprivation can increase sleep quality (e.g., so tired you sleep like a rock; Maas & Robbins, 2010) and that it is also plausible that mothers may be stressed or anxious about their child's sleep or ADHD behavior, disrupting their sleep quality, we did not make a prediction about this association.

Child sleep duration was hypothesized to have a positive association with mother's sleep onset (please note that higher scores are indicative of greater sleep problems for both of these variables). If children with ADHD have a shorter sleep duration, particularly if they have trouble getting to sleep, mothers' sleep onset can be affected. We foresee child sleep duration to have a positive relation with mother sleep duration; if children with ADHD have a shortened sleep duration, the mother may be kept awake later or woken earlier, possibly shortening mother sleep duration. Child sleep duration is expected to have a positive significant relation with mother sleep quality (higher scores indicate worse sleep on both of these variables); if children with ADHD have a shortened sleep duration, it is likely that mothers are not obtaining quality sleep, possibly due to stress and worry about their child's behavior or regulation issues. This hypothesis is guided by research findings showing a relation between poor sleep of caregivers and increased stress (Hvolby et al., 2009).

Nightwakings in children with ADHD is not predicted to have a relation with mother sleep onset. However, we predict a significant positive relation between child nightwaking and mother sleep duration (on both assessments higher scores are representative of more problematic sleep). When children are waking up during the night, there is a possibility they are waking their mothers, which will shorten their sleep duration. Child nightwaking and mother sleep quality are also predicted to have a

significant positive relation; mothers may not be getting quality sleep and restfulness if her child is waking her during the night.

CHAPTER IV

RESULTS

Introduction

This chapter provides the results of our study. After identifying the important covariates for this sample, we ran nine hierarchical regressions, three of which were found to be significant. This approach allowed us to understand the specific markers of child sleep and their association with his or her mother's sleep domains.

Preliminary analysis

The means and standard deviations of the study variables are presented in Table 1. To provide a more comprehensive view of the sleep within this sample, we included the average global PSQI score for the mothers, which was not used as a variable in analyses because we wanted to understand which domain of sleep was affected. Descriptive analyses indicated both children and their mothers were experiencing sleep difficulties. For example, mothers reported children to have difficulty falling asleep (i.e., longer than 20 minutes) almost all nights of the week. Sleep duration and nightwakings were (both coded as higher values represent greater sleep problems) both suggestive of problematic sleep. For mothers' sleep, they reported receiving less than the recommended minimum of 7 hours and reported taking almost 30 minutes to fall asleep, which is also considered to be problematic (National Sleep Foundation). Additionally, mothers' sleep assessed via

the global PSQI score was indicative of significant sleep problems (i.e., >5 is considered problematic; Buysse et al., 1989).

Table 1 Means and standard deviations of child and mother sleep variables

	<i>M</i>	<i>SD</i>	Possible Range
Child sleep onset delay	1.88	.81	1-3
Child sleep duration	4.78	1.60	1-9
Child night waking	4.77	1.83	1-9
Mother sleep duration	6.4 hrs	1.5 hrs	-
Mother sleep quality	1.32	.81	0-3
Mother PSQI score	7.45	4.77	0-21
Mother sleep onset	28.5 min	18.4 min	-

Note. Hrs = hours; Min = minutes.

Table 2 shows the correlations between the sleep of children with ADHD and that of their mothers. As expected, children’s sleep domains were correlated with each other in the expected directions. Similarly, mothers’ sleep variables were also associated with each other as expected. We examined the possible control variables that are suggested in the literature to influence sleep (i.e., child age, child gender, ethnicity, insurance type, and mother medication use). Correlations revealed child age to be the only one of the aforementioned variables to be related to any of the study variables and thus, it was the only covariate in our models. Furthermore, many of these variables are shown to have a high correlation; for instance, child sleep onset and child sleep duration were highly correlated. These variables overlap as the later the child falls asleep, the shorter the sleep

duration, and the same concept can apply to mother's sleep onset and mother's sleep duration. Child age and child night waking were negatively correlated, which is expected since as a child ages, nightwakings decrease.

