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Implications of sleep disorders symptoms on school behavior, academics, and quality of life

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Implications of Sleep Disorders Symptoms on School Behavior, Academics, and Quality of Life

by

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ABSTRACT

Pediatric sleep problems are among the most common yet significant pediatric health issues faced by families. Sleep problems can impact social-emotional and academic functioning of schoolchildren. Once identified, pediatric sleep problems and disorders are treatable with effective and rapid behavioral and medical interventions. The purpose of the current study was to determine the prevalence rates of symptoms of sleep disorders in a diverse school-based sample as well as the relationship between symptoms of sleep disorders and school behavior, academic achievement, and quality of life.

The present study examined the relationship between the independent variables of No Sleep Disorders symptoms and Sleep Disorders symptoms derived from the Sleep Disorders Inventory for Students, Children's Form (SDIS-C) and the dependent variables Externalizing and Internalizing scales of the Behavior Assessment System for Children, Second Edition (BASC-2), Curriculum-based Measurement Reading (R-CBM), Curriculum-based Measurement Math (M-CBM), PedsQL™ 4.0, and Students' Life Satisfaction Scale (SLSS). A Multivariate analysis of variance (MANOVA) was used to identify a significant difference between students with and without symptoms of sleep disorders on behavior, academics, and quality of life. Follow-up analyses using a

modified Bonferroni adjustment determined significant differences between students with and without symptoms of sleep disorders on R-CBM, externalizing behaviors and internalizing behaviors. Medium effect sizes were reported for R-CBM, externalizing and internalizing behaviors and M-CBM. Very small effect sizes were found for PedsQL™ 4.0 and SLSS.

Implications for School Psychologists and directions for future practice and research are discussed including understanding prevention, early identification and intervention, broadening the scope of school psychology training at the preservice and inservice levels and educating locally and nationally.

Chapter 1

Introduction

Pediatric sleep problems and sleep disorders are among the most common pediatric health issues with wide ranging impact on health and well-being. Sleep problems ranging from difficulty falling asleep or frequent nightwakings to serious primary sleep disorders such as obstructive sleep apnea syndrome are experienced by approximately 25% of all children. One in three elementary school age children suffer serious sleep problems (Mindell & Owens, 2003).

The consequences of sleep problems are significant and represent a public health crisis. Sleep disorders can result in physical complications such as cardiovascular problems or failure to thrive. Sleep problems also can impact the social, emotional, and academic performance of children in the educational system. In addition, sleep problems ranging from infant crying to obesity-related sleep apnea represent a major financial burden in our society (Morris, James-Robert, Sleep, & Gillham, 2001).

Though pediatric sleep problems and sleep disorders can have significant consequences on the individual child, the family system, and the larger community, sleep problems are treatable (Mindell & Owens, 2003). There are several highly effective, efficient behavioral and medical treatments that address pediatric sleep disorders. In

addition, children who are successfully treated for sleep problems demonstrate rapid and apparent improvements in mood, behavior, attention, and academic performance (Ebert & Drake, 2004; Friedman et al., 2003; Gozal, 1998; Guilleminault, Eldridge, Simmons & Dement, 1976).

Unfortunately, sleep problems are inadequately addressed in pediatric practice and educational settings. For example, in a recent survey of community-based pediatricians, more than 20% did not screen school aged children for sleep problems during well-child visits, despite acknowledging the importance of sleep related to overall health, behavior, and school performance (Owens, 2001). Educational personnel, too, rarely screen for sleep problems. However, a measure called the Sleep Disorders Inventory for Students – Children's Form (SDIS-C) was recently developed specifically for educators to screen students for sleep disorders (Luginbuehl, 2004).

School based prevalence rates of sleep disorders are currently unknown. Most studies on sleep problems have been conducted in medical and university settings. Children who were study participants most likely represented those with the most severe or detrimental sleep problems warranting a sleep professional. However, there may be many other children silently suffering with sleep problems that equally impact behavioral and academic success in schools. These children may exhibit daytime behavioral problems such as ADHD-like behaviors (Pinicietti, England, Walters, Willis, & Verrico, 1998) or academic failure (Gozal, 1998). Recent research suggests that children with sleep problems experience reduced quality of life which also impacts daily functioning and psychological well-being (Crabtree, Varni, & Gozal, 2004; Hart, Palermo, & Rosen, 2005; Rosen, Palermo, Larkin, & Redline, 2002).

Pediatric sleep medicine is a field in its infancy. The deleterious impact of sleep disorders on health, school performance, and quality of life has been documented. However, there remains a paucity of research and dissemination of information in the field of education. Upwards of 30% of school children experience sleep problems yet medical and educational personnel do not routinely ask about or screen children for sleep disorders. Externalizing behaviors or ADHD-like behaviors may be a result of sleep disorders (Chervin, Dillon, Bassetti, Ganoczy, & Pituch, 1997), but teacher perception of student behavior has rarely been considered in the studies of behavior. Reduced academic performance has been found in children suffering from sleep disorders (Gozal, 1998) however, an objective measure of academics rather than cognitive tests or a subjective measure such as grades has not been investigated in prior studies. Finally, health related quality of life appears to be diminished in children with sleep disorders (Crabtree et al., 2004), though a replication study is necessary before conclusive statements can be made.

Purpose of the Study

The current study attempted to address these issues, adding to the literature base with prevalence rates of sleep disorders in a school-based sample. The relationship between sleep disorders and school-based behavioral and academic problems in reading and math also was explored. Finally, the relationship between sleep problems and self-reported quality of life was investigated.

Research Questions

The following research questions were addressed:

1. What is the prevalence of sleep problems/disorders in one school district in the Northeast?
2. Is there a difference between students with and without symptoms of sleep disorders as measured by the Sleep Disorders Inventory for students (SDIS-C) on teacher report of student behavior determined by high scores on the Behavioral Assessment System of Children, Second Edition (BASC-2)?
3. Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on academic achievement related to reading as determined by Curriculum-based Measurement Reading (R-CBM)?
4. Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on academic achievement related to mathematics as determined by Curriculum-based Measurement Math (M-CBM)?
5. Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on student self-report of quality of life determined by high scores on the PedsQL ™ 4.0 and low scores on the Students' Life Satisfaction Scale?

Hypotheses

1. It was hypothesized that the proportion of sleep disorders in one school district in the Northeast would be comparable to the proportion of sleep disorders reported in clinic and community samples.

2. It was hypothesized that there would be a difference between students with and without symptoms of sleep disorders on teacher report of student behavior. Specifically, it was hypothesized that students with symptoms of sleep disorders would be identified by teachers using the BASC-2 as exhibiting more externalizing behaviors at school than students without symptoms of sleep disorders.
3. It was hypothesized that there would be a difference between students with and without symptoms of sleep disorders on reading achievement. More specifically, it was hypothesized that students with symptoms of sleep disorders would orally read fewer words correct per minute on R-CBM passages than students without symptoms of sleep disorders.
4. It was hypothesized that there would be a difference between students with and without symptoms of sleep disorders on mathematics achievement. Specifically, it was hypothesized that students with symptoms of sleep disorders would compute fewer digits correct per standard M-CBM protocol than students without symptoms of sleep disorders.
5. It was hypothesized that there would be a difference in self-reported quality of life between students with and without symptoms of sleep disorders. More specifically, it was hypothesized that students with symptoms of sleep disorders would identify that they had reduced quality of life on the PedsQL™ 4.0 than students without symptoms of sleep disorders. It was also hypothesized that students with symptoms of sleep disorders would identify that they have less life

satisfaction indicated by lower scores on the Students' Life Satisfaction Scale (SLSS) than students without symptoms of sleep disorders.

Educational Significance

The results of this study will inform educational personnel of the relationship between sleep disorders and student behavior, academic performance, and quality of life. Currently, students with symptoms of sleep disorders may be overlooked or misdiagnosed due to the lack of knowledge regarding these disorders. Screening, referral, and treatment of a sleep disorder may enable some students to experience positive social, emotional, and academic outcomes and attain a higher quality of life.

Thus far, there have been no studies conducted in schools with a reliable, valid screening measure assessing the major sleep disorders of childhood. In addition, the prevalence of sleep disorders in children as well as school-based consequences of sleep disorders remains unknown. To that end, this project aimed to determine the difference between students with and without symptoms of sleep disorders on specific measures of behavior, academic performance in reading and math, and quality of life using a recently developed school-based screening measure of sleep disorders.

Definition of Terms

Apnea: An apnea is a discrete pause in breathing lasting longer than 10 seconds.

Hypopnea: A hypopnea is a 30% to 50% reduction in airflow and a 4% or greater desaturation or fragmentation of sleep or arousal.

Arousal: An arousal is defined three or more but less than fifteen seconds of wake.

Awakening: Awakening includes five minutes or more of wake.

Primary Snoring (PS): Primary snoring is defined as an attempt to breathe in the face of increased upper airway resistance without apnea, hypopnea, or hypoxemia, or significant arousals (Mindell & Owens, 2003).

Obstructive Apnea: Obstructive apnea is cessation of airflow for more than 10 seconds.

Obstructive Sleep Apnea Syndrome (OSAS): OSAS is characterized by intermittent upperairway obstruction evidenced by hypopnea or apnea that disrupts normal ventilation including snoring, apneic pauses, and/or arousals, resulting in sleep disturbance and daytime symptoms (Guilleminault & Pelayo, 1998).

Periodic Limb Movement Disorder (PLMD): Periodic Limb Movement Disorder is defined as the occurrence of periodic episodes of repetitive and stereotyped limb movements during sleep (Crabtree, Ivaneko, O'Brien, & Gozal, 2003).

Restless Legs Syndrome (RLS): Restless legs syndrome is a sensorimotor disorder characterized by uncomfortable sensations in the lower extremities usually accompanied by an irresistible sensation to move the legs. Sometimes the arms and other body parts are involved (Mindell & Owens, 2003).

Polysomnogram (PSG): A polysomnogram, or an overnight sleep study, is a diagnostic tool that outlines sleep architecture and shows details about breathing, body movements, and arousals during sleep (Mindell & Owens, 2003).

Chapter Two

Literature Review

This chapter presents a literature review of the effects of sleep disorders on the school functioning of children. First, a description of normal sleep in children and the prevalence of sleep disorders in children is presented. The effects of two common sleep disorders on behavior is then discussed followed by a review of the cognitive and academic effects of sleep disorders. Research on the impact of sleep disorders on health-related quality of life (HRQOL) is then presented. The chapter commences with the purpose of the current study.

Sleep

Sleep is a complex process that occupies almost half of childhood. During infancy and toddlerhood, sleep hours surpass wake hours as sleep is the primary activity of the brain during that critical period of early development. By two years of age, toddlers have spent approximately 9,500 hours asleep compared with 8,000 hours awake (Mindell & Owens, 2003). In the preschool years, sleep hours and wake hours are essentially equal while in childhood and adolescence sleep is recommended to constitute 40% of the hours of the day (Mindell & Owens, 2003).

Many children experience some form of sleep problems in childhood (Mindell, Owens, & Carskadon, 1999; Owens & Witmans, 2004). This includes 25% to 50% of preschool age children (Montgomery-Downs, O'Brien, Holbrook, & Gozal, 2004), 30%

of school age children (Owens, Spirito, McGuinn, & Nobile, 2000) and 40% of adolescents (Mindell et al., 1999). The National Institutes of Health has estimated that 15% of children have significant sleep disorders that may impact academic performance, behavior, social-emotional well-being and health and safety. Due to the lack of knowledge in assessment of sleep disorders, the medical and education communities often mistake the symptoms related to sleep problems for psychiatric and psychological disorders (Mindell et al., 1999).

Sleep is necessary for children's optimal functioning and affects every aspect of a child's physical, emotional, cognitive, and social development. Thus, inadequate or disturbed sleep may lead to excessive daytime sleepiness, and have negative consequences on several domains including behavior, academic performance, mood, and health outcomes (Owens & Dalzell, 2005). Empirical evidence indicates that children and adolescents with sleep disorders experience significant daytime sleepiness (which manifests itself as daytime externalizing behaviors such as overactivity, noncompliance, oppositional behavior, poor impulse control, increased risk-taking, and drowsy driving) (Ali, Pitson, & Stradling, 1994; Ebert & Drake, 2004; Gaultney, Terrell, & Gingras, 2005; Wolfson & Carskadon, 2003). Cognitive and academic problems may be caused by inadequate sleep quality and quantity and include inattention, poor concentration, decreased reaction time, and decreased executive functioning such as problem solving (Chervin et al., 2002; O'Brien, Mervis, Holbrook, Bruner, Smith et al., 2004). Health and well being also are affected by inadequate sleep, and outcomes include growth impairments, failure to thrive, developmental delays (Swift, 1988), as well as effects on cardiovascular, immune, and metabolic systems (Owens & Witmans, 2004), and an

increase in accidental injuries (Owens, Fernando, & McGuinn, 2005).

There are several reasons why medical and educational personnel should devote their attention to pediatric sleep. First, sleep problems are common among children and adolescents. Second, sleep problems are chronic. It is a misguided and inaccurate assumption that children "grow out" of sleep problems. In fact, there is evidence that infant sleep problems often persist into early childhood and that some sleep disorders reappear in adulthood (Chervin et al., 1997; Gozal & Pope, 2001; Mindell, 2005; Mindell & Owens, 2003). In addition, early sleep disorders may have a lasting cognitive impact long after they disappear (Gozal & Pope, 2001).

Sleep problems can be a significant source of distress on the family and constitute one of the most common complaints to medical and educational personnel (Mindell & Owens, 2003). The effects of sleep problems on the family can include a negative impact on the parents leading to martial discord in some cases and negative effects on parent sleep in most cases (Montgomery-Downs, Crabtree, & Gozal, 2005). When identified, however, sleep problems are treatable (Mindell & Owens, 2003). There are several medical and behavioral treatments available to respond to the variety of sleep disorders. In addition, children show marked improvements in academics (Gozal, 1998) and behavior after treatment (Ebert & Drake, 2004; Friedman et al., 2003; Montgomery-Downs et al., 2005). Unfortunately, pediatricians and educators do not routinely screen for sleep problems because they lack knowledge and skills in screening, evaluating, and treating sleep problems (Owens, 2001; Owens & Dalzell, 2005).

Screening. There is a critical need for medical and educational personnel to screen for and recognize the symptoms of sleep disorders in children and adolescents.

The number of children suffering with sleep problems makes it a public health crisis that is a major economic burden (Owens & Dalzell, 2005). The American Academy of Pediatrics (AAP) currently recommends that all children should be regularly screened for primary snoring (PS) in order to prevent morbidity associated with sleep-disordered breathing (SDB) (Owens & Dalzell). Besides morbidity, PS and SDB have been found to negatively affect school performance and behavior compared to controls without PS or SDB (Blunden, Lushington, Kennedy, Martin, & Dawson, 2000; Chervin et al., 2003; Gozal, 1998; Montgomery-Downs, et al., 2004; O'Brien, Mervis, Holbrook, Bruner, Smith, et al., 2004).

Owens (2001) surveyed 626 pediatricians in the Northeast on their general and specific sleep knowledge, screening, diagnostic, and treatment practices for common sleep disorders. In terms of screening practices, 18.2% of the pediatricians did not screen routinely for sleep problems in infants and toddlers and 43.9% did not ask adolescents about sleep. Only one-quarter of respondents reported screening school age children for snoring although 92.6% recognized the impact of childhood sleep problems on academic performance.

In a follow-up study, Owens and Dalzell (2005) considered the screening practices of pediatric residents. The charts of 195 children included a brief screening measure during an annual well child visit. Although the residents were unlikely to diagnose sleep disorders or order a sleep diagnostic test, they were 10 times more likely to request information on bedtime issues and excessive daytime sleepiness with the screening measure included in the chart than without. In addition, twice as many mentioned sleep in their patient notes. The study found that the use of a simple screener

that was cost-effective and readily available to pediatric residents was significantly more likely to yield general and specific sleep information.

Besides pediatricians, school personnel are in an excellent position to screen students for sleep disorders. Unfortunately, screening is performed infrequently due to lack of knowledge and lack of screening instruments. In fact, there are only two known screening instruments designed for use in the school setting, the Children's Sleep Habits Questionnaire (CSHQ) (Owens, Spirito, & McGuinn, 2000) and the Sleep Disorders Inventory for Children (SDIS) (Luginbuehl, 2004). Due to the lack of screening instruments designed for use in the school system, most of the studies reported in the literature are comprised of a clinic sample of children who were referred to sleep specialists. Thus, the prevalence rates of sleep disorders in a diverse community-based sample of school children is unknown.

Prevalence of Sleep Disorders. Despite a good deal of information on sleep and sleep problems in toddlers and preschool aged children, few studies have looked at the prevalence of sleep disturbance in a community sample of school-age children. Most sleep screening measures rely on parent report of their child's sleeping behavior. In school age children it is commonly believed that parents are less aware of their child's sleep habits (Mindell, 2005). However, Montgomery-Downs et al. (2004) assessed the predictive validity of parent report of snoring and other sleep/wake behaviors by comparing these reports with an objective measure, overnight polysomnography. The study involved 127 preschoolers who were considered to be at-risk for developmental problems or of low socioeconomic status and 266 first-graders recruited from the general population. Findings revealed that parents were accurate reporters of snoring in their

children regardless of age or socioeconomic status. Thus, sleep disorder screening measures completed by parents may be accurate representations of sleep disorders in the population. Additional research is needed to corroborate these findings.

Blader, Koplewicz, Abikoff, and Foley (1997) developed a questionnaire to determine the prevalence of sleep problems in school-age children. They sent the questionnaire to the homes of children attending public school in six school districts in Nassau County, New York. Nine hundred seventy two households returned completed questionnaires on predominately Caucasian (86%) children ages 5 to12 years.

Results of the study found that sleep was a problem for more than one-fourth of the sample. More than one-third of parents thought that their children did not get enough sleep or were tired during the day. Bedtime resistance was experienced by 27% of the families at least 3 nights per week. Recurrent sleep onset delays were experienced by 11.3% of the sample. Interestingly, 80% of those with sleep-onset problems displayed bedtime resistance, but only one-third of bedtime resisters had trouble falling asleep once in bed. Age was related to the co-occurrence of bedtime resistance and sleep-onset difficulties although the mean age of the sample was 7.5 years old (Blader et al., 1997). This study presents the prevalence rates of general sleep problems as measured by a screening instrument created by researchers for a homogeneous group of school-age children. The screening instrument was not validated. In addition, the measure considered the prevalence rates of behaviorally based rather than medically based sleep disorders. Medically based sleep disorders often yield more serious behavior and academic problems.

Similar to the study by Blader et al. (1997), other studies that have investigated general sleep problems in school-age children have also used instruments with questionable reliability and validity (Owens, Spirito, & McGuinn, 2000). In addition, few sleep instruments considered both behaviorally and medically based sleep disorders. Two sleep screening instruments were developed to respond to the need for a school-based screening instrument (Luginbuehl, 2004; Owens, Spirito, & McGuinn, 2000). The Children's Sleep Habits Questionnaire (CSHQ) was designed to distinguish children in the school system with and without symptoms of sleep problems as well as Obstructive Sleep Apnea Syndrome (OSAS) (Owens et al., 2000). The Sleep Disorders Inventory for Students (SDIS) was developed to recognize the five sleep disorders faced by children that negatively impact school performance (Luginbueghl, 2003).

In summary, prevalence rates of pediatric sleep disorders remain unknown in the general population despite the validation of the CSHQ and SDIS. Large epidemiological studies have not been conducted in schools using either screening instrument. In fact, several studies conducted on children in schools have used instruments created by researchers that were not psychometrically sound, having not gone through a rigorous validation process (Montgomery-Downs et al., 2005; Montgomery-Downs et al., 2004; O'Brien, Mervis, Holbrook, Bruner, Smith et al., 2004; O'Brien, Mervis, Holbrook, Bruner, Klaus, et al., 2004). There is a need for studies conducted in the school system in order to determine community prevalence rates of pediatric sleep disorders.

Effects of Sleep Disorders on Student Behavior

Sleep Disordered Breathing (SDB). Sleep Disordered Breathing (SDB) is a general term to describe a spectrum of clinical conditions. At one end of the continuum

falls primary snoring which involves increased upper airway resistance without evidence of apnea, hypopnea, hypoxemia, or significant arousals. An apnea is a pause in breathing lasting longer than 10 seconds whereas a hypopnea is a 30% to 50% reduction in airflow. Hypoxemia is defined as insufficient oxygenation of the blood, and an arousal is defined as at least three seconds of wake (Mindell & Owens, 2003). Ten percent of children snore nightly and 20% snore occasionally. Obstructive Sleep Apnea, on the other end of the continuum, may be characterized by snoring as well as apnea events and arousals due to cessation of airflow (Mindell & Owens).

Obstructive Sleep Apnea Syndrome (OSAS) is estimated to affect 1% to 3% of children. It peaks in preschool and early elementary school due to enlargement of the tonsils and adenoids, adenotonsillar hypertrophy, with a second peak in adolescence (Mindell & Owens, 2003; Owens, Opipari, Nobile, & Spirito, 1998). OSAS is usually related to upper airway obstruction exacerbated by such things as asthma, allergies, and reflux but also decreased upper airway diameter and muscle tone common in obese children. Many children with a combination of these risk factors such as Down Syndrome or medical conditions including craniofacial syndromes and neurological disorders may also suffer with OSAS (Mindell & Owens, 2003).

Guilleminault was the first to describe childhood OSAS in 1976 and he included behavior and learning problems among the first clinical description of OSAS (Guilleminault, Eldridge, Simmons, & Dement, 1976). Excessive daytime somnolence in children resulting from disturbed sleep caused by OSAS appears to manifest itself though externalizing behaviors such as impulsivity, aggression, increased activity, poor concentration and attention, and Attention-Deficit/Hyperactivity Disorder (ADHD)-like

symptoms (Gozal & Pope, 2001). Additional symptoms of excessive daytime somnolence may include difficulty waking in the morning, falling asleep at school, increased napping, mood changes, and academic problems (Mindell & Owens, 2003).

To examine the relationship between sleep disordered breathing (SDB) and daytime behaviors, Chervin et al. (1997) compared three groups of children with a mean age of nine years who spanned 2 to 18 years. Approximately half of the children were recruited for study participation from a psychiatry clinic and half from a general pediatrics center in a large public university. After parents completed the Pediatric Sleep Questionnaire (PSQ) and a questionnaire with 18-ADHD symptoms from the Diagnostic and Statistical Manuel (DSM-IV), the sample from the psychiatry clinic was further divided into an ADHD group (n=27), and a non-ADHD psychiatry group (n=43). The non-ADHD general pediatrics group remained stable (n=73) (Chervin et al., 1997).

Results supported a relationship between ADHD and sleep disordered breathing as determined by the Pediatric Sleep Questionnaire (PSQ). Habitual snoring was more common among children with ADHD (33%) than children in the non-ADHD psychiatry clinic group (11%) and children from the general pediatric group (9%). The authors speculated that sleep disorders could be a cause rather than an effect of hyperactivity in a significant number of children. If this causal relationship does exist, they claimed that controlling snoring and SDB would eliminate "ADHD"-like behaviors in 25% of children diagnosed with ADHD (Chervin et al., 1997). Though their findings support this claim, the total sample size was small and the ADHD group consisted of merely 27 children. Replication of these results in order to make conclusive statements of the causal relationship between SDB and ADHD is necessary.

In a community sample of first-graders, O'Brien et al. (2003) further examined this relationship. Researchers found frequent and loud snoring associated with "ADHD"-like behaviors in a community sample. Approximately 12% of 5,500 students were reported by their parents to snore. Seven percent of those students were diagnosed with ADHD or had a parent that suspected clinically elevated hyperactive behavior.

Select students from the community sample, including 83 children with parent reported ADHD and 34 controls underwent Polysomnogram (PSG) and neurobehavioral testing including the Connors' Parent Rating Scale, Child Behavior Checklist (CBCL), Differential Ability Scales (DAS), and NEPSY to further investigate the relationship between snoring and behavior. After parents completed the Connors', 44 of the children with ADHD were defined as having "significant" ADHD symptoms and 27 had "mild" ADHD symptoms. On PSG, Obstructive Sleep Apnea Syndrome (OSAS) was present in 5% of children in the significant ADHD group versus 26% in the mild ADHD group. OSAS was also present in 5% of the control group. Children in the mild ADHD group compared with controls did not differ significantly on DAS or NEPSY scores but did differ significantly on measures of internalizing behavior problems, externalizing behavior problems, and total behavior problems. In conclusion, the authors stated that sleep disordered breathing can lead to mild "ADHD"-like behaviors that might be misperceived and misdiagnosed as ADHD (O'Brien et al., 2003).

Results of this study appear to support a relationship between sleep disordered breathing and an increase in internalizing behaviors, externalizing behaviors or both although further examination is necessary. Specifically, a larger sample of children with and without symptoms of sleep disordered breathing and with and without behavior

problems is warranted. To further bolster results, information on behaviors in other settings such as school would be beneficial. In any case, preliminary results appear to support the premise that some children with mild sleep disordered breathing may be inaccurately diagnosed with ADHD (O'Brien et al., 2003).

Periodic Limb Movement Disorder/Restless Legs Syndrome. Periodic Limb Movement Disorder (PLMD) and Restless Legs Syndrome (RLS) often occur concomitantly and have been only recently recognized in children. Periodic Limb Movement Disorder is characterized by periodic, repetitive episodes of stereotyped limb movements usually in the legs, