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# The Relationship between Parent Identified Sleep Problems, Internalizing Behaviors, Externalizing Behaviors, and Adaptive Functioning in a Pediatric Population

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The Relationship between Parent Identified Sleep Problems, Internalizing Behaviors,  
Externalizing Behaviors, and Adaptive Functioning in a Pediatric Population

by

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A thesis submitted in partial fulfillment  
of the requirements for the degree of  
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Department of Psychological and Social Foundations  
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The Relationship between Parent Identified Sleep Problems, Internalizing Behaviors,  
Externalizing Behaviors, and Adaptive Functioning in a Pediatric Population

Kyle Marissa Popkave

ABSTRACT

Pediatric sleep problems are among the most common pediatric health issues faced by families today. Sleep problems can have a deleterious impact on children's academics, behaviors, social-emotional development, health, and/or safety. Once sleep problems are identified and treated, many of the associated negative impacts can be ameliorated. The purpose of the current study was to examine prevalence rates of symptoms of sleep disorders in young children, and the relationship between these symptoms and various behavior problems.

One hundred and four children, ages 2 to 5 years, attending a pediatric health clinic served as the participants in this study. Data on sleep disorder symptoms were derived from the Sleep Disorders Inventory for Students, Children's Form. The Child Behavior Checklist was used to measure internalizing and externalizing behaviors, and adaptive behavior was assessed through ratings on the Adaptive Behavior Assessment System, Second Edition. Results indicated that a total of 31% of the sampled children were at high risk for at least one type of sleep disorder. Children rated as high risk for having a sleep disorder displayed more externalizing and internalizing problems, as compared to children whose sleep was reported to be in the normal range. No significant differences were found between adaptive behavior scores and risk for having a sleep

disorder. The implications of these results for school psychologists and directions for future practice and research are discussed.

## CHAPTER 1

### Introduction

#### *Statement of the problem*

Research on sleep has revealed the negative impact sleep deprivation can have on psychological and physical health. Sleep impacts the daily functioning of people at all ages. Research conducted by the National Center of Sleep Disorders Research (2003) estimates that an upwards of 70 million Americans are negatively impacted by sleep related problems. Of these estimates, approximately 15% of the 70 million Americans with sleep problems are children (Luginbuehl, 2004). Only recently has pediatric sleep medicine begun to be studied in children. There is limited epidemiologic research focusing on sleep in infants and young children (Owens, 2005). Compared to adults, little is known about the magnitude and distribution, causes, consequences, and assessment of sleep loss and sleepiness in young children (National Sleep Disorder Research Plan, 2005).

Because little is known about pediatric sleep disorders and how to diagnose them, it is estimated that only 1-to-2% of children with sleep disorders are being diagnosed and treated. Of the children who are diagnosed as having a sleep disorder, 12 – 15% of them have learning, behavior, and/or emotional regulation challenges (National Sleep Disorder Research Plan, 2005). In addition, many children are diagnosed as having a learning disability, when in fact they actually have a correctable sleep disorder (Gozal, 1998; Marcotte et al., 1998). Therefore, it is vital that sleep disorders are identified and treated

at the earliest possible age in order to prevent the negative academic, behavioral, emotional, and health outcomes associated with them.

Further research is needed examining the relationship between sleep disorders and emotional, and behavioral outcomes (Halborow & Marcus, 2003). Specifically, research is needed to identify which age groups are at highest risk for specific sleep disorders, and when intervention implementation would have the highest impact in terms of improving overall functioning. Research is also needed to study the prevalence rates in young children as well as the effects that sleep disorders have on emotional and behavioral outcomes (Wiggs & Stores, 1996). Current research suggests a link between sleep disorders and behavioral outcomes, but the age at which children with sleep disorders begin experiencing behavioral difficulties is still unknown.

One possible reason that sleep disorders and their impact on young children are unknown is because only a handful of programs train child service providers on sleep disorders and their effects on everyday functioning (Wiggs & Stores, 1996). Children with sleep disorders usually do not complain of sleep problems. (Kryger, 2005). Sleep disorders in children are typically suspected by adults, but because little knowledge exists regarding sleep disorders, many children go unidentified. Professionals do not know what to look for, and many times, if a sleep disorder is suspected, professionals do not know where to refer these children (Benbadis, 1998). Even if a child is suspected of having a sleep disorder, professionals have to rely on the validity of parental concerns and opinions regarding their child's sleep (Owens, 2005). It is important to enhance the current research on sleep disorders, as well as disseminate this information to child

service providers so that children do not go undiagnosed, and early intervention can be implemented.

### *Understanding sleep*

In order to understand sleep disorders, it is helpful to understand normal sleep. What constitutes normal sleep differs by age; therefore developmental differences in sleep will be briefly discussed. Finally, the instruments used to aid in the diagnosis of sleep disorders will be discussed.

*Normal sleep.* There are 5 well-defined, ordered stages of normal sleep. The stages of sleep are made up of rapid eye movement sleep (REM), and non-rapid eye movement sleep (NREM) (Morrison, 2004). NREM sleep makes up 4 of the 5 stages of normal sleep. Stage 1 of NREM is when a person transitions from wakefulness into sleep; it is known as light sleep. Stage 2 of NREM is considered to be the first stage of actual sleep, but a person can be woken rather easily during this stage. Stages 3 and 4 of NREM are deep, slow wave sleep, and during these stages, it is difficult to wake the person. The last stage of sleep is REM sleep. During REM sleep, the body is rather active where eyes dart back and forth; heart rate and blood pressure increase; breathing is irregular, shallow, and fast; the brain is active; and dreams occur (Anders, Sadeh & Appareddy, 1995). It takes approximately 90 – 110 minutes to go through stages 1 – 5 of sleep. Once all 5 stages of sleep are complete, stage 1 of sleep starts all over again. People typically go through stages 1 – 5 of sleep approximately 4 – 6 times a night.

*Developmental differences in sleep.* The way people sleep varies across ages. For instance, infants fall directly into REM sleep and spend more than half of their time sleeping in this stage. In contrast, adults spend almost one-half of their sleep in stages 1

and 2 of NREM sleep, and do not reach REM sleep until after stage 4 of NREM. As children grow older, the amount of REM sleep decreases and the amount of NREM sleep increases. Also, younger children need more sleep per day than older children and adults.

*Measuring sleep.* Subjective reports of sleepiness can be unreliable (Thorpy et al., 2006) so it is important to quantify sleep using reliable methods. Polysomnography and multiple sleep latency test (MSLT) are the two most commonly used methods to measure sleep (Davey, 2005). Polysomnograms are overnight tests (also referred to as sleep studies) that extensively measure sleep architecture, including time in bed and total sleep time; sleep efficiency and latency; REM latency; the percentage of time spent in each sleep stage; arousals; and sleep fragmentation. MSLT is usually follows a polysomnography, and measures the average time it takes to fall asleep.

#### *Five major pediatric sleep disorders negatively impacting children*

There are five sleep disorders that are most commonly seen in children that negatively impact academic performance, behavior, social-emotional functioning, and/or health (Coccagna, 1990; Hla, 1994; Wise, 1998). There are a number of other pediatric sleep disorders, but these disorders do not have as much influence on the daily functioning of children. The five sleep disorders that do negatively impact daily functioning of children are: (1) Periodic Limb Movement Disorder (PLMD), (2) Restless Legs Syndrome (RLS), (3) Delayed Sleep Phase Syndrome (DSPS), (4) Narcolepsy, and (5) Obstructive Sleep Apnea Syndrome (OSAS).

Periodic Limb Movement Disorder (PLMD) is characterized by limb contractions that occur at 15 – 40 second intervals lasting 5 seconds or longer causing the toes, legs, thighs or arms to jerk repetitively. This repetitive jerking movement can wake a child out

of sleep and prevent a child from getting sufficient sleep (Luginbuehl, 2004). PLMD is diagnosed when there are more than five periodic limb movements per hour and those movements are associated with a sleep disruption.

Restless Leg Syndrome (RLS) can occur with or without PLMD, but children with RLS also usually have PLMD (The International Restless Legs Syndrome Study Group, 1995). In RLS, a child will experience uncomfortable sensations in his or her legs. These sensations are typically described as tingling, searing or crawling sensations (Luginbuehl, 2004). These uncomfortable sensations cause an uncontrollable urge to move ones legs. This urge worsens when people sit or lie down, and the urge to move is totally or partially relieved by movement (Gringas, 2005; Lavigne & Montplaisir, 1994). Because the urge to move worsens when people lie down, these sensations contribute to sleep disruption (The International Restless Legs Syndrome Study Group, 1995).

Delayed Sleep Phase Syndrome (DSPS) is most common in adolescence because it is associated with changes in the circadian rhythm during puberty. DSPS is also characterized by poor sleep habits and hygiene (Carskadon, Viera, & Acebo, 1993). To be diagnosed with DSPS, the inability to fall asleep or wake up at normal times must persist for at least six months (Roehr & Roth, 1994). DSPS tends to begin when sleep patterns change, which can delay the circadian sleep cycle (Wolfson & Carskadon, 1998). When a child or adolescent has DSPS, they have difficulty falling asleep or staying asleep throughout the night. Children or adolescents with DSPS might stall going to bed or refuse to go to bed at the appropriate time. DSPS is also associated with children or adolescence not having limits set for them to help them establish good sleep habits (Luginbuehl, 2004).

Narcolepsy is another sleep disorder that is characterized by disrupted nighttime sleep, cataplexy, sleep paralysis, hypnagogic hallucinations when falling asleep or awakening, and daytime sleep attacks (Luginbuehl, 2004). A daytime sleep attack is when a person takes frequent short naps (Benbadis, 2005). Cataplexy is provoked by emotions such as laughter, surprise, or anger and causes a sudden decrease in muscle tone (Guilleminault, Mignot, & Partinen, 1994). With sleep paralysis, a person is fully aware of their surroundings but cannot move their extremities, speak, or open their eyes. Hypnagogic hallucinations are auditory and visual disturbances (Guilleminault, Mignot, & Partinen, 1994). Oftentimes, hypnagogic hallucinations co-occur with sleep paralysis. Excessive daytime sleepiness is associated with narcolepsy. Children typically do not show all of the characterizations of narcolepsy, which makes it difficult to diagnose (Aldrich, 1992).

Obstructive Sleep Apnea Syndrome (OSAS) is the most frequently researched sleep disorder in children and is characterized by “pauses in breathing (apneas) during sleep and/or hypopnea events that result in a significant decrease of oxygen to the arterial blood flow” (Luginbuehl, 2004). The most common cause of OSAS in children is enlarged tonsils and adenoids that obstruct airway passages (Bower & Buckmiller, 2001). Airway passages can also be obstructed by physical abnormalities of the tongue, palatal size and position, and the jaw. The most common symptoms of OSAS in children are gasping, a pause in breathing, raspy breathing, choking, snorting, excessive sweating, open mouth breathing during the daytime or nighttime, and snoring (Gaultier, 1992).

PLMD, RLS, DSPS, Narcolepsy, and OSAS have significant negative daytime and nighttime effects. Negative academic, behavioral, and social-emotional outcomes are

associated with sleep disorders. Federal policies such as Individuals with Disabilities Education Act—Amendments of 2004 (IDEA) emphasize the need and importance for early identification and early intervention of disorders effecting children’s daily functioning.

*The relationship between sleep disorders, internalizing behavior, externalizing behavior, and adaptive functioning*

Early identification of sleep disorders is extremely important because of the suggested negative consequences of sleep disorders on behavior and every day functioning. Sleep deprivation is related to depressed mood, anxiety, as well as hyperactivity, irritability, or shortened attention span (Aaronen, Paavonen, Fjallberg, & Torronen, 2000; Dahl, 1998; Dollinger, Molina, & Campo, 1996; Reite, 1998; Sadeh, McGuire, Sachs, Seifer, Tremblay, Civita, & Hayden, 1994). For instance, Dollinger et al. (1996) found that children suffering from anxiety had more sleep problems than children without anxiety. Another study conducted by Aaronen et al. (2000) found that less amount of sleep in children ages 8 – 12 years was associated with increases in emotional and behavioral problems. Decreased sleep quality is also highly correlated with depression (Sadeh et al., 1994). Studies have also suggested that inattentive, hyperactive, and aggressive behaviors are comorbid with sleep disordered breathing (Chervin & Archibold, 2001; Guilleminault et al. 1981; Picchiatti & Walters, 1999). In a study conducted by Stores and Wiggs (1998), children ages 5-16 years with sleep disturbances exhibited more challenging behaviors such as irritability and hyperactivity as compared to controls. Picchiatti et al. (1998) found similar results in a study of children ages 2 – 15 years. Specifically, there was a high incidence rate of PLMD within this sample of

children who were all diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD). Chervin et al. (1997) also looked at the relationship between children ages 2 – 18 years diagnosed with ADHD and sleep problems. The results of this study showed strong relationship between snoring, sleepiness, and restless legs and ADHD, thus providing more support for an overlap between ADHD symptoms and symptoms of sleep disorders. Children diagnosed with ADHD have also been found to have poor daily functioning skills (Stein, Szumowski, Blondis, & Roizen, 1995). Likewise, children experiencing internalizing and externalizing behaviors also have been found to have poorer adaptive skills than children without these problems (Palermo et al., 2002). Even though there is research linking internalizing and externalizing behavior problems to adaptive behavior, there is no research on how sleep impacts adaptive functioning in children.

#### *Purpose of the study*

The primary purpose of this study was to assess the prevalence rates of children ages 24 months to 5 years referred to a clinic setting displaying sleep disorder symptoms, using the Sleep Disorders Inventory for Students – Children’s Version (SDIS-C). The SDIS-C is a screening tool that aids in the identification of children at risk for PLMD, RLS, DSPS, Narcolepsy, and OSAS. A secondary purpose of the study was to examine if there was a difference between children who fall into high, cautionary or low risk ranges for having a sleep disorder as measured by the SDIS-C and their scores on the Child Behavior Checklist (CBCL), indicating problems with internalizing and/or externalizing behavior. A third purpose of this study was to examine if there was a difference between children who fall into high, cautionary or low risk ranges for having a sleep disorder as measured by the SDIS-C and their overall adaptive functioning as

measured by Adaptive Behavior Assessment System – Second Edition (ABAS-II). A final goal of this study was to assess the relationship between sleep problems as measured by the CBCL and the sleep index score as measured by the SDIS-C.

By examining these issues, this study contributed to the research and literature concerning sleep disorders in young children.

### *Research questions*

This research study investigated the prevalence rates of risk for sleep disorders in an at-risk population of children ages 2 – 5 years as well as examined the relationship between sleep disorders, problem behaviors, and adaptive skills. Therefore, the following research questions were addressed:

1. What is the prevalence rate of children at risk for sleep disorders, as measured by the Sleep Disorders Inventory for Students - Children's version (SDIS-C), in children ages 2 – 5 years presenting to a university-based child development clinic for assistance?
2. What is the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and externalizing behavior problems, as measured by the Child Behavior Checklist (CBCL)?
3. What is the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and internalizing behavior problems, as measured by the CBCL?
4. What is the relationship between children at risk for sleep disorders in the normal, cautionary, and high-risk range, as measured by the SDIS-C and their functional adaptive skills as measured by the Adaptive Behavior Assessment System – Second Edition (ABAS-II)?

5. What is the relationship between the sleep problem score on the CBCL and the total sleep index score on the SDIS-C?

*Significance of this study*

This study provided valuable information regarding the prevalence of sleep disorders in a young pediatric clinical population as well as information about the relationship between sleep disorders, behavioral, and adaptive functioning. Because sleep disorders in children are still under-diagnosed, information on the prevalence of sleep disorders in children can potentially increase the awareness of the degree to which sleep disorders are problematic and impact children. Additionally, data from preliminary research indicates that sleep disorders negatively impact behavior as well as daily functioning. This study further examined these relationships.

*Organization of remaining chapters*

The remaining chapters present information that is pertinent to this study. More specifically, Chapter 2 provides a thorough review of the related literature, discussing the five major sleep disorders seen in children and the relationship between these disorders and internalizing behaviors, externalizing behaviors, and adaptive skill functioning. Furthermore, in order to understand sleep problems, normal sleep is discussed as well as developmental differences both in sleep patterns and in the presence of internalizing and externalizing behaviors. Chapter 3 details the methods that were used in this study, including sampling, instrumentation, procedures, and data analysis. The results of this study are discussed in Chapter 4, followed by a discussion of the results and their implications in Chapter 5.

## Chapter 2

### Review of the Literature

#### *Overview*

This chapter provides a review of the literature relevant to this study. Pediatric sleep disorders are discussed, including the prevalence of sleep disorders in children and the characteristics of five major sleep disorders most commonly seen in children. Normal, healthy sleep is described in some detail so that problematic sleep can be distinguished from healthy sleep. A thorough review of the literature focusing on the relationship between sleep disorders, adaptive functioning, and behavioral outcomes is presented. The chapter concludes with the rationale for the current investigation.

#### *Introduction*

Sleep is a behavioral state that is a natural part of every individual's life. In fact, people spend about one-third of their lives asleep. Sleep is considered problematic when "sleepiness interferes with daily routines and activities, or reduced ability to function" (National Heart, Lung, & Blood Institute, NIH, 2006). Although a definition of sleep problems in children does exist, objective, reliable, and cost-effective measures of sleepiness and alertness in children are lacking. Subjective self-report data regarding sleepiness are largely unavailable in children. Behavioral manifestations of sleepiness not only vary with age and developmental level but also are often not reliably interpreted by parents and other caretakers. As a result, the amount of research on pediatric sleep disorders is less than that of adults. In the 1991 edition of *Sleep Research* (Chase, Lydic,

& O'Connor, 1991), a culmination of published research on sleep was evaluated and revealed that sleep research involving children ages 5 to 12 years accounted for only 7% of the sleep research done with humans, and studies involving toddlers ages 3 and 4 only accounted for 3% of all sleep research conducted. Studies that have been conducted on pediatric sleep problems report an overall prevalence of a variety of parent-reported sleep problems ranging from 25–50% in preschool-aged samples to 37% in a community sample of 4–10 year-olds (Owens, Spirito, Mc-Guinn, & Nobile, 2000; Kerr & Jowett, 1994; Mindell, Owens, & Carskadon, 1999). A survey conducted by Johnson (1991) found that 42% of 12- to 35-month-olds showed problematic bedtime resistance, and 35% woke and demanded attention at night. Other research has shown that bedtime struggles become increasingly common from the second to the fifth year (Beltramini & Herzog, 1983; Crowell, Keener, Ginsburg, & Anders, 1987), and can still be a problem for more than 25% of children ages 5 to 12 years (Blader, Koplewicz, Abikoff, & Foley, 1996). Mindell et al (1994) found that practicing pediatricians noted that 23% of their patients, between the ages of 6 months and 4 years, experienced sleep problems that were brought to the attention of the physician. While prevalence rates of sleep disturbances in children are being researched, the prevalence of sleep disorders in children are still unknown.

Little is known about pediatric sleep disorders and how to diagnose them.

Therefore, it is estimated that only 1-to-2% of children with sleep disorders are being diagnosed and treated. Of the children who are diagnosed as having a sleep disorder, 12 – 15% of them have learning, behavior, and/or emotional regulation challenges (National Institute of Health, 2001). Because sleep has been found to have such a profound impact

on daily functioning, it is extremely problematic that the prevalence rates of sleep disorders in children are still unknown.

### *Normal sleep*

In order to understand sleep problems, it is important to be able to distinguish healthy, normal sleep from problematic sleep. This next section describes healthy sleep and the biological mechanisms that contribute towards sleep. There is a common misconception that the brain is inactive during sleep, but this is not the case. Sleep is a dynamic, active process that involves physiological changes in the organs of the body. Normal sleep has five stages; the first four stages of sleep are non-rapid eye movement (NREM) sleep and the last stage is rapid eye movement (REM) sleep. These five stages are cyclic, meaning that a sleeping person will go through the five stages in the same order every 90 – 110 minutes. Typically, people cycle through the five stages four to six times a night.

The first four stages of sleep are NREM sleep, which people enter as they begin to fall asleep (Salzarulo & Fagiolo, 1995). Stage one of sleep is described as being between an awake state and a sleep state. At this stage, people drift in and out of sleep, and can be awakened easily. During stage one, people's eyes move slowly and their muscle activity slows down. Stage one typically lasts five to fifteen minutes per sleep cycle, and includes short dreams and myoclonic jerks (sudden muscle twitches without any rhythm or pattern) often followed by a sensation of starting to fall. These sudden movements are similar to the "jump" people make when startled. If someone is woken during stage one, they often remember fragmented visual images.

Stage two is described as light sleep and is considered to be the onset of sleep. Humans spend 50% of their time sleeping in this stage of sleep. The average time for stage two sleep is fifteen to twenty minutes. During this stage, people are disengaged from their surroundings, but can still be easily awoken. Physiologically, body temperature drops, eye movements stop, and brain waves slow down, but have occasional bursts of rapid waves called sleep spindles. Stage three of sleep is deep sleep and is the stage in which the brain waves become even slower, but are punctuated by smaller, faster waves. Stage four of sleep is slow-wave deep sleep. In this stage, the brain produces only slow waves. Stage four is the deepest, most restorative sleep. During stage four, blood pressure drops, breathing is slow, tissue growth and repair occurs, and hormones essential for growth are released. In both stages three and four of sleep, it is very difficult to wake someone. If a person is woken during stages three or four, they will most likely feel groggy and disoriented. It is in stage four that bedwetting, night terrors, or sleep walking occurs. People with normal sleep patterns spend 75% of their sleep time in stages one through four NREM sleep. The deepest stages of NREM sleep occur in the first part of the night and the episodes of REM sleep are longer as the night progresses. By morning, people spend nearly all their sleep time in stages one, two, and REM sleep.

REM sleep, which is the fifth stage of sleep, consumes 20 – 25% of nightly sleep (Morrison, 2004). The first occurrence of REM sleep is seventy to ninety minutes after falling asleep, and recurs about every ninety minutes. The reason REM sleep is distinguished from NREM sleep is because of the physiological state of the body during this sleep stage. During REM sleep, eyes rapidly dart back and forth; breathing is irregular, shallow, and fast; heart rate increases; blood pressure rises; the brain is active;

and dreams occur (Anders, Sadeh & Appareddy, 1995). REM sleep provides energy to the brain and the body, and it supports daytime performance.

A number of factors contribute to healthy sleep. Adenosine is a nucleoside that contributes to sleep. While awake, adenosine concentrations accumulate in the extracellular space of the basal forebrain. The more time a person spends awake, the more adenosine is built up. When a person sleeps, adenosine concentrations are broken down or reduced. Adenosine is thought to be responsible for keeping track of lost sleep and triggers the body when more sleep is needed (Basheer, Strecker, Thakkar & McCarley, 2004). Because of this built-in molecular feedback, people cannot adapt to getting less sleep than their body needs.

Another contributing factor to sleep and sleepiness is the circadian clock (Dotto, 1990). The circadian clock is located in the suprachiasmatic nucleus (SCN) of the hypothalamus in the brain. The SCN is an extremely small structure consisting of a pair of tiny regions, each containing about 10,000 neurons out of the brain's estimated 100 billion neurons. These neurons are light sensitive. Photoreceptors in the retina transmit light-dependent signals to the SCN, which then signal different parts of the brain. The pineal gland, responsible for the production of melatonin, receives these signals from the SCN. Melatonin is a hormone that causes drowsiness. When it becomes dark, the production of melatonin is triggered. Besides triggering melatonin, the SCN also impacts other physiological functions including body temperature, hormone secretion, urine production, and changes in blood pressure. If the circadian clock is malfunctioning, there are a number of adverse effects that might occur such as changes in cerebral blood flow,

abnormal hormone levels, as well as physiological changes in the brain, which may negatively impact healthy sleep (Ferber, 1996; Sheldon, 2005).

### *The relationship between sleep and development*

Age affects sleep more than any other natural factor. Adults spend almost one-half of total time sleeping in stages one and two of NREM sleep. In contrast, infants spend half or more of their total sleep time in REM sleep. Actually, infants fall directly into REM sleep and do not undergo the same sleep cycle that children and adults experience. A major task of a newborn is to organize the behaviors of wake, NREM, and REM, into discrete states (Carskadon, Anders & Hole, 1968). It is not until several weeks after they are born that infants are able to operate within a circadian rhythm. By six weeks of age, infants have a clear diurnal/nocturnal pattern of sleep (Anders & Keener, 1985); and by six to nine months most infants have a well-established pattern of nocturnal sleep (Moore & Ucko, 1957).

As children grow older, the REM-NREM cycle lengthens. Kahn et al. (1973) conducted research comparing the sleep of two-year-old children to five-year-old children. This study found that five-year-olds have longer sustained stages three and four of NREM sleep, while two-year-olds spend more time in REM sleep. This study contributed to the evidence that during early childhood, the sleep cycle is undergoing changes. While the Kahn et al. study does provide evidence for developmental differences in sleep, detailed research on sleep in pre-school aged children is lacking. Thus physiologically, a lot remains unknown about sleep in young children. What is known is that as children grow older, stage two of NREM sleep increases. Gradually, as

children mature, the percentage of total sleep time spent in REM progressively decreases to reach the one-fifth level typical of later childhood and adulthood.

The amount of sleep needed per day also differs by age. Infants need fourteen to fifteen hours of sleep a day while toddlers and pre-school-aged children need eleven to fourteen hours of sleep daily (Wolfson & Carskadon, 1998). It is important to note that for children pre-school aged or under, cumulative sleep throughout a 24-hour time cycle is what is important. It is not expected that an infant or toddler will sleep over eleven hours at one time. Time spent napping contributes to the total time of sleep in a 24-hour time period. Conceptualizing sleep needed per day changes for older children.

Elementary school-aged children require ten to eleven hours of sleep a day, while adolescents and adults need nine hours of sleep a day (Wolfson & Carskadon, 1998). For anyone over pre-school-age, nap time is not counted towards total time of sleep per day. It is expected that elementary school-aged children have at least ten hours of uninterrupted sleep per night, and adolescents and adults have at least nine hours of uninterrupted sleep per night (Wolfson & Carskadon, 1998).

The amount of time spent sleeping is not the only thing that contributes to healthy sleep. In fact, it is possible that an individual has the proper quantity of sleep, but their sleep quality is poor. Sleep quality is extremely important to consider when assessing sleep. During normal, healthy sleep, the brain triggers physiological responses, such as respiratory functioning, and cardiovascular functioning (Sheldon, 2005). If an individual's sleep quality is poor, this can lead to physiological malfunctioning as discussed previously, which in turn can negatively effect sleep (Rosen, 2005). Understanding healthy sleep helps to differentiate problematic sleep.

### *Measures to assess sleep disorders*

In order to comprehend and assess problematic sleep, sleep must be measured. Sleepiness or feeling tired needs to be quantified because subjective reports of sleepiness can be unreliable (Thorpy et al., 2006). There are a number of methods to assist in the assessment of sleep. The two most commonly used methods are polysomnography and multiple sleep latency test (MSLT) (Davey, 2005). A polysomnogram, also referred to as a sleep study, measures physiologic parameters related to sleep and wakefulness. Polysomnograms are overnight tests that extensively measure sleep architecture, including time in bed and total sleep time; sleep efficiency and latency; REM latency; the percentage of time spent in each sleep stage; arousals; and sleep fragmentation. Sleep architecture is measured by electroencephalography (EEG), electromyography (EMG), electrooculogram (EOG), thermocouple sensors, piezo crystal effort sensors, pulse oximeter, and actigraphy. EEG is an electrical recording of the brain that detects and records brain waves to determine the stage of sleep during any given period of the night. EMG records electrical activity in muscles, which is helpful in documenting arousals and spastic movements. EOG records eye movements during sleep and also helps determine sleep stages. Thermocouple sensors measure airflow through tracking the amount of air moving in and out of airways. Piezo crystal effort sensors measure chest wall and abdominal movements during breathing. Both thermocouple sensors and piezo crystal effort sensors are used to determine the presence and extent of how often a person stops breathing in their sleep. The pulse oximeter measures oxygen saturation. Actigraphy records physical motion. All of these tests are conducted simultaneously while a person sleeps. The polysomnogram recordings are divided into epochs or thirty second time

intervals. For every epoch, the predominant stage of sleep is recorded. The total time and relative proportion of time spent in each stage of sleep is calculated and latencies to REM sleep are recorded. Abnormal neurophysiological events, respiratory activity, and other parameters like body position are also recorded.

To assess daytime sleepiness and the amount of time it takes to go from awake to sleep, MSLT is used. MSLT is usually conducted following a polysomnography, and measures the average time it takes to fall asleep. In an MSLT, EEG, EOG, EMG, and heart rate are measured as well as sleep latency. Sleep latency is defined as the time from intent to fall asleep to the first epoch of any sleep stage. An average time to fall asleep is ten minutes. If someone falls asleep in less than five minutes or cannot fall asleep after twenty minutes, that indicates a problem. MSLT and polysomnography are used to diagnose sleep disorders.

#### *Pediatric sleep disorders*

Pediatric sleep disorders can be divided into four broad categories; primary sleep disorders including dyssomnia and parasomnia, sleep disorders related to another medical disorder, sleep disorders due to a general medication condition, and substance-induced sleep disorders (Anders & Eiben, 1997). There are more than eighty different types of primary sleep disorders, but the most common sleep disorders in children are Periodic Limb Movement Disorder (PLMD), Restless Legs Syndrome (RLS), Narcolepsy, Delayed Sleep Phase Syndrome (DSPS), and Obstructive Sleep Apnea Syndrome (OSAS). The following sections will review each sleep disorder in more detail.

*Periodic Limb Movement Disorder.* Periodic Limb Movement Disorder (PLMD) is the periodic movement of the arms and/or legs during sleep (Coccagna, 1990). In order

to be diagnosed with PLMD, a person must move at least five times for every hour of sleep and the movements must interfere with sleep (Picchiette, England, Walters, Willis, & Verico, 1998). Four contractions lasting between 0.5 and 5 seconds every four to ninety seconds constitute a movement (Hening, 1999). The most common movements in PLMD are a flexed knee or hip, the extension of the big toe, and the flexing of the foot. Children with PLMD have increased stages one and two of NREM sleep and decreased stages three, four, and REM sleep (Trenkwalder, Walders, & Hening, 1996). Polysomnography and actigraphy are used to diagnosis PLMD. Medications, such as opioids, benzodiazepines, and anticonvulsants are used to treat PLMD (Hening, 1999). Other treatments for PLMD include sleep hygiene improvement as well as special diets. Only a few studies have been conducted on the treatment of PLMD in children, and studies on the long-term effects of medications used to treat PLMD in children are sparse. Prevalence of PLMD in children is still unknown (Owens, 2005).

*Restless Legs Syndrome.* The diagnostic criteria for Restless Leg Syndrome (RLS) is uncomfortable sensations in the legs that are temporarily relieved by movement (American Sleep Disorders Association, 1997). Children with RLS describe the sensations as “snakes in the legs” or “creepy-crawly things in the legs” (Walters, Picchietti, Ehrenberg, & Eagner, 1994). The most prominent symptom of RLS is the uncomfortable leg sensations, but other common symptoms of RLS include muscular weakness, headaches, and daytime sleepiness (Coccagna, 1990). Symptoms are exacerbated by long periods of sitting, and tend to be strongest around bedtime. RLS is associated with PLMD, and can be diagnosed alone or comorbidly (Coleman, 1982). The diagnosis of RLS in children is rare. It is hypothesized that many children who are

misdiagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD) actually have undiagnosed RLS (Walters, Picchietti, Ehrenberg, & Eagner, 1994). The behavior that children exhibit when they have RLS looks very similar to the diagnostic criteria of ADHD. Like PLMD, RLS can be treated through opioids, benzodiazepines, and anticonvulsants. Improved sleep hygiene and a special diet are also treatments for RLS. With mild cases of RLS, exercise, leg massages, and elimination of caffeine are recommended.

*Delayed Sleep Phase Syndrome (Circadian Rhythm Disorder).* Delayed Sleep Phase Syndrome (DSPS) is the inability to fall asleep and wake up at regular hours for at least six months. Adolescents who do not fall asleep until after midnight and sleep until the afternoon are suspected of having DSPS (Roehrs & Roth, 1994). In fact, most of the studies conducted on DSPS use adolescents. There is little research on children with DSPS. Poor sleep hygiene and a faulty circadian clock are thought to cause DSPS (Caskadon, Wolfson, Acebo, Tzischinsky & Seifer, 1998). Chronotherapy is a treatment for DSPS which resets the circadian rhythm by imposes a bedtime earlier and earlier until the bedtime reaches a normal hour (Czeisler et al., 1981).

*Narcolepsy.* Narcolepsy is a neurological disorder associated with excessive daytime sleepiness, cataplexy, and premature onset of REM sleep (Aldrich, 1992). It usually becomes evident during adolescents or young adulthood, with the peak age of symptoms occurring between the ages of fifteen and twenty-five (Guilleminault, 1994). Daytime sleep attacks may occur with or without warning and nighttime sleep may be fragmented. People with narcolepsy have trouble staying awake. There are three classic symptoms of narcolepsy: cataplexy, sleep paralysis, and hypnagogic hallucinations.

Cataplexy is a sudden decrease in muscle tone triggered by emotions such as anger, laughter, or surprise (Guilleminault, Mignot, & Partinen, 1994). Severe attacks of cataplexy may result in a complete body collapse with a fall to the ground and risk of injury. Milder forms of cataplexy are more common and involve symptoms such as a dropping head, sagging jaw, slurred speech, buckling of the knees, or weakness in the arms. Cataplectic attacks can last anywhere from a few seconds to a few minutes. Some narcoleptics have cataplectic attacks daily while others might only have a few attacks a year. Sleep paralysis is the temporary inability to talk or move when waking up or falling asleep, although being fully aware of the surroundings (Guilleminault, 1994). The duration of these episodes may be from seconds to minutes. Breathing is maintained although some patients may experience a frightening sensation of “not being able to breathe.” Hypnagogic hallucinations are visual and auditory disturbances that occur while falling asleep (Guilleminault, 1994). The hallucinations tend to be vivid, frightening, disturbing, and/or bizarre for the people having them. The sleep cycle in narcoleptics is atypical and starts with REM sleep rather than NREM sleep. Narcolepsy can be diagnosed from polysomnography, MSLT, or human leukocyte antigen (HLA) testing. Diagnosing children is challenging because they do not present all narcolepsy symptoms, and these children are commonly misdiagnosed with psychiatric disorders (Dahl, Holttun & Trubnick, 1994). Stimulants and antidepressants are the most commonly used treatment for narcolepsy.

*Obstructive Sleep Apnea Syndrome.* Obstructive Sleep Apnea Syndrome (OSAS) accounts for 50% of sleep disorders and occurs in people of all ages from infants through senior citizens (Benbadis, 1998). OSAS is characterized by the cessation of breathing for

more than five seconds two or more times an hour during sleep. Apneic episodes cause temporary drops in blood oxygen and increases in carbon dioxide levels, which wake people up from sleep. Waking up from apneic episodes account for the chronic sleep deprivation and the resultant excessive daytime sleepiness that is a major hallmark of this condition. The cause for OSAS is usually an obstruction of the airway. Common obstructions to airway passage are tonsils, adenoids, the tongue, palatal size and position, and the jaw (Bower & Buckmiller, 2001). Obesity is also highly comorbid with OSAS. Raspy breathing, snoring, gasping, and choking at night are all symptoms of OSAS. Other symptoms include open mouth breathing any time of the day and sleeping in strange positions at night. A deleterious outcome of OSAS is hypoxemia. Hypoxemia is caused by the lack of oxygen from an apneic episode, and results in problems with the nervous system and cognitive impairments (Findley, 1989). It is estimated that 1 - 3% of children have OSAS (Gaulter, 1992; Kuppersmith, 1996; Marcus, 1997; Wang, Elkins, Keech, Eauguier, & Hubbard, 1998), with a peak prevalence in children ages 3 to 7 years (Brouillette, Fernbach, & Hunt, 1982). The most common treatment for children with OSAS is the removal of their tonsils and/or adenoids (Gaultier, 1992). According to Kohler (2004), 85% of children are cured of OSAS when their tonsils or adenoids are removed. Another common treatment for OSAS in both children and adults is the use of continuous positive airway pressure (CPAP), which is a special oxygen mask that forces air into the throat. Other treatments for OSAS are weight loss and the use of dental appliances.

### *Deleterious effects of sleep disorders on young children*

Sleep problems may have significant short- and long-term consequences on young children's cognitive, behavior, academic and social functioning, as well as their health (Anders, Carskadon, Dement, & Harvey, 1978; Fallone, Owens, & Deane, 2002).

Daytime sleepiness resulting from fragmented or disturbed sleep is often manifested in young children by behaviors such as increased activity, aggression, impulsivity, acting out behavior, poor concentration, and inattention (Carskadon, Pueschel, & Millman, 1993; Guilleminault et al., 1982). Recent research suggests that sleep problems in early childhood may predict the development of subsequent internalizing disorders in adolescence and adulthood (Gregory & O'Connor, 2002).

Sleep problems are associated with a variety of changes in mood and behavior (Ali, Pitson, & Stradling, 1993) and disturbances of mood and behavior can alter sleep. Sleep disturbances in pediatric special populations are so common that almost all psychiatric disorders in children are associated with sleep disruption (Owens, 2005; Roberts, 2003). Many psychiatric disorders can be associated with fatigue, daytime sleepiness, abnormal circadian sleep patterns, nightmares, and movement disorders during sleep. Growing evidence suggests that insomnia with no concurrent psychiatric disorder is a risk factor for later development of psychiatric conditions, particularly depression and anxiety disorders (Owens, 2005). Sleep problems also are associated with behavioral problems (Minde et al., 1993). Children diagnosed with ADHD tend to exhibit behavioral problems at bedtime including taking a longer time to fall asleep, being tired upon awakening, having variable sleep duration, and frequently waking up in the middle of the night (Corkum, Beig, Tannock, & Moldofsky, 1997). In order to further understand

how sleep impacts mood and behavior, understanding internalizing and externalizing behaviors is important.

#### *Defining internalizing and externalizing disorders*

Research has identified internalizing and externalizing problems as two broad dimensions of child psychopathology (Mash & Barkley, 2003). Externalizing behaviors can be thought of as disruptive behavior disorders of childhood (Mash & Barkley, 2003). Achenbach (2001) identifies aggression, social problems and attention problems as subdimensions of externalizing behaviors. The Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition, Text Revision (DSM-IV-TR) (American Psychiatric Association, 2000), disorders including Attention-Deficit Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), and substance abuse disorders are all externalizing disorders. (Northey, Wells, & Silverman, 2003). Internalizing behaviors can be thought of as negative feelings or mood states that are directed towards oneself (Mash & Barkley, 2003). Achenbach (2001) identified withdrawn behavior, somatic complaints, anxious/depressed feelings, and thought problems as subdimensions of internalizing behaviors. According to the DSM-IV-TR (American Psychiatric Association, 2000), internalizing behavior problems are most commonly equated with anxiety and mood disorders.

#### *Developmental differences in psychopathology*

There are certain disorders that are not typically diagnosed for children under the age of five because of developmental differences in the presence of symptoms (Mash & Barkley, 2003). This is particularly relevant to the current study since the sample population will be ages 24 months – 5 years. In mood disorders, such as depression,

having a depressed mood is one of the diagnostic features of depression. But in young children, irritability, uncooperativeness, apathy, and disinterest is more common than having a depressed mood (Kashani, Holcomb & Orvaschel, 1986). Similarly, preschoolers are unlikely to report feelings of hopelessness and dysphoria (Ryan et al., 1987); instead they may display a depressed appearance (Carlson & Kashani, 1988). In fact, depressed preschoolers are more likely to act out physically or report exaggerated somatic complaints than exhibit typical symptoms of depression (Kashani, Rosenberg, & Reid, 1989). Overall, the lifetime rate of depressive disorders is less than 3% in school-age children, and is even less common among preschool-age groups (Costello & Angold, 1995).

Anxiety disorders, on the other hand, are among the most common psychiatric disorders affecting children (Costello & Angold, 1995; Gurley, Cohen, Pine, & Brook, 1996; Mash & Barkley, 2003). In the DSM-IV-TR (American Psychiatric Association, 2000), children can be diagnosed with any of nine anxiety disorders including: separation anxiety disorder (SAD), panic disorder, agoraphobia, generalized anxiety disorder (GAD), social phobia, specific phobia, Obsessive Compulsive Disorder (OCD), posttraumatic stress disorder (PTSD), and acute stress disorder. These disorders share anxiety as the predominant feature, but are distinguished based on the focus of the anxiety (Mash & Barkley, 2003).

Separation anxiety disorder is an anxiety disorder unique to children (APA, 2000). The major feature of SAD is the onset of excessive anxiety and fear regarding separation from home or from those to whom the child is attached (APA, 2000). Such anxiety must be inappropriate for the child's age and developmental level, especially because

separation anxiety is normal from approximately 7 months to 6 years of age (Bernstein & Borchardt, 1991). SAD has an acute and early onset often occurring after a major stressor or at a period of developmental change (Last, 1989). A change in school or starting school can be a trigger (Last, 1991). Children with SAD commonly have bedtime resistance and report recurrent nightmares characterized by separation themes (Bell-Dolan & Brazeal, 1993).

Just as internalizing disorder symptoms differ by age, so do the symptoms of externalizing disorders. In preschool aged children, externalizing disorders such as ODD and CD are rarely diagnosed. Oppositional and defiant symptoms are fairly common during the preschool years, which means that it would take extremely high and severe levels of such behaviors, in comparison with age and sex norms, to warrant diagnosis (Coie & Dodge, 1998). In fact, stubbornness, tantrums, and defiance are relatively typical for preschool aged children. The symptoms of CD, however, are not normative during childhood and it is extremely rare that CD be diagnosed in children under the age of 9 (Loeber, 1988; Moffitt, 1993; Patterson, 1993). It is believed that the ODD pattern could serve as a developmental precursor to CD (Loeber et al., 1991). Because both ODD and CD are rare in preschool-aged children, evaluating the externalizing behaviors identified by Achenbach (aggression, social problems and attention problems) is more logical. It is common for preschool-aged children to be active; move from one activity to another; to act without forethought, and to respond on impulse to events that occur around them often with emotional reactions being quite apparent. This behavior becomes problematic when a child persistently displays levels of activity that are excessive compared to peers of the same gender, age group, and developmental level (Mash & Barkley, 2003).

### *Internalizing disorders and sleep problems*

The majority of research examining the association between sleep problems and internalizing problems has focused on adults (Gregory et al., 2005). Much of this research examined the association between insomnia and depression, and suggests that adults' sleep problems forecasts depression (Breslau, Roth, Rosenthal, & Andreski, 1996; Chang, Ford, Mead, Cooper-Patrick, & Klag, 1997; Livingston, Blizard, & Mann, 1993; Weissman, Greenwald, Nino-Murcia, & Dement, 1997). For example, Ford and Kamerow (1989) found that adults who reported insomnia at two consecutive interviews were significantly more likely to develop a new case of major depression over the course of the next year than were those without insomnia. Furthermore, the risk of developing major depression was reduced for those whose insomnia had resolved by the second assessment. Similar findings have been reported by other investigators (Breslau et al., 1996; Dryman & Eaton, 1991; Livingston et al., 1993; Weissman et al., 1997).

Whether or not sleep problems forecast depression in children is less clear and is in need of further investigation. Preliminary research suggests that childhood sleep problems may predict the development of subsequent internalizing problems in adolescence (Gregory & O'Connor, 2002). Childhood risk indicators, such as parental loss, family conflict, and physical and sexual abuse also have been identified for the development of later internalizing problems (e.g., Birmaher et al., 1996; Fergusson, Horwood, & Lynskey, 1996). Less attention, however, has been paid to assessing the predictive associations between sleep problems and internalizing problems in children.

Gregory and O'Connor (2002) conducted a longitudinal study to examine the specificity, order of appearance, and developmental changes in the relationships between

sleep problems and both internalizing and externalizing problems in children. The sample included 490 children ages 4 – 15 years. Parental ratings of sleep and behavior as measured by the Child Behavior Checklist (CBCL; Achenbach, 1991) were obtained. The CBCL includes measures of externalizing behaviors, internalizing behaviors, and sleep problems. CBCL measures were collected annually over an 11-year period. Findings revealed that sleep problems were moderately but significantly correlated with anxiety/depression, attention problems, and aggression. Early sleep problems at age 4 years also predicted an increase in depression/anxiety, inattention/overactivity, and aggression at mid-adolescence. For example, the correlation between sleep and anxiety/depression increased from  $r = 0.39$  at age 4 to  $r = 0.52$  in mid-adolescence. Overall, there was a sizable decrease in sleep problems from preschool to mid-adolescence. Other studies using different definitions of sleep problems and different age groups have found parallel associations (Gregory, Eley, O'Connor, & Plomin, 2004; Wong, Brower, Fitzgerald, & Zucker, 2004). It is noteworthy that the prediction of later internalizing problems from sleep problems is more robust in adults than in children, suggesting that sleep problems may be a better predictor of internalizing problems in older than in younger individuals (Gregory et al., 2005).

To expand on the Gregory and O'Connor (2002) study, Gregory, Caspi, Eley, Moffitt, O'Connor and Poulton (2005) conducted another longitudinal study to assess the relationship between childhood sleep problems and anxiety and depression disorders in adulthood. Parents of 943 children participating in a longitudinal investigation of health and behavior provided information on their children's sleep and internalizing problems at ages 5, 7, and 9 years. At both 5 and 7 years, three sleep-related questions were asked

("Sleep problems last night?", "Typically has sleep problems?", "Does child have sleep problems?"). At the 9-year-old assessment, six sleep-related questions were asked ("Sleep problems last night?", "Sleeping difficulties?", "Child has trouble falling asleep?", "Child awakens at night and can't return to sleep?", "Child slept much more recently?", "Child wakens very early?"). The responses to the questions were coded on a binary scale (0 = no problem; 1 = sign of a problem). Internalizing problems were assessed by parent report using the Rutter Child Behavior Scales (Rutter, Tizard, & Whitmore, 1970) at 5, 7, and 9 years. When the participants were 21 and 26 years, adult anxiety and depression were diagnosed using a private standardized interview (The Diagnostic Interview Schedule; Robins, Cottler, Bucholz, & Compton, 1995), administered by interviewers unaware of participants' previous data, including their mental health status. At age 21 years, disorders were diagnosed using the (then current) Diagnostic and Statistical Manual of Mental Disorders – Third Edition Revised (DSM-III-R) (American Psychiatric Association, 1987) criteria. At age 26, the DSM-IV (American Psychiatric Association, 1994) was used to determine the presence of a diagnosis. Findings showed that children with persistent sleep problems had more internalizing childhood problems than those without persistent sleep problems. Of those children providing data on sleep problems at 9 years old, 97% of these participants also provided data on anxiety and depression in adulthood. Of the children with persistent sleep problems, 46% of them had anxiety in adulthood compared to 33% of adults with anxiety who did not have persistent sleep problems during childhood. This difference was found to be statistically significant. In contrast, there were no differences in the proportions of participants with and without persistent sleep problems who had

depression in adulthood. The results of this study provide some evidence for a link between sleep problems and anxiety, although these results do not imply that early sleep problems predict an increase in later anxiety. While these studies evaluated the longitudinal associations between childhood sleep problems and the likelihood of later being diagnosed with an internalizing disorder, neither study examined the relationship between having a pediatric sleep disorder as a young child and exhibiting internalizing behaviors as a young child.

Paavonen et al. (2002) evaluated associations between sleep problems and psychiatric symptoms of 4,531, 8 and 9 year old children. The Children's Depression Inventory (CDI) was used as a self-report questionnaire, while parents completed the Rutter A2 (RA) scale, which is a 36-item questionnaire assessing psychiatric symptoms. Teachers of the children completed a RA scale for teachers. These scales were used to assess both psychiatric symptoms and sleep problems since both the CDI and RA include questions assessing sleep. Findings showed that children with more severe sleep problems were more likely to have psychiatric disturbances including emotional problems, hyperactivity, and other behavioral problems. The limitation to this study was that sleep problems were assessed through measures that have a limited number of questions assessing sleep disturbance rather than using a measure designed to assess risk for sleep disorders. Additionally, this study evaluated only 8 and 9 year old children, which potentially limits the generalizability of the findings to children of other age groups.

### *Externalizing disorders and sleep problems*

There is substantial evidence that sleep problems in children are associated with behavior problems in pediatric samples (Broughton & Shimizo, 1995; Fallone, Ownens, & Deane, 2002; Owens, Opipari, Nobile, & Spirito, 1998). Children with identified behavior problems are more likely to have parent-reported sleep problems than children without behavior problems (Richman, 1987; Richman, Stevenson, & Graham, 1982). For instance, Zuckerman, Stevenson, and Bailey (1987) found that children whose sleep problems persisted from age 8 months to 3 years showed relatively high levels of tantrums and other management difficulties at age 3 years compared to controls. In a sample of children, with the mean age of 5 years, Owens-Stively et al. (1997) found that children diagnosed with sleep problems exhibited both negative emotional temperament as well as more disruptive behavior when compared to controls.

Owens, Opipari, Nobile and Spirito (1998) conducted a study that examined the relationship between sleep quality and daytime behaviors in 152 children ranging in ages from 2 through 12 years. All participants were referred to a pediatric sleep disorders clinic and had primary diagnoses of either Obstructive Sleep Apnea Syndrome (OSAS) or Behavioral Sleep Disorder (limit setting sleep disorder). Parents of the participants completed three sleep questionnaires (Children's Sleep Behavior Scale (CSBS), Children's Sleep Habits Questionnaire (SHQ), and Obstructive Sleep Apnea Screening Questionnaire (OSASQ)) and a behavior rating scale (Eyberg Child Behavior Inventory (ECBI)). The participants of the study were categorized into one of three groups: (1) having only a behavioral sleep disorder, (2) having only OSAS, or (3) combined - having both OSAS and a behavioral sleep disorder. Findings showed that children in the

behavioral sleep disorder group had a greater number and severity of externalizing daytime behavior problems as measured by the ECBI than the other two groups. The greatest limitation of this study is that each group being compared had a diagnosed sleep disorder, so it is hard to attribute externalizing disorders to poorer sleep quality alone. This study could have been stronger if a control group of children with no diagnoses was also assessed and compared to children with sleep diagnoses.

Chervin, Dillon, Archbold and Ruzicka (2003) examined the relationship between children's sleep quality and daytime behavior. The sample included 872 children ages 2 through 14 years attending two general pediatric clinics. The children's parents completed questionnaires assessing sleep and behavior including: a Pediatric Sleep Questionnaire and The Connor's Parent Rating Scale. Behavioral differences between children with and without sleep-related problems were analyzed. Children rated as having aggressive behavior and behaviors that reflect conduct problems were two to four times more frequent among children at high-risk for sleep disordered breathing or periodic limb movement disorder than among children with less aggressive behavior. Excessive daytime sleepiness was strongly associated with conduct problems as well. Overall, children at risk for sleep problems were more likely to exhibit challenging behaviors. One problem with this study is that problematic behavior was not differentiated by age. As discussed earlier, conduct disordered behavior is not typically seen in younger children. This study would have been stronger had the age range been narrowed, focusing on a particular age group.

Lavigne et al. (1999) conducted a similar study with preschool-aged children. In this study, parents of 510 children ages 2 to 5 years reported on their child's sleep and

behavior. To measure behavior, parents completed the Child Behavior Checklist and the Rochester Adaptive Behavior Inventory. Sleep was assessed by asking parents to report the usual time at which their child fell asleep and woke up, as well as the number of naps taken per week and the average length of naps. An estimate of average sleep in a 24-hour period (including nap time) was calculated. Findings indicated that the less sleep the child had, the higher levels of externalizing behavior problems the child exhibited, particularly aggressive behaviors. The biggest limitation of this study is that sleep was assessed through informal measures. There are a number of sleep-related problems that can be overlooked when just asking parents what time they put their child to sleep and what time their child woke up. A number of standardized sleep measures, including the Sleep Disorders Inventory for Students and the Children's Sleep Habits Questionnaire, ask more specific questions that assess sleep quality in children. Using standardized sleep-measures can potentially strengthen studies that wish to evaluate children's sleep and its impact on children's overall functioning.

Challenging behavior is not the only behavior associated with poor sleep quality in children. Children may engage in more risk-taking behaviors when they have poor sleep quality, which could place them at greater risk for injury. Research conducted by Owens, Fernando, and McGuinn (2005) investigated the relationship between sleep disturbance and both injury rates and injury-prone behaviors in 71 children ages 3 through 7 years enrolled in a pediatric clinic. The parents of the participants completed the Children's Sleep Habits Questionnaire as well as the Injury Behavior Checklist. Additionally, each patient's medical chart was reviewed for reported injuries including falls, cuts and lacerations, unintentional ingestions, pedestrian injuries, burns and scalds, and choking

episodes. Results suggest that children with more frequent injuries had significantly more sleep problems overall than did children with low injury rates. Children with more parent-reported injury prone behaviors also had significantly more sleep disturbance. Daytime sleepiness-related items did not differ between injury history or injury behavior groups. Results of this study support an increased prevalence of sleep disturbances in young children with higher injury rates and more injury-prone behavior.

Children diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD) tend to be more injury prone. Considerable empirical evidence supports an association between sleep disorders in children and the diagnosis of ADHD (Chervin et al., 1997; Picchietti, England, Walters, Willis, & Verrico, 1998; Stores & Wiggs, 1998). Sleep problems, particularly difficulties in initiating and maintaining sleep, are reported in an estimated 25% to 50% of children and adolescents with ADHD in clinical practice (Owens, 2005).

Picchietti et al. (1998) examined the relationship between meeting diagnostic criteria for ADHD and having PLMD and/or RLS diagnoses. This study included 69 children ages 2 – 15 years who were being seen by a neurologist for ADHD-related symptoms. A neurological history and examination were performed, and all participants were diagnosed with ADHD. Parents of the participants were asked to observe their child's sleep for minimally three nights immediately after their child's sleep onset. Parents who reported significant movement during their child's sleep were referred for an overnight PSG. Of the 69 participants, 27 underwent an overnight PSG. Archival PSG data matched for age were used for the control group (n = 38). Of the children who were diagnosed with ADHD and had an overnight PSG, 18 of them were also diagnosed with

PLMD. Only 2 out of the 38 matched controls met PLMD criteria. These results indicate a relationship between being diagnosed with PLMD and ADHD.

Gaultney, Terrell, and Gingras (2005) compared the relative strength of ADHD symptoms with sleep disordered breathing, PLMD, and bedtime resistance behaviors. Parents of 283 children ages 7-14 years completed the Pediatric Sleep Questionnaire (PSQ; Chervin et al., 2000). Besides inquiring about sleep, this questionnaire also has two questions asking parents whether or not their child has been diagnosed with ADHD by a professional. Using the results from the Pediatric Sleep Questionnaire, risk for SDB, PLMD, and bedtime resistance behaviors were correlated with ADHD symptoms. High correlations were found between parent-reported ADHD symptoms and PLMD. These data, however, should be interpreted with caution due to the fact that only one measure was used that was highly dependent on parent report. There were no measures in the study solely assessing ADHD symptoms.

Owens, Maxim, Nobile, McGuinn, and Msall (2000) conducted a study to determine the prevalence of parent-reported sleep disturbances with a sample of school-aged children diagnosed with ADHD. The sample consisted of 46 children diagnosed with ADHD and 46 matched controls ages 5 – 10 years. An ADHD diagnosis using DSM-IV-TR criteria was determined by an evaluation team which included a behavioral-developmental pediatrician, a neuropsychologist, a social worker, and an educational consultant. Every participant also had a two-day evaluation which included a physical and neurodevelopmental examination, a parent-child clinical interview, the CBCL, The Parent Child Depression Inventory (P-CDI; Kovacs, 1985), the Conners Parent Questionnaire, and a review of medical and school records. Sleep related behavior was

measured using the Children's Sleep Habits Questionnaire (Owens, Spirito, & McGwinn, 2000) and the Sleep Self-report (Owens et al., 2000). Findings showed that children diagnosed with ADHD had significantly higher sleep disturbance scores on both sleep measures than did controls. Additional findings were that children diagnosed with ADHD had a shorter sleep duration compared to controls. This study supports a relationship between ADHD and sleep problems.

The strong link between ADHD and sleep disorders is thought to be because the prefrontal cortex, the locus coeruleus, and neurotransmitters that regulate sleep also impact attention and arousal. Physiological dysfunctions result in deficient information processing, memory, and learning, as well as problems with self-regulation. Another possible connection is that sleepiness either coexists with or produces symptoms consistent with ADHD (Gaultney, Terrell, & Gingras, 2005). Children diagnosed with ADHD also have impairments in their daily functional skills. (Stein, Szumowski, Blondis & Roizen, 1995).

#### *Adaptive behavior in young children*

Adaptive skills are practical, everyday skills needed to meet the demands of the environment (Harrison & Oakland, 2003). They are skills that a person learns in the process of adapting to his/her surroundings. Examples of adaptive skills include those related to dressing, eating, communicating with others, self-care, social interaction, and practicing safety. The American Academy of Mental Retardation (AAMR) defines adaptive skills as "the collection of conceptual, social, and practical skills that have been learned by people in order to function in their everyday lives" (p. 41). Adaptive behaviors can change according to a person's age, cultural expectations, and environmental

demands (Wikipedia.org, 2006). Since adaptive behaviors are for the most part developmental, it is possible to describe a person's adaptive behavior as an age-equivalent score. An average seven-year-old, for example, would be expected to have adaptive behavior similar to that of other seven-year-olds. For instance, it would be expected that a typical American seven year old could dress him or herself. This adaptive behavior may not be expected of a three-year-old, or possibly in another culture with seven-year-old children.

Adaptive behavior assessment is typically used to aid in diagnosing or program planning. For example, the diagnosis of mental retardation requires deficits in both cognitive ability and adaptive behavior, occurring before age 18 years. Assessment of adaptive behavior is also used to determine the type and amount of special assistance that people with disabilities may need. Adaptive behavior assessments are often used in preschool and special education programs for determining eligibility, for program planning, and for assessing outcomes. Adaptive skills should be assessed routinely for children who have difficulties, disabilities, or disorder that interfere with daily functioning (Harrison, 1990; Harrison & Boney, 2002; Reschly, 1990).

One adaptive skill that is commonly measured for younger children is self-regulation, which is considered to be a key factor in children's adjustment. The ability to self-regulate underlies many of the behaviors and attributes associated with successful school transition and academic achievement (Coie, Dodge, & Kupersmidt, 1990; Ladd, 1990; Schultz, Izard, Ackerman, & Youngstrom, 2001). When a child has impaired self-regulation, this can result in less on-task behavior in the classroom (Goodman & Linn, 2003). On-task behavior in a classroom is imperative for learning (Strain, Danko, &

Kohler, 1995). Therefore, children who experience difficulty with the regulation of emotion and attention are at risk for experiencing problems with the adjustment to school. Problems with the initial adjustment to school can lead to continuing difficulties with social and academic competence and self-concept and increased risk for school failure (Blair & Peters, 2003).

Blair and Peters (2003) conducted a study to examining 42 children ages 3 years 9 months to 5 years 7 months physiological and cognitive self-regulation, and to relate them to teacher reports of social competence and engagement in the classroom. All children were attending a Head Start facility. Participants were seen during half-hour increments over two days. The first day, children completed the Peabody Picture Vocabulary Test – 3 (PPVT-3; Dunn & Dunn, 1997). On the second day, children were administered electrocardiograms (ECG) to assess their vagal tone while completing executive functioning measures (a peg-tapping test and a stroop-like day and night measure). Parents then completed a CBCL, while the children’s teachers completed the Teacher Observation of Classroom Adaptions – Revised (TOCA-R; Werthamer-Larsson, Kellam, & Wheeler, 1991). The TOCA-R is a 41-item measure designed to assess children’s performance on showing concern for others, accepting limits, paying attention, staying on task, and showing effort. Results indicated that higher resting vagal tone, as well as a vagal increase during the administration of the cognitive task, and higher levels of fearful emotionality on the CBCL were related to higher ratings of social competence. In contrast, lower resting vagal tone, as well as a vagal suppression in response to the cognitive task, and higher levels of executive function were associated with higher teacher ratings of on-task behavior, adjusted for social competence. These findings were

unexpected because social competence and on-task behavior are typically strongly positively correlated and this study's findings did not support this. This study had several limitations including the small sample size and the single time point of measurement. This study also only evaluated adaptive functioning as it related to social competence, disregarding many other areas of adaptive functioning.

A larger study conducted by Palermo et al. (2002) evaluated adaptive functioning more broadly. In this study, 14,630 children ages 6-15 years seen in three large pediatric practices were evaluated to determine the prevalence of functional limitations and to identify psychosocial factors related to functional limitations. Parents completed questionnaires including the Pediatric Symptom Checklist (to assess emotional & behavioral problems), the Family Apgar (to assess family functioning) and the Functional Limitations Index (to assess adaptive skills). Findings showed that 15% of the participants had some limitation in their daily functioning. Schoolwork and physical function limitations were more common than personal and self-care. Children with any psychosocial symptoms (externalizing, internalizing, and attention problems) were at increased risk for functional limitations. This study had the benefit of having such a large sample size. In addition, this study was able to identify specific areas of adaptive functioning that were more impaired over other areas.

While there are studies examining the relationship between adaptive skills and psychosocial symptoms, there are no studies evaluating the relationship between sleep and adaptive behavior. Since there is emerging evidence linking sleep problems to internalizing and externalizing behaviors, and having psychosocial symptoms is associated with poorer adaptive skills, it is hypothesized that there will be a positive

relationship between poor adaptive skills and having increased risk for a sleep disorder.

### *Summary*

Research in the area of pediatric sleep disorders is still relatively new. The existing research has shown that sleep disorders can have deleterious effects on children's cognitive and behavioral outcomes. It is possible that many children who have sleep disorders are being misdiagnosed with other disorders such as ADHD. It is important to continue researching pediatric sleep disorders since it is estimated that a large number of children do in fact have undiagnosed and untreated sleep disorders. There is no published research to date that assesses the relationship between being at risk for various sleep disorders and the impact on adaptive functioning as well as internalizing and externalizing behaviors in young children. Likewise, very little research exists on the prevalence of sleep disorders in young children. This study seeks to examine both the prevalence of sleep disorder risk in children ages 24 months – 5 years, as well as how being at risk for certain sleep disorders is associated with the presence of internalizing behaviors, externalizing behaviors, and adaptive functioning.

## Chapter 3

### Methods

#### *Introduction*

The purpose of this study was to assess the prevalence rates of a clinic-based sample of children ages 24 months – 5 years at risk for sleep disorders. In addition, this study examined the relationship between symptoms of sleep disorders, internalizing and externalizing behavior, and adaptive functioning in these children. This chapter presents information on the participants in this study, the instruments and procedures that were used for data collection, and the methods of data analysis used in this study.

#### *Participant characteristics*

A sample of 104 children ages 24 months-5 years attending a university-based child development clinic served as participants in this study. The university-based child development clinic provides children and their families with collaborative evaluations, consultation, service coordination, referral, and family support services. All children attending the clinic receive a standard battery of assessments, and these data from these assessments were analyzed for the purpose of this study. The sample was 78% male and 22% female. The race/ethnicity of the children was 53.8% Caucasian, 3.8% mixed race, 30.8% Hispanic, 10.6% African-American, and 1% Native American. The ethnic breakdown of this sample is similar to the ethnicity of the county as a whole. The children's ages ranged from 2 years to 5 years with a relatively equal sampling of each age (e.g, 27.9% of the sample were 2 years old, 26.9% of the sample were 3 years old,

23.1% of the sample were 4 years old, and 22.1% of the sample were 5 years old). A little over half of the participants had private insurance (56.7%), while 43.3% of the sample had Medicaid. See Table 1 for participant characteristics.

Table 1

*Participant Characteristics*

Race/Ethnicity	N	Percentage
African-American	11	10.6%
Caucasian	56	53.8%
Hispanic	32	30.8%
Native American	1	1.0%
Mixed/Other	4	3.8%
<b>Insurance Type</b>		
Private Insurance	59	56.7%
Medicaid	45	43.3%
<b>Age</b>		
2 years old	29	27.9%
3 years old	28	26.9%
4 years old	24	23.1%
5 years old	23	22.1%
<b>Gender</b>		
Male	81	77%
Female	23	13%

*Setting*

All of the data for this study were collected through USF Pediatrics Child Development Clinic located in West Central Florida. This clinic serves children from birth through the age of 12 years who live in the local communities. Children are usually referred to the child development clinic because an adult (e.g., pediatrician, teacher, parent) is concerned with their lack of progress in developmental, behavioral, social, and/or academic functioning. All children who come through the clinic have an initial triage appointment lasting approximately one hour where a team of professionals

interview the parents and screen the child for problems related to the referral concern. This team may include a physician or resident, a school psychologist or (school) psychology intern, and sometimes a nurse or nursing students. Based upon the information gained, the team of professionals decides if further assessments are needed. If developmental or academic functioning is of concern, parents are given a battery of assessments to complete including the SDIS-C, ABAS-II, and the CBCL. The child is then rescheduled for further applicable assessments. Parents complete the assessment battery provided during the triage appointment at home, and send the completed battery back to the clinic before their child's next scheduled appointment. Based on assessment results, intervention options are developed with the parents. Follow-up appointments are scheduled as needed on a case-by-case basis.

#### *Instrumentation*

*Sleep Disorders Inventory for Students.* The Sleep Disorders Inventory for Students (SDIS-C; Luginbuehl, 2004) was developed as a school-based screening instrument used to identify children at risk for Obstructive Sleep Apnea Syndrome, Narcolepsy, Periodic Limb Movement Disorder, Restless Leg Syndrome, and Delayed Sleep Phase Syndrome. There are two versions of the SDIS; one normed for children ages 2 – 10 years (SDIS-C), and the other form normed for adolescents ages 11 – 18 years (SDIS-A). Both the SDIS-C and SDIS-A are available in English and Spanish. This study examined data for children ages 24 months – 5 years, therefore only the SDIS-C was used for data collection.

The SDIS-C is a 41-item questionnaire which asks parents to rate their child's sleep behaviors in the past 6 – 12 months. The first 30 responses are on a likert scale

ranging from 1 – 7, and the last 11 responses are in a yes/no format. For most parents, the SDIS-C takes approximately 8 – 15 minutes to complete. If a parent is unsure of how to respond to specific items, parents are prompted to observe their child's sleep on two different nights. Responses are scored using a computerized scoring program. Scores are expressed as T-scores with a mean of 50 and a standard deviation of 10, and yield sleep disorder risk levels. T-scores of 60 and under are in the normal range of sleep meaning that the child is sleeping similarly to children of the same age. T-scores of 61 – 64 are in the caution range, meaning that the child is at mild risk of having a sleep disorder. A t-score of 65 and above places a child in the high-risk range of having a sleep disorder. Beyond producing t-scores, the computerized scoring program also produces a bar graph with scores for each sleep disorder and a score for the total sleep disturbance index, as well as a very detailed interpretive report explaining the different sleep disorders and recommendations if a child is at risk for a particular sleep disorder.

The SDIS-C was normed on a national sample of 821 children with demographics similar to the 2000 U.S. census. Exploratory and confirmatory factor analyses were conducted yielding four sleep factors on the SDIS-C, which includes OSAS, Excessive Daytime Sleepiness (EDS), PLMD, and DSPS. Criterion-related validity was moderate with OSAS being at 33% agreement compared to polysomnography and respiratory distress index, and EDS being at 83% agreement compared to Multiple Sleep Latency Tests. Using discriminate function analysis, predictive validity of the SDIS-C was found to be 93%. An expert review panel determined that the content validity of the SDIS-C was 94%. The internal consistency was 0.91 and the test-retest validity was 0.97. Overall,

the SDIS-C has demonstrated an 86% accuracy rate in determining which children need to be referred for more comprehensive sleep evaluations.

*Child Behavior Checklist.* The Child Behavior Checklist (CBCL; Achenbach, 2001) was developed to assess internalizing and externalizing behaviors in children. There are multiple versions of the CBCL. The CBCL/1½ - 5 was normed for 18-month to 71-month olds and is filled out by parents or caregivers. The CBCL/6 – 18 was normed for children ages 6-18 years and is filled out by parents or caregivers. The CBCL problem behavior scores include two broad-band factors (internalizing and externalizing problems), a total broad-band score, and eight narrow-band subscales. The narrow-band subscales include aggressive behavior, anxious/depressed, attention problems, delinquent behavior, social problems, somatic complaints, thought problems, and withdrawn behavior. All versions of the CBCL are available in English and Spanish. Since this study evaluated the results of children ages 24 months – 5 years, the CBCL/1½ - 5 was used for data collection.

The CBCL/1½ - 5 is a 99-item questionnaire that asks parents to rate their child's behavior based on the last 2 months, plus prompts for a description of problems, disabilities, what concerns parents most about their child, and the best things about the child. Parents are asked to rate each item as 0 for *not true* of the child, 1 for *somewhat* or *sometimes true*, and 2 for *very true* or *often true*. The CBCL/1½ - 5 takes approximately 20 minutes to complete. Responses are scored using a computerized scoring program. Scores are expressed as t-scores with a mean of 50 and a standard deviation of 10. A t-score of 64 or under is in the normal range; 65 – 70 is in the borderline range; and 70 or above is in the clinical range. Scores in the borderline or clinical range indicate that a

child has more problems than are typically reported by a child of the same age and gender.

The CBCL/1½ - 5 was normed on a national sample of 700 children. The manual reports median internal consistency coefficients for the Internalizing and Externalizing scales that range from .76 to .92. Studies of the CBCL subscales indicated high retest reliability (Withdrawn:  $r = .82$ ; Somatic Complaints:  $r = .95$ ; Anxious/Depressed:  $r = .86$ ; Social Problems:  $r = .87$ ; Internalizing Problems:  $r = .89$ ) and adequate interrater reliability (Withdrawn:  $r = .66$ ; Somatic Complaints:  $r = .52$ ; Anxious/Depressed:  $r = .77$ ; Social Problems:  $r = .77$ ; Internalizing Problems:  $r = .66$ ; Achenbach, 1991).

*Adaptive Behavior Assessment System – Second Edition.* The Adaptive Behavior Assessment System – Second Edition (ABAS-II; Harrison & Oakland, 2003) was developed to assess adaptive skills functioning for individuals birth to 89 years. There are multiple versions of the ABAS-II. The ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) was normed for children ages birth to 5 years 11 months and is filled out by parents or caregivers. The other ABAS-II forms include the Parent and Teacher Forms (Ages 5 – 21) and the Adult Form (Ages 16 – 89). Norm-referenced scores include three broad domains of adaptive behavior (Conceptual, Social, and Practical), a total score called the General Adaptive Composite (GAC), and 10 skill areas. The skill areas measured by the ABAS-II Parent/Primary Caregiver Form are communication, community use, functional pre-academics, home living, health and safety, leisure, self care, self-direction, social, and motor skills. The skill areas that make up the Conceptual domain are communication, functional pre-academics, and self-direction. The Social domain is composed of skill areas that measure social skills and leisurely skills. The skill areas that make up the

Practical domain are self-care, home living, community use, and health and safety. Both the ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) and the ABAS-II Parent Form (Ages 5 – 21) are available in English and Spanish. Since this study evaluated the results of children ages 24 months – 5 years, the ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) was used for data collection.

The ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) is a 241-item questionnaire that asks parents or caregivers to rate their child's current performance on adaptive skills functioning. Parents or caregivers are asked to rate each item as 0 for *is not able* to do the skill, 1 for *never or almost never when needed* to do the skill, 2 for *sometimes when needed* will do the skill, and 3 for *always or almost always when needed* will do the skill. The ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) takes approximately 20 minutes to complete. Responses are scored using a computerized scoring program. Specific skill area scaled scores have mean of 10 and a standard deviation of 3. The skill area scores combine to form the three ABAS-II broad domain scores and the GAC score, each with a composite score mean of 100 and a standard deviation of 15. Composite scores falling between 90 – 109 and scaled scores falling between 8 - 12 are classified in the Average range. This study only used the GAC score to assess adaptive functioning rather than also using the broad domains of adaptive behavior (e.g., Conceptual, Social, and Practical) because the purpose of this study was to look at adaptive functioning as a general construct relative to sleep disorder risk.

The ABAS-II Parent/Primary Caregiver Form (Ages 0 – 5) was normed on a national sample of 2,100 children ages birth to 5 years 11 months with demographics similar to the 2000 U.S. census. The manual reports the internal consistency for the skill

area scores to range from 0.80 – 0.92, and 0.91 – 0.97 for the composite scores. Studies of the ABAS-II subscales indicated high retest reliability (Communication:  $r = 0.82$ ; Community Use:  $r = 0.79$ ; Functional Pre-Academics:  $r = 0.85$ ; Home Living:  $r = 0.83$ ; Health and Safety:  $r = 0.81$ ; Leisure:  $r = 0.80$ ; Self-Care:  $r = 0.81$ ; Self-Direction:  $r = 0.80$ ; Social:  $r = 0.81$ ; Motor:  $r = 0.80$ ; Harrison & Oakland, 2003).

In summary, the SDIS-C, CBCL, and ABAS-II are all psychometrically sound instruments, as evidenced by their validity and reliability. Each instrument has a different contribution toward providing information about a child's overall functioning. The SDIS-C assesses sleep quality and risk for various childhood sleep disorders, the CBCL measures problem behavior, and the ABAS-II assesses functional skills. Because these instruments do have strong technical properties and are commonly used in part of a standard battery of assessments at the clinic, data from these instruments were used in this study.

### *Procedure*

Permission was obtained to conduct research with human subjects through the University of South Florida Institutional Review Board (IRB). Because data are archival in nature, parental consent forms were not necessary. The process by which the assessments were conducted was discussed in the *Setting* section of this chapter. After assessments results were obtained and reviewed with the children's parents, these data were entered into a clinic database. Participant data were entered into the database between February 2006 and February 2007. Permission from the Director of the child development clinic was granted for the student researcher to access these data for the purpose of this research. Confidentiality of participants was ensured because no names

were used on the database. Each subject had a unique number, which cannot be traced back to their name. Additionally, the student researcher had completed both IRB and HIPAA training. For each participant, the researcher accessed their demographic information including gender, age, ethnicity, and whether or not the family is on Medicaid, as well as the scores on the SDIS-C, CBCL, and the ABAS-II from the database. Data were used from children between the ages of 24 months and 5 years 11 months. If the child was either below of the age of 24 months or above the age of 5 years 11 months, their data were not included in this study. There were 4 children between the ages of 24 months and 5 years 11 months who did not serve as participants in this study because of missing data. Once inclusion criteria were met, participants' scores were then transferred to a SPSS file where the data was analyzed. A school psychology graduate student conducted a data integrity check by random sampling one-quarter of the data to ensure that the data were both entered and transferred accurately from the database into SPSS. An inter-rater agreement of 98% was obtained.

#### *Data analysis*

Separate data analyses were conducted for each of the five research questions. Descriptive statistics were used to describe the demographics of the sample as well as additional information on the SDIS-C, CBCL and ABAS-II. The first research question sought to determine the prevalence rate of sleep disorder risk in children ages 24 months to 5 years who were assessed at the clinic. Prevalence rates of sleep disorder risk were assessed through calculating a percentage with a 95% confidence interval.

The second and third research questions examined the relationship between sleep scores in the normal, cautionary, and high-risk ranges and externalizing behavior and

internalizing behavior (respectively) as measured by the CBCL. An analysis of variance (ANOVA) was conducted for both research question to determine if there is a difference between means of the normal, cautionary, and high-risk ranges for sleep disorders. Follow-up tukey-tests were also conducted to determine which means differed significantly. The ANOVA assumptions of normality, homogeneity of variances, and independence were assessed for both research questions before the data analysis takes place.

The fourth research question sought to examine the relationship between sleep scores in the normal, cautionary, and high-risk ranges and GAC scores as measured by the ABAS-II. An ANOVA was conducted to determine if there is a difference between mean scores as measured by the SDIS-C. The assumptions of ANOVA were again analyzed before the data analysis took place.

The final research question examined the relationship between sleep problems as measured by the CBCL and the sleep index score as measured by the SDIS-C. In order to assess this relationship, a 2-tailed Pearson Product Moment Correlation was calculated.

## Chapter 4

### Results

#### *Instrumentation reliability*

*Sleep Disorders Inventory for Students.* Parents completed the Sleep Disorders Inventory for Students – Children’s version (SDIS-C). Parents completed this screening measure as part of a standard battery of assessments administered at the Child Development Clinic. In this study, the reliability estimate for the total sleep disturbance scale of the SDIS-C was measured using Cronbach’s alpha ( $\alpha = 0.90$ ).

*Child Behavior Checklist.* The Child Behavior Checklist (CBCL) was completed by parents as part of a standard battery of assessments administered at the Child Development Clinic. The reliability estimate for the CBCL was measured using Cronbach’s alpha ( $\alpha = 0.95$ ).

*Adaptive Behavior Assessment System – Second Edition.* Parents also completed the Adaptive Behavior Assessment System – Second Edition (ABAS-II) as part of a standard battery of assessments administered at the Child Development Clinic. The reliability estimate for the ABAS-II as measured using Cronbach’s alpha was 0.99.

#### *Descriptive statistics*

Upon examination of the sleep scores, it was found that the mean scores for the sleep disorders scales were in the low to mid 50s, except for the SDI Index score ( $M = 60.42$ ). The SDI Index mean score can be higher than all the other sleep disorder mean

scores when participants score above a 3 or 4 on two or more individual items within a sleep disorder risk scale. For instance, when a child is beginning to develop sleep problems, he or she may exhibit only a few sleep symptoms that raise a particular sleep disorder risk scale a little above the mean of 50, but there are not enough symptoms yet to raise that scale into the caution or high risk range. However, when all the scores from each sleep disorder risk scale are combined, they can raise the SDI Index score and indicate that overall, the child is experiencing some emerging symptoms of sleep disorders but the child would not yet be at risk for a particular sleep disorder. For the SDIS-C, T-scores of 60 and under are in the normal range. The standard deviations for all sleep scores ranged from 9.45 to 13.0 points (see Table 2). On the CBCL, the means and standard deviations were as follows: 61.97 and 12.69 for the total CBCL score, 59.20 and 11.36 for the internalizing problems subscale, and 61.54 and 13.30 for the externalizing problems subscale (see Table 3). A T-score on the CBCL of 64 or less is in the normal range. As for the adaptive functioning scores, it can be seen in Table 4 that the mean on the ABAS-II was 75.65 and the standard deviation was 19.20. On the ABAS-II, standard scores between 90 – 109 are in the average range, scores between 80 – 89 are in the low average range, scores between 70 – 79 are in the borderline range, and scores of 69 and below are in the extremely low range.

#### *Prevalence of sleep disorders*

The first research question sought to determine the prevalence rates of sleep disorders in the study population. According to the overall index of sleep disorders (SDI), 67.6% of children scored in the normal range of sleep. However, 12.4 % of children

received sleep scores in the cautionary range, and 17.1% scored in the high-risk range. Frequencies for the specific types of sleep disorders can be found in Table 5.

When individual subscales were examined, it was found that 57.84% of the children scored in the normal range (T-scores of 60 and under) across all sleep disorders areas, including obstructive sleep apnea syndrome, periodic limb movement, delayed sleep phase syndrome, and excessive daytime sleepiness (see Table 6). Further analysis revealed that 10.78% of the sample were reported as being at moderate risk (T-scores of 61 – 64) for having at least one type of sleep disorder. The remainder of the children, 31.38%, were reported as being at high-risk (T-scores of 65 and above) for having at least one type of sleep disorder.

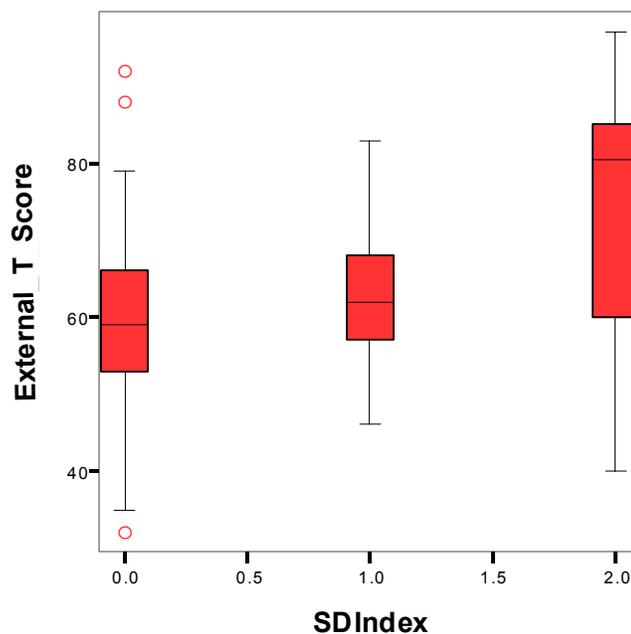
#### *Externalizing problems and sleep disorders*

The second research question sought to examine the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and externalizing behavior problems, as measured by the CBCL. A T-score on the CBCL of 64 or less is in the normal range; scores of 65 – 70 are in the moderate range, and scores of 71 and above are in the clinical range. The distribution for each of these groups can be seen in Figure 1. The means and standard deviations for each group on the externalizing problems scale are displayed in Table 7.

Several assumptions were checked in order to ensure that an Analysis of Variance (ANOVA) was an appropriate test to use to determine whether or not differences existed between scores on the externalizing problems subscale of the CBCL, based on the category of sleep disorder. Specifically, independence, normality, and homogeneity were considered. Since all subjects were separate individuals who completed both measures

independently and without the ability to interact with each other, it was ensured that the assumption of independence was not violated. Scores on the externalizing subscale of the CBCL had a small positive skew (0.21), and kurtosis was normal (0.09), indicating that the assumption of normality was passed. Boxplots of each condition revealed that the high-risk sleep disorder category had the most variability of scores ( $SD = 16.03$ ), while the caution sleep disorder category had the least variability ( $SD = 8.80$ ). However, this variation was not different enough for it to be problematic in conducting the ANOVA because the largest variance was not coupled with the smallest sample size (Stevens, 1995).

*Figure 1.* Distribution of externalizing behavior scores by sleep disorder risk level.



After checking all assumptions, a one-way ANOVA was conducted. The level of overall sleep disorder risk (normal, caution, and high-risk) served as the categorical variable, while the score on the externalizing problems subscale of the CBCL served as the continuous variable. There was a statistically significant difference among the three

groups ( $F(2,99)=9.67, p < .0001$ ). This indicates that because the ANOVA was significant at the .05 level, there was a difference in parent-reported externalizing problems based on the overall level of sleep disorder.

A Tukey test was conducted in order to determine for which levels of overall sleep disorders risk (normal, cautionary, and high-risk) there was a difference in externalizing scores. The Tukey test indicated a difference between the normal level and high-risk level of sleep disorders at a .05 confidence level. The difference between sample means was 14.17, with a 95% simultaneous confidence interval indicating that the difference between population means was between 6.45 and 21.90. No differences were found between the caution level and either of the other 2 levels of sleep disorders. Of the participants who were at high risk for a sleep disorder, 71% of these participants had CBCL externalizing scores falling in the clinical range, while 16% had CBCL externalizing scores in the borderline range and 13% had CBCL externalizing scores in the normal range. Of the participants who were at normal or no risk for a sleep disorder, 60% of these participants had CBCL externalizing scores falling in the normal range, while 24% had CBCL externalizing scores in the borderline range and 16% had CBCL externalizing scores in the clinical range.

Overall, the findings from the ANOVA and Tukey Test indicates that children who were rated as high-risk for a sleep disorder received significantly higher scores on the externalizing problems subscale of the CBCL as compared to children who scored in the normal sleep range.

### *Internalizing problems and sleep disorders*

The third research question sought to examine the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and internalizing behavior problems, as measured by the CBCL. The distribution of internalizing problems for each of these groups can be seen in Figure 2. On the SDIS-C, T-scores of 60 and under are in the normal range, 61 – 64 are in the caution range, and 65 and above are in the high-risk range. On the CBCL, T-scores of 64 and under are in the normal range, 65 – 70 are in the borderline range, and 71 and above are in the clinical range. The means and standard deviations for each sleep disorders risk classification on the internalizing problems scale are displayed in Table 8.

*Figure 2.* Distribution of internalizing behavior scores by sleep disorder risk level

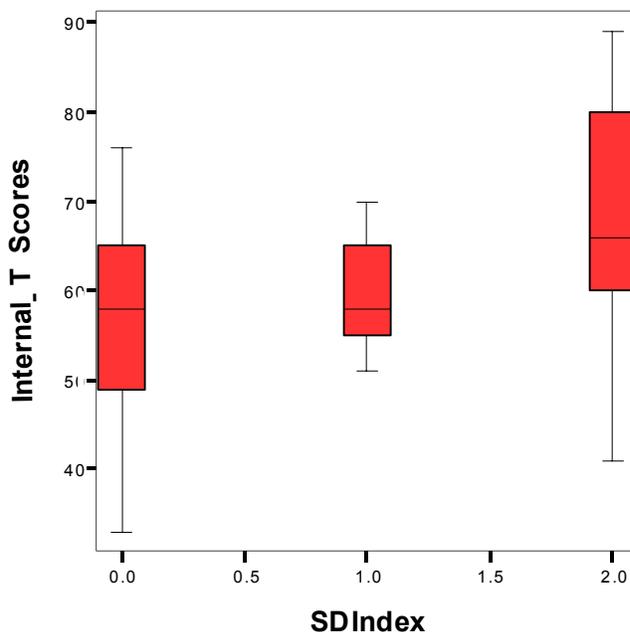


Table 2

*SDIS-C Descriptive Statistics*

	Mean	Standard deviation	Median	Mode	Skewness	Kurtosis	Min	Max
OSAS	54.51	10.52	51	45	1.15	1.13	41	88
PLMD	54.33	10.07	53	41	0.618	-0.278	39	80
DSPS	53.82	13.01	49	41	1.05	0.17	41	90
EDS	52.56	9.45	51	48	1.22	2.14	39	90
SDI	60.42	12.28	54	47	1.22	0.90	50	100

Table 3

*CBCL Descriptive Statistics*

	Mean	Standard Deviation	Median	Mode	Skewness	Kurtosis	Min	Max
Total CBCL Score	61.97	12.69	62	65	0.141	0.228	32	90
Internalizing behavior	59.20	11.36	60	65	0.078	-0.015	33	89
Externalizing behavior	61.54	13.30	61	57	0.209	0.088	32	97

Table 4

*ABAS-II Descriptive Statistics*

	Mean	Standard Deviation	Median	Mode	Skewness	Kurtosis	Min	Max
Adaptive functioning Skills	75.65	19.20	74	61	0.233	-0.735	41	123

Table 5

*Prevalence of Sleep Disorders as Measured by the SDIS-C*

	Level 1: Normal		Level 2: Caution		Level 3: High-risk	
	Frequency	Percentage 95% C.I.	Frequency	Percentage 95% C.I.	Frequency	Percentage 95% C.I.
OSAS	78	74.3 65.08 – 81.81	8	7.6 3.86 – 14.41	16	15.2 9.50 – 23.42
PLMD	73	69.5 59.94 – 77.66	13	12.4 10.48 – 20.23	15	14.3 8.78 – 22.44
EDS	82	78.1 69.08 – 85.03	12	11.4 6.59 – 19.02	8	7.6 3.86 – 14.41
DSPS	75	71.4 61.98 – 79.27	8	7.6 3.86 – 14.41	19	18.1 11.83 – 26.68
SDI	71	67.6 58.02 – 75.90	13	12.4 7.34 – 20.19	18	17.1 11.02 – 25.57

Table 6

*SDIS-C Subscale Percentages*

	Overall	
	n	Percentage 95% C.I.
Normal	59	57.84 48.14 – 66.97
Caution	11	10.78 6.13 – 18.28
High-risk	32	31.38 23.19 – 40.92

Table 7

*Externalizing Problems Means and Standard Deviations by Sleep Score*

Sleep Category	N	Mean	Standard Deviation
Normal	71	58.55	11.76
Caution	13	63.31	8.80
High-risk	18	72.72	16.03

Table 8

*Internalizing Problems Means and Standard Deviations by Sleep Score*

Sleep Category	N	Mean	Standard Deviation
Normal	71	57.01	10.46
Caution	13	59.15	6.59
High-risk	18	68.22	13.57

In order to determine that the ANOVA was the best test to use, the three assumptions of independence, normality, and homogeneity were considered (see Figure 3). The same data collection procedures and participants ensured that the assumption of independence was passed for the same reasons that this assumption was passed for externalizing problems. Scores on the internalizing subscale of the CBCL had a small positive skew (0.078), and the distribution was neither leptokurtic or platykurtic (-.015). Standard deviations of each condition revealed that the high-risk sleep disorder condition had the most variability of scores (SD = 13.57), while the caution sleep disorder condition had the least variability (SD = 6.59).

After checking all assumptions, an ANOVA was conducted to determine whether or not a difference existed between scores on the internalizing problems subscale of the CBCL, based on the category of sleep disorder. The level of overall sleep disorder risk was used as the categorical variable, while the score on the internalizing problems subscale of the CBCL served as the continuous variable. Results of the ANOVA revealed that a significant difference existed between the three groups ( $F(2,99)=7.893, p=.001$ ). This indicated that at the .05 level, there was a significant difference in parent-reported internalizing problems based on the overall level of sleep disorder.

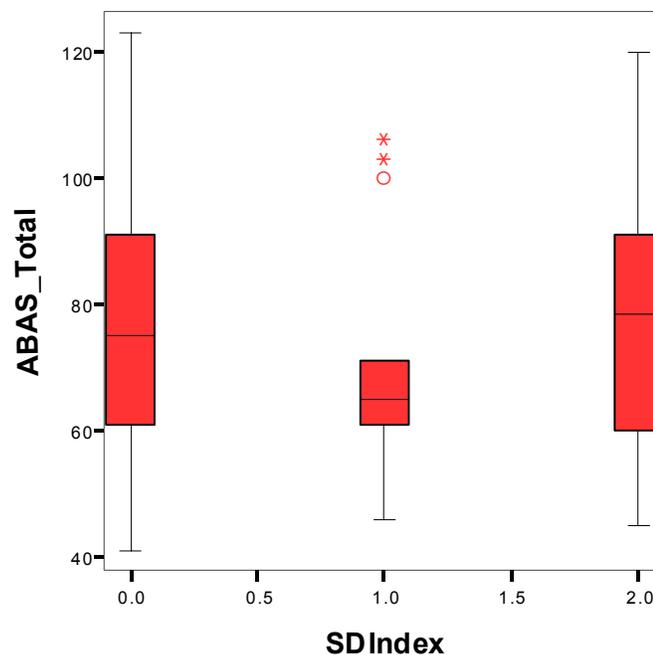
A Tukey test was conducted in order to determine for which levels of overall sleep disorders risk there was a difference in internalizing problems. The Tukey test showed a difference between the normal and high-risk levels of sleep disorders at a .05 confidence level. This indicates that children with high-risk factors for sleep disorders had significantly more internalizing problems, as compared to children with no risk factors for sleep disorders. The difference between sample means was 11.21, with a 95% simultaneous confidence interval indicating that the difference between populations means was between 4.50 and 17.92. No differences were found between the caution level and either of the other 2 levels of sleep disorders. Of the participants who were at high risk for a sleep disorder, 61% of these participants had CBCL internalizing scores falling in the clinical range, while 16% had CBCL internalizing scores in the borderline range and 22% had CBCL internalizing scores in the normal range. Of the participants who were at normal or no risk for a sleep disorder, 60% of these participants had CBCL internalizing scores falling in the normal range, while 30% had CBCL internalizing scores in the borderline range and 10% had CBCL internalizing scores in the clinical range. The ANOVA and Tukey Test results indicate that children who were rated as high-risk for a sleep disorder received significantly higher scores on the internalizing problems subscale of the CBCL as compared to children who scored in the normal sleep range.

#### *Adaptive behavior functioning and sleep disorders*

The fourth research question sought to examine the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and functional adaptive skills as measured by the ABAS-II. The distribution of adaptive

behavior functioning for each of the 3 groups can be seen in Figure 3. On the SDIS-C, T-scores of 60 and under are in the normal range, 61 – 64 are in the caution range, and 65 and above are in the high-risk range. On the ABAS-II, standard scores between 90 – 109 are in the average range, scores between 80 – 89 are in the low average range, scores between 70 – 79 are in the borderline range, and scores of 69 and below are in the extremely low range. The means and standard deviations for each sleep disorders risk classification on the ABAS-II, a measure of adaptive behavior functioning, are found in Table 9.

*Figure 3.* Distribution of adaptive behavior scores by sleep disorder risk level.



The assumptions of independence, normality, and homogeneity were again tested to make certain that an ANOVA was a valid test to use. Scores on the ABAS-II had a small positive skew (0.233), and the distribution was slightly platykurtic (-.735).

Table 9

*Adaptive Behavior Functioning Means and Standard Deviations by Sleep Score*

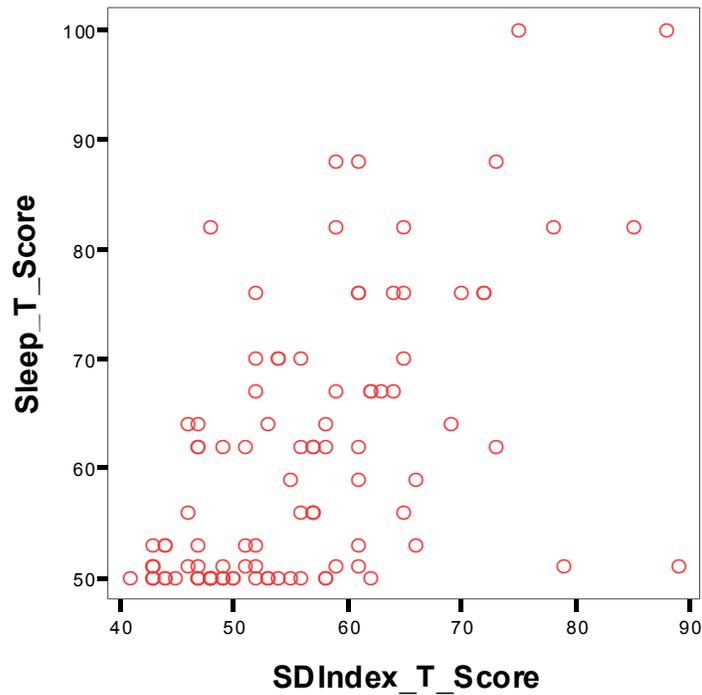
Sleep Category	N	Mean	Standard Deviation
Normal	71	76.66	19.28
Caution	13	71.31	19.15
High-risk	18	76.33	19.70

An ANOVA was conducted in order to determine whether or not a difference existed between scores on the adaptive behavior functioning based on the category of sleep disorder. Again, the level of overall sleep disorder risk was used as the categorical variable, while the score on the ABAS-II served as the continuous variable. The results revealed that the ANOVA was not significant ( $F(2,99)=0.426, p=.0.654$ ), meaning that there were no significant differences in scores between children’s adaptive behavior functioning based on the overall level of sleep disorder.

*Relationship between SDIS-C and CBCL sleep score*

To address the final research question, a Pearson Product Moment Correlation was conducted to evaluate whether or not a relationship existed between the sleep scores measured by the CBCL and the Sleep Disturbance Index (SDI) score measured by the SDIS-C. The sleep score on the CBCL is calculated by the responses to 6 items, whereas the SDI score on the SDIS-C is calculated by the responses to 41 items. The results revealed that there was a moderate correlation ( $r = 0.583$ ) (Franzblau, 1958), which was significant at the 0.01 level using a 2-tailed test. The relationship between the sleep scores as measured by the SDIS-C and the CBCL can be seen in Figure 4.

Figure 4. Scatterplot of sleep scores as measured by the CBCL sleep score and the SDIS-C sleep index score.



### Summary

The findings in the present study indicate that a significant number of young children may be at risk for at least one type of sleep disorder. In this sample, 31% of children were found to be at high-risk for at least one type of sleep disorder while 10% of children were found to be at cautionary-risk for at least one sleep disorder. Overall, 41% of the children in this sample were reported by their parents to be experiencing significant sleep problems.

Internalizing and externalizing behavior problems in young children were also associated with being at risk for symptoms related to a sleep disorder. Young children who were reported to be at high-risk for a sleep disorder were more likely than young

children who were reported to be at normal risk for sleep disorders to exhibit significant internalizing and externalizing problematic behaviors. In other words, the young children who were reported as having poorer sleep quality were also reported as displaying higher rates of challenging behaviors. Despite these significant results, no relationship was found between young children's adaptive functioning and their reported risk for having a sleep disorder. However, the scores on the ABAS-II did reveal that this sample showed signs of developmental delays. Based on these results, the entire sample of children was considered high risk and this could account for the spurious relationship between adaptive functioning and sleep disorder risk. This study also found a moderate relationship between the overall sleep index score as measured by the SDIS-C and the sleep score on the CBCL, indicating that the two scores measure similar constructs.

## Chapter 5

### Discussion

The International Sleep Task Force Committee (2004) estimated that 20-to-25% of all children experience sleep problems in childhood. An estimated 15% of all children may have a significant sleep disorder that is negatively impacting their academics, behaviors, social-emotional development, health, and/or safety (Brown & DuPaul, 1999; Kubisyn, 1999). Early intervention programs can contribute towards the reduction of risks associated with children who have pediatric sleep disorders. Given the link between academic underachievement, problematic behavior, and sleep problems (Gozal, 1998), early identification and treatment of sleep disturbances may serve to reduce the risk of negative outcomes in later life.

The primary purpose of this study was to assess the prevalence rates of children ages 24 months to 5 years referred to a clinic setting displaying sleep disorder symptoms, and to analyze the relationship between sleep disorder symptoms and internalizing, externalizing, and adaptive behaviors. A secondary goal of this study was to assess the relationship between sleep problems as measured by the CBCL and the sleep index score as measured by the SDIS-C. This final chapter addresses each research question and discusses the implications of the research findings on the practice of school psychology. Additionally, this chapter discusses the limitations of this study and explores areas for future research in pediatric sleep disorders.

### *Research Question 1*

*What is the prevalence rate of children at risk for sleep disorders, as measured by the Sleep Disorders Inventory for Students Children's version (SDIS-C), in children ages 2 – 5 years presenting to a university-based child development clinic for assistance?*

While previous research has evaluated the prevalence of bedtime resistance behaviors in preschool age children (Johnson, 1991; Kerr & Jowett, 1994; Mindell, Owens, & Carskadon, 1999; Owens, Spirito, Mc-Guinn, & Nobile, 2000), very little research has been conducted on the prevalence rates of sleep disorders in this population. Three recent studies have evaluated the prevalence rates of sleep problems in pediatric populations using the SDIS-C. Luginbuehl (2004) screened 595 students from across school and clinical settings for sleep disorders and found that approximately 20% of participants were at high-risk for at least one sleep disorder. Ax (2006), who evaluated prevalence rates of sleep disorder risk in 216 second- and third-grade general education students, also found that 20% of participants were at significant risk for sleep disorders. Witte (2006) found that 32% of an at risk preschool sample (n = 86) was at high-risk for at least one type of sleep disorder and 10% of the sample was at cautionary risk for at least one type of sleep disorder.

Findings in this study revealed that 31% of the preschool age children in this sample were at high-risk for at least one sleep disorder and 10% of young children were at cautionary risk for at least one sleep disorder. In other words, one out of every three children in this study as well as the Witte (2006) study was at high-risk for having a sleep disorder. These rates are alarming; especially since so many children with sleep disorders go undiagnosed (National Sleep Disorder Research Plan, 2005). Furthermore, because so

many children with sleep disorders go undiagnosed, the prevalence rates of specific sleep disorders (e.g., OSAS, RLS, PLMD, DSPS) in young children are still unknown.

This study found that 18% of the sample was at high-risk for DSPS. It is not surprising that 18% of this sample was at high-risk for DSPS, which is also referred to Behavioral Insomnia of Childhood (BIC) for preschool age children. BIC is most typically caused by a lack of an enforced bedtime or poor sleep hygiene. Because this sample was an at-risk population, and their families were bringing their children to a medical clinic because of developmental or behavioral concerns, it is very likely that these caregivers have problems setting limits (e.g., structured bedtimes) with these children. Research conducted by Owens, Spirito, Mc-Guinn, & Nobile (2000), which did not use norm-referenced measures, found that 25 – 50% of preschool age children exhibited bedtime resistance behavior. Witte (2006), who did use a structured, norm-referenced sleep scale to evaluate prevalence rates found that 20% of her preschool age sample was at high-risk for DSPS, which is consistent with findings from this study.

Previous research has also found that the rate of OSAS in preschool age children is between 1-3% (Ali, Pitson, & Stradling, 1993; Gisalson & Benediktsdottir, 1995). This study found that 15% of the sample was at high-risk for OSAS. Witte (2006) found that 11.6% of the sample was at high-risk for OSAS. The samples from both studies evaluated at risk populations. This study was made up of children coming to a medical clinic because of health or behavioral concerns, so it is possible that these children have higher rates of sleep problems than a general preschool population. Additionally, tonsils and adenoids are at their largest among the entire population between the ages of 3 and 6

years, and this coincides with the peak incidence of childhood OSAS (Jeans, Fernando, Maw, & Leighton, 1981).

The prevalence rates of preschool age children diagnosed with PLMD are still unknown (McLaughlin-Crabtree, Ivanenko, O'Brien, & Gozal, 2003; Owens, 2005; Picchietti & Walters, 1999). Previous research has found that approximately 8% of their sample ages 5 – 7 years was diagnosed with PLMD via polysomnography (McLaughlin-Crabtree, Ivanenko, O'Brien, & Gozal, 2003). This study found that 14% of the sample was at high-risk for PLMD. The rates in this study may differ from previous research because the former study actually diagnosed PLMD in children, while this study used a screening tool to assess risk for PLMD.

The prevalence of EDS also was assessed in this study. Only 7% of the sample was at high-risk for EDS. This finding is somewhat surprising given the larger numbers of young children found to be at high-risk for other sleep disorders. Specifically, if large numbers of children are displaying symptoms of sleep disorders, it could be assumed that their sleep quality is poor, and this in turn would impact their daytime performance. However, this study found that a smaller number of children were experiencing daytime sleepiness compared to the number of children rated by their parents as being at high risk for PLMD, OSAS, or DSPS. While prevalence of EDS was not assessed in previous research, the relationship between EDS and externalizing behaviors has been evaluated (Chervin, Dillon, Archbold, & Ruzicka, 2003; Lavigne et al., 1999; Owens, Oipari, Nobile, & Spirito, 1998). It is possible that parents misinterpret daytime sleepiness in toddlers since it is often manifested in young children by behaviors such as increased activity, aggression, impulsivity, acting out behavior, poor concentration, and inattention

(Carskadon, Pueschel, & Millman, 1993; Guilleminault et al., 1982). Parents do not usually associate such behaviors with sleepiness, due in part to the lack of information available and disseminated to parents about pediatric sleep problems.

A major reason only 1-2% of children with sleep disorders are properly diagnosed (National Center of Sleep Disorders Research, 2003) is because there is limited research on pediatric sleep disorders. Pediatric sleep research with preschool populations only accounts for 3% of all sleep research being conducted (Chase, Lydic, & O'Connor, 1991). The majority of the pediatric sleep research that does evaluate preschool populations focuses on bedtime resistance (Beltramini & Herzog, 1983; Crowell, Keener, Ginsburg, & Anders, 1987; Johnson, 1991; Mindell et al, 1994). This study is unique in that the prevalence rates of common sleep disorders in children were evaluated in children ages 2 to 5 years.

Research evaluating the prevalence rates of common sleep disorders in pediatric samples is starting to emerge (Ax, 2006; Luginbuehl, 2004; Witte, 2006). This study, as well as the research conducted by Ax (2006) and Witte (2006), found that the most common sleep problem among pediatric populations was DSPS. OSAS had the second highest prevalence rate across the three studies. The prevalence rates for all sleep disorders in this study and the Witte (2006) study were extremely similar, while the prevalence rates for sleep disorders found in Ax (2006) were significantly lower. One possible reason for the discrepancy in rates is because Ax (2006) assessed children from the general population, while this study and Witte (2006) evaluated children from at risk populations. Additionally, the sample from this study and Witte (2006) evaluated

preschool age children, while Ax (2006) used second and third grade students, which could also account for the differences in prevalence rates.

It is important for school psychologists to be knowledgeable of pediatric sleep disorders and prevalence rates in order to help ameliorate problems associated with these disorders. If sleep disorders in young children are identified and treated at the earliest possible age, the negative academic, behavioral, emotional, and health outcomes associated with sleep problems can potentially be prevented. School psychologists can assist in the early identification of sleep disorders in young children through facilitating universal screenings. Additionally, school psychologists can educate others on the importance of good sleep hygiene and the negative impact that poor sleep can produce.

#### *Research Question 2*

*What is the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and externalizing behavior problems, as measured by the Child Behavior Checklist (CBCL)?*

Previous research has found that sleep problems in young children are associated with behavioral problems, such as hyperactivity, aggression, impulsivity, acting out behavior, poor concentration, and inattention (Carskadon, Pueschel, & Millman, 1993; Broughton & Shimizo, 1995; Fallone, Ownens, & Deane, 2002; Owens, Opiari, Nobile, & Spirito, 1998). Preschool age children with sleep problems have shown high levels of tantrums and other disruptive behaviors (Owens-Stively et al., 1997; Zuckerman, Stevenson, & Bailey, 1987). The findings in this study are consistent with previous research. Specifically, children who were at high-risk for sleep disorders had significantly higher rates of externalizing behaviors compared to children who were at normal-risk for

sleep problems. There were not, however, significant discrepancies observed between children with cautionary risk and children with normal sleep meaning that externalizing behavioral problems were reported mostly in high-risk group only. Identical results were found in two recent studies (Ax, 2006; Witte, 2006). A number of previous studies have suggested that the symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD) are overrepresented in children diagnosed with various sleep disorders, especially PLMD (Chervin & Archibold, 2001; Guilleminault et al. 1981; Picchiatti & Walters, 1999). While this study did not assess specific externalizing behaviors, such as rule-breaking behavior or aggression, it did identify children reported with higher risk of having a sleep disorder as also exhibiting more externalizing behaviors.

The majority of previous research in the area of pediatric sleep medicine used either broader age ranges or older children. This study evaluated children ages 2-5 years. Although there are studies that evaluated the relationship between externalizing behaviors and sleep problems in preschool populations, informal sleep measures (e.g., asking parents to report the usual time their child fell asleep and woke up, the number of naps taken per week the average length of naps, etc.) were used. This study as well as research conducted by Witte (2006) used a norm-referenced sleep-screening instrument to assess sleep disorder risk in young children.

It is important for school psychologists to recognize the high comorbidity between sleep problems and externalizing behaviors. School psychologists commonly receive referrals for problematic behavior (Kratochwill, Kratochwill, Albers & Shernoff, 2004). Symptoms such as disorganization, impulsivity, poor planning, poor attention, and hyperactivity are commonly misdiagnosed as behavioral dysregulation disorders.

However, these symptoms are also seen in children with sleep disorders. School psychologists who are knowledgeable of sleep disorder symptoms and the impact of sleep on daily functioning can develop sleep-related hypotheses and use assessment tools to confirm or disconfirm hypotheses, which may assist in the problem solving process.

### *Research Question 3*

*What is the relationship between normal, cautionary and high-risk range sleep disorder symptoms, as measured by the SDIS-C, and internalizing behavior problems, as measured by the Child Behavior Checklist (CBCL)?*

The majority of research examining the association between sleep problems and internalizing problems has focused on adults (Gregory et al., 2005) and has identified a positive relationship between sleep disorders and internalizing problems (Fallone, Acebo, Seifer, & Carskadon, 2005). Gregory and O'Connor (2002) found that sleep problems were moderately but significantly correlated with anxiety/depression in a sample of 4 – 15 year olds. A longitudinal study conducted by Gregory et al. (2005) found that children with persistent sleep problems have more internalizing problems than children without persistent sleep problems. The same study also found that 46% of the sample that reported significant sleep problems at 9 years old had anxiety in adulthood. Another study conducted by Paavonen et al. (2002) found that 8 and 9 year old children with more severe sleep problems were more likely to have emotional problems than children without sleep problems. While previous studies have found some relationship between sleep problems and internalizing problems in childhood, these studies used older samples of children and informal measures of sleep.

The present study contributed to the empirical literature by examining the

relationship between parent-reported sleep disorder risk and internalizing behavior problems in preschool age children using standardized measures. Findings revealed that children who were reported to be at high-risk for sleep disorders had significantly higher rates of internalizing behaviors compared to children who were reportedly at normal-risk for sleep problems. No significant discrepancies were observed between children reported to be at cautionary risk and children with reportedly normal sleep meaning that internalizing behavioral problems were seen mostly in the group of children reported to be high-risk for a sleep disorder. Similar results were found in recent studies (Ax, 2006; Witte, 2006). Although these findings are consistent with previous literature on older populations, the significant findings in this study are somewhat surprising given the fact young children with internalizing problems tend to exhibit more externalizing behaviors than internalizing behaviors (Mash & Barkley, 2003). In preschool age children, irritability, uncooperativeness, apathy, and disinterest are more common than having a depressed mood (Kashani, Holcomb & Orvaschel, 1986). Similarly, preschoolers are unlikely to report feelings associated with internalizing disorders (Ryan et al., 1987). Less than 3% of preschool-age children have diagnosed internalizing disorders (Costello & Angold, 1995). Because internalizing problems are not commonly reported in preschool age children (with the exception of Separation Anxiety), it was unexpected to see the significant differences in internalizing behavior scores between children at high-risk for sleep disorders and children at normal risk for sleep disorders found in this study.

This study differed from other studies evaluating sleep and internalizing behavior problems in a number of ways. Previous studies assessed sleep problems through measures using a limited number of questions and used older children. This study as well

as research conducted by Witte (2006) used a norm-referenced sleep-screening instrument to assess sleep disorder risk in young children. Additionally, this study, Witte (2006), and Ax (2006) distinguished internalizing behavior problems by sleep disorder risk, whereas the previous studies merely examined the correlation between sleep disturbance and internalizing behavioral symptoms.

School psychologists should be cognizant of research demonstrating that internalizing behavior problems have been found to be more significant in children reported to be at risk for sleep disorders. Through early identification of both sleep disorder risk as well as risk for internalizing behavior problems, school psychologists can aid in prevention and early intervention strategies for these children. Specifically, because both sleep problems and internalizing behavior problems are associated with future academic impairments, school psychologists can help to prevent these problems.

#### *Research Question 4*

*What is the relationship between children at risk for sleep disorders in the normal, cautionary, and high-risk range, as measured by the SDIS-C and their functional adaptive skills as measured by the Adaptive Behavior Assessment System –Second Edition (ABAS-II)?*

Adaptive behavior is oftentimes evaluated in preschool and special education programs for determining need, program planning, and assessing performance outcomes (Harrison, 1990; Harrison & Boney, 2002; Reschly, 1990). Children who experience difficulty with adaptive behaviors are at increased risk for experiencing problems with the adjustment to school, which in turn leads to difficulties with social and academic competence (Blair & Peters, 2003). Previous studies have found a relationship between

poor adaptive skills and externalizing and internalizing problems (Palermo et al., 2002), but there have been no empirical studies evaluating the relationship between sleep and adaptive behavior. Since there is emerging evidence linking sleep problems to internalizing and externalizing behaviors (Witte, 2006), it was hypothesized that the present study would find a significant relationship between poor adaptive skills and reported risk for a sleep disorder. The results of this study did not support this hypothesis.

No differences in adaptive behavior were observed between young children at high, cautionary, or normal risk for sleep disorders. Further examination of the data revealed that the sample had poor adaptive skills overall, with a mean score falling in an extremely low range for adaptive behavior. In fact, the high-risk and normal risk sleep disorder groups had the same mean adaptive behavior score and the same standard deviation (standard score = 76; standard deviation = 19), while the cautionary group mean score was only 5 points lower and the standard deviation was the same as the other two groups (standard score = 71; standard deviation = 19). One possible reason the finding of no difference in adaptive behavior between the categories of sleep disorder risk is that the children in the sample were coming to the medical clinic because of existing developmental or behavioral concerns. Both developmental delays and behavioral problems can be assessed through adaptive skill measures. Typically, children with developmental delays and behavioral problems exhibit poor adaptive skills and this was the case with this sample. Future research should evaluate the relationship between adaptive skills and sleep disorder risk in the general population where there may be more variability among adaptive behavioral functioning.

School psychologists must be knowledgeable of the impact of adaptive behavior on school functioning and how to measure and improve adaptive functioning in children. School programs and early intervention services are typically the systems that identify children as having problems with adaptive functioning. Without early identification of adaptive skill problems, the likelihood that effective interventions will be implemented is slim. Therefore, it is important that school psychologists identify children with adaptive skill problems early, and then help the interdisciplinary problem solving team design and implement interventions to increase adaptive skill development.

*Research Question 5*

*What is the relationship between the sleep problem score on the CBCL and the total sleep index score on the SDIS-C?*

The SDIS-C is a screening tool designed to assist school and clinical psychologists to measure children's risk for having sleep disorders that interfere with academic and behavioral success. The sleep disorders that are assessed in preschool age children include: OSAS, EDS, PLMD, and DSPS. There are specific items on the SDIS-C that ask about symptoms of each of the aforementioned sleep disorders. The CBCL was developed to assess internalizing and externalizing behaviors in children. On the children's version of the CBCL, sleep problems are assessed through six specific items (e.g., doesn't want to sleep alone, has trouble getting to sleep, nightmares, resists going to bed at night, sleep less than most kids during day and/or night, wakes up often at night).

The results of the present study found a moderate yet significant correlation between the SDIS-C and the CBCL. This moderate relationship indicates that both measures assess similar constructs, but cannot be used interchangeably. This finding was

expected given that the CBCL measures sleep problems as a general construct, while the SDIS-C differentiates between specific sleep disorders in addition to providing an overall sleep disturbance score. The CBCL cannot be used to assess sleep disorder risk, nor does it distinguish various types of sleep problems.

School psychologists should be using both a measure of sleep disorder risk as well as a measure of risk for internalizing and externalizing problems when engaging in the problem-solving process. As mentioned previously, a large number of children with sleep disorders go either undiagnosed or misdiagnosed. This problem could potentially be ameliorated if school psychologists promoted universal screenings to aid in the early identification of children with a variety of problems, including sleep disorders. It is only through early identification that early interventions can be implemented. If sleep disorders and/or psychosocial disorders are left untreated, a number of deleterious outcomes could result, including academic failure.

*Implications for school psychologists: School-based health services*

A major goal of school psychology is to support the academic achievement and mental health of students. For this reason, school psychologists are expected to assist in the improvement of instructional outcomes by assessing student's barriers to learning. One major barrier to learning is chronic health problems, including sleep problems/disorders.

A number of reforms in education as well as in public health have documented the importance of addressing the chronic health needs of children in schools (Power, Shapiro, & DuPaul, 2003). The Preventive Health Amendments of 1992 (PL 102-531), mandated the coordination between the health care and educational systems in training educators

about the risks associated with medical conditions, such as sleep disorders. The importance of health promotion in schools also was outlined in The Goals 2000: Educate America Act (1994), which specified that health-related problems have negative impacts on school performance. More recently, the Individuals with Disabilities Education Act (IDEA) – Amendments of 2004 (IDEA, 2004) specified that children with disabilities are entitled to have their educational and health needs addressed in schools. This emphasis on providing health-based support in schools has expanded the mission for schools to include the promotion of health for all students and the removal of barriers to learning for children with health disorders (Kolbe, Collins, & Cortese, 1997).

As a result of legislation, school psychologists will be increasingly placed in new roles of coordinating educational, health, and mental health services for children with medical conditions (Power & Blom-Hoffman, 2004). School psychologists have expertise in school ecology and community-school relations, in addressing children's mental health problems, and emerging skills in addressing children's health problems. Because of these knowledge and skills, school psychologists can serve as evaluators and interventionists as well as take a greater role in indirect school-based services through serving as systems consultants, program developers, and program evaluators within school-based health centers (Bradley-Johnson & Dean, 2000; Power & Blom-Hoffman, 2004; Reeder et al., 1997; Tharinger, 1995). In order to successfully serve in this newer role, school psychologists need training in pediatric health issues and the educational implications of children with health disorders, including sleep disorders (Power, DuPaul, Shapiro, & Parrish, 1995). Furthermore, schools need to establish school-based health and mental-health programs to promote academic success through the removal of these barriers to

instruction (Adelman, 1996; Power, 2000).

School psychologists who are knowledgeable about pediatric health conditions can serve as a liaison between the school system and the medical system (Power & Blom-Hoffman, 2004). For instance, if a school and medical system or large pediatric practice established a partnership, school psychologists would be able to assist in making health-related referrals, especially since school psychologists are in a unique position to access the majority of children. Likewise, the school psychologist can assist the medical professional in data collection at the school to aid in the progress monitoring process. Through this collaborative system, schools and medical systems can impact students on a universal level of health promotion (Kolbe, Collins, & Cortese, 1997; Short & Talley, 1997).

In an ideal system, school psychologists would facilitate the administration of universal screenings including measures of sleep disorder risk. Through universal screenings, early identification of sleep problems can occur. Concurrently, school psychologists can educate school personnel as well as parents and children on various health disorders, such as sleep disorders, and their impact on school performance. When school psychologists are skilled and experienced in addressing the health needs of children, they can have a pivotal role in providing relevant health-related information to parents, children, and school personnel (Power & Blom-Hoffman, 2004). Educational programs on sleep have shown to be associated with better sleep hygiene as well as sleep quality (Brown, Buboltz, & Soper, 2006; Simore, Crassard, Rechatin, & Locard, 1987). Educating others on the importance of sleep quality as well as the importance of sleep screening increases the treatment acceptability of universal screenings (Joshi, 2004;

Kazdin, 1981). Once all students have been screened, school psychologists as well as other school personnel can identify which students need further evaluations and/or support. If a child is found to be at risk for a sleep disorder, school psychologists who work in a school with a medical partnership can recommend that the medical practice refer the child to a sleep specialist for further evaluation given that parental permission is granted. School psychologists can also educate parents on the child criteria for diagnosing sleep disorders (Rosen, D'Andrea, & Haddad, 1993). With this knowledge, parents will know what to look for and know what questions to ask of physicians, which can increase the likelihood that their child receives a proper diagnosis. Through use of a problem-solving process, an intervention plan for a child with a sleep problem/disorder can be designed by an interdisciplinary team including the parents, school psychologist, physicians involved in the child's treatment, as well as any school personnel that could aid in intervention development and implementation. Next, school-based and medical interventions can be implemented with the school psychologist serving in a consultative role. Finally, the school psychologist can aid in monitoring the child's response to intervention to maximize educational and health outcomes.

#### *Limitations and implications for future research*

This study evaluated the prevalence rates and behaviors related to sleep disorders in a sample of 104 children ages 2-5 years. Studies that typically assess prevalence rates tend to have much larger sample sizes. Because of the small sample size, there is an increased chance of error in estimating the prevalence rates in the population. This study also only sampled children attending a medical clinic for developmental or behavioral concerns. Typically children with developmental and behavioral problems have increased

sleep problems as well as increased problems in daily functioning. Because of this unique sample, the prevalence rates only represent at-risk preschool populations; the results cannot be generalized to general preschool populations. The overall low adaptive scores could also have reflected the at-risk nature of this sample. This study also analyzed prevalence rates by an age-group (e.g., preschool). As a result, no conclusions can be drawn on how the prevalence rates may differ by age. Future research should evaluate the prevalence rates of preschool children in the general population and should use a large sampling for more representative prevalence rates.

Another limitation of this study is the possible threat of reactivity. Reactivity is when people alter their responses because they are aware that their responses will be analyzed (Johnson & Christensen, 2004). Parents who completed the measures wanted help for their children. It is possible that parents could have over-reported certain behaviors and under-reported others in order to receive medical attention. Rater bias could have also impacted parental reporting. For instance, some parents have extremely low tolerance for specific behaviors and then will rate such behaviors much more severely than parents who are more tolerant of specific behaviors. Future research can assess these threats to validity through adding measures that assess parental expectations as well as parenting stress. Teacher/Caregiver versions of the behavior ratings scales can also be administered in future research so that behavior across settings can be assessed. Future research should also sample children from the general population therefore obtaining a more representative sample of the general preschool population.

In this study, the parents of the sample completed the measures at one point in time. As part of the medical clinic's protocol, if a child is reported to be high-risk for a

sleep disorder, then a recommendation is written to the child's pediatrician that the child be referred to a pediatric sleep specialist. While the clinic does follow-up with the families in regard to whether or not sleep problems were diagnosed, this information was not recorded and therefore not analyzed. Future studies can evaluate the accuracy of sleep disorder screening tools in identifying children who do have diagnosable sleep disorders. Future studies also can use sleep screening, externalizing, internalizing, and adaptive behavior measures after interventions have been implemented to assess the effectiveness of the intervention.

This study evaluated the relationship between overall sleep disorder risk and internalizing, externalizing, and adaptive behaviors as general constructs, rather than evaluating sleep in relation to the specific behaviors that make up each construct (e.g., aggression, inattention, depressed affect for behavior). Similarly, sleep disorder risk total score was used to classify children into high, cautionary, and normal risk groups for the purpose of comparing those groups' behaviors. Future research can compare children at high-risk for specific sleep disorders to children in the cautionary and normal groups to determine if group differences exist in specific internalizing, externalizing, or adaptive behaviors.

### *Conclusion*

The current study evaluated the prevalence rates of common sleep disorders in children ages 2 – 5 years and evaluated the relationship between sleep disorder risk and behavioral outcomes. Thirty-one percent of young children in the sample were reported as being at high-risk for at least one type of sleep disorder. DSPP or behavioral insomnia of childhood was the most common sleep disorder that the young children in this sample

were reported as being at high-risk for, followed by OSAS, and then PLMD. These findings indicate that preschool age children maybe at risk for sleep disorders, and that screening for sleep disorders is important. Young children who were reported as high-risk for a sleep disorder displayed higher levels of both internalizing and externalizing behaviors. No differences in sleep disorder risk levels were found in adaptive behavioral functioning. School psychologists can play a pivotal role in helping to identify children at risk for sleep disorders through universal screenings and implementation of interventions. Additionally, school psychologists can educate parents, teachers, and children on the importance of good sleep hygiene as well as the signs and symptoms of sleep disorders. Finally, school psychologists can promote system change to incorporate health-based services in schools, thus promoting beneficial health and educational outcomes for all students.

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