Table 2 Correlations among study variables

	1	2	3	4	5	6	7
1. Child age	-						
2. Child sleep onset	-.156	-					
3. Child sleep duration	.266	.527**	-				
4. Child night waking	-.371*	.390*	.248	-			
5. Mother sleep onset	.312	.296	.325	-.004	-		
6. Mother sleep duration	.023	.311	.239	-.034	.523**	-	
7. Mother sleep quality	.181	.322	.344*	.076	.781**	.638**	-

Note. * $p < .05$; ** $p < .001$

Regression analysis of mother sleep

Results from the hierarchal regressions are presented in Tables 3, 4, and 5. As hypothesized, child sleep onset delay predicted all three of the sleep outcomes for mothers (see Table 3). Specifically, child sleep onset latency predicted mother's sleep onset ($\beta = .36, p < .05$) and accounted for 12.8% of the unique variance; the model accounted for a total variance of 21.8%. The second regression model examined the association between child sleep onset delay and mother sleep duration. Results indicated child sleep onset delay to be a significant predictor of mother sleep duration ($\beta = .43, p < .05$) as it explained 18% of the unique variance, with the total model explaining 18% of

the variation in mother sleep duration. However, and contrary to most of our hypotheses, we found no significant associations for either child sleep duration (see Table 4) or nightwakings (see Table 5) and any of mother sleep variables.

Table 3 Unstandardized regression estimates (Standard Errors) of models with child sleep onset predicting mother sleep

	Sleep onset	Sleep duration	Sleep quality
Step 1: Controls			
Child Age	.010 (.006)	.001 (.006)	.006 (.005)
Step 2: Child sleep onset	.475 (.219)*	.579 (.219)*	.478 (.190)*
R ² Step 1	.090	.001	.035
ΔR ² Step 2	.128	.179	.172
Total R ² Model	.218	.180	.208

Note. * $p < .05$

Table 4 Unstandardized regression estimates (Standard Errors) of models with child sleep duration predicting mother sleep

	Sleep onset	Sleep duration	Sleep quality
Step 1: Controls			
Child Age	.010 (.006)	.001 (.007)	.005 (.005)
Step 2: Child sleep duration	.202 (.121)	.193 (.134)	.165 (.106)
R ² Step 1	.081	.001	.032
ΔR ² Step 2	.086	.067	.077
Total R ² Model	.167	.068	.109

Table 5 Unstandardized regression estimates (Standard Errors) of models with child nightwakings predicting mother sleep

	Sleep onset	Sleep duration	Sleep quality
Step 1: Controls			
Child Age	.010 (.006)	.001 (.007)	.006 (.005)
Step 2: Child nightwakings	.034 (.104)	-.071 (.113)	.070 (.093)
R ² Step 1	.090	.001	.035
ΔR ² Step 2	.003	.013	.018
Total R ² Model	.094	.014	.053

Discussion

We examined associations between the sleep of children with ADHD and that of their mothers'. Findings address calls in the literature (Brand et al., 2009; Meltzer & Mindell, 2007) and build on the sparse understanding of how children's sleep, particularly that of a child with ADHD, is related to a mother's sleep. Results indicated that children's ability to fall asleep was particularly an important contributor to multiple domains of mothers' sleep. That is, the longer it takes for a child to fall asleep, the more time it takes the mother to fall asleep, the shorter her sleep amount, and the more disrupted she reported her sleep. It is also worthy to note that these findings were significant after controlling for child age, indicating that regardless the age of the child, there was still a relation between child sleep onset and mother sleep variables (i.e., sleep onset, sleep duration, sleep quality). Kryger (2004) indicated the possibility of child sleep disruptions impacting mothers' sleep, specifically children with ADHD who require more monitoring (Meltzer & Westin, 2011). This research is the first to our knowledge to investigate the relation between sleep of children with ADHD and their mothers and the results from our analysis contribute to the scant literature available that suggests

children's sleep patterns predict mothers' sleep (e.g., Meltzer & Mindell, 2007). From a Family Systems Perspective (Bowen, 1978), these findings highlight the importance of considering the family system when working to reduce sleep problems of children with ADHD and further support Dahl's (1996) hypothesis linking daytime dysregulation with sleep.

Our results are consistent with previous research that indicated children with ADHD are poor sleepers (Hvolby et al., 2009; Hansen et al., 2013). Specifically, similar to the literature review, our sample of children showed to have a difficult time falling asleep (Hvolby et al., 2009), short sleep duration, and multiple nightwakings (Scott et al., 2013; Gruber et al., 2012; Lycett et al., 2013). These findings lend themselves to the importance of sleep considerations and potential interventions for children diagnosed with ADHD.

Our findings are strengthened by the use of valid and reliable measures. We examined many potential confounds known to be associated with sleep and ADHD, also lending strength to our findings. Despite the low number of participants, our sample was diverse, specifically with age and income level which was indicated by insurance provider.

Implications

These data can be used to guide pediatricians, physicians, teachers and special needs instructors, and sleep educators as they make recommendations and develop intervention and prevention programming. For example, these data suggest that children with ADHD may have a particularly hard time transitioning from wake to sleep, similar to the types of self-regulation disruptions they have during wakefulness (Efron et al.,

2014). Thus, upon duplication with larger samples and more diverse measurement, intervention and prevention efforts may need to focus on sleep hygiene tips that can assist children with ADHD specifically in preparing their body and mind for sleep. Changes in children's sleep routine and the consistency of this routine may have the potential to not only improve the children's sleep but also the parents' sleep. Thus, by examining these individual sleep markers, researchers and clinicians can determine the most effective and efficient practices to promote proper sleep among parents and children with ADHD.

These data also underscore the importance of considering not only the child with ADHD, but also other family members in the treatment of ADHD. For example, there is available evidence that indicates parents' symptoms of poor sleep may also disrupt the child's sleep (Hvolby et al., 2009), which could potentially exacerbate children's ADHD symptoms. A two-dimension generational approach to treatment of sleep problems may be particularly important for clinical populations, as there are many contributors to sleep within the home environment.

Given the importance of sleep and its impact on behavior and cognitive functioning, it is important for children with ADHD to obtain adequate sleep, especially given the symptoms of ADHD (e.g., aggression, inattention). As previous research has found, child sleep onset delay is common among children with ADHD (Gruber et al., 2012; Lycett et al., 2014). Our research has indicated this has a negative impact on mother's sleep. By establishing nightly bedtime routines, the child will be more likely to have stable bedtime and familiarity with daily routines. Our research findings suggests the decrease of sleep onset latency of the child will promote mother's sleep onset, duration, and quality. It is plausible that assisting children in downregulating for bedtime

may not only improve the sleep of family members, but also improve family functioning (Meltzer & Westin, 2011).

Limitations

Findings should be interpreted within the study's context and limitations. Although we examined multiple domains of sleep, all of our sleep assessments were subjective in nature. Thus, it is plausible that the inclusion of objective sleep measurement (e.g., actigraphy) may have resulted in differing results. Additionally, mothers were the only reporters of sleep, raising the issue of monoreporter bias. Given that the ages of the children varied greatly, it was not feasible to have children report on their own sleep. (e.g., a four year old is unable to adequately answer sleep timing questions). Future studies should attempt to resolve this issue by incorporating a sleep diary assessment, objective assessments, or additional caregivers to provide confidence in the findings. The small sample and cross-sectional design of the study may have bearing on the results. However, the sample was diverse in that it included a high representation of minorities and low income dyads. We did not screen for maternal clinical sleep problems, although we did have information regarding whether she took medication for sleep. Additionally, we did not obtain the ages of the mothers. These findings should be viewed as preliminary and as a first step in understanding the role of child ADHD diagnosis and family sleep patterns.

CHAPTER V

CONCLUSION

The purpose of this study was to examine sleep in children with ADHD and its relation to their mother's sleep. After examining important individual variables of child's sleep (i.e., sleep duration, sleep onset, and nightwakings), we found child sleep onset predicted mother's subjective sleep onset, duration, and quality in the expected directions. Neither children's sleep duration nor the amount of nightwakings reported were associated with any of the mother sleep outcomes. These findings, although preliminary, can help guide the development of prevention and intervention efforts.

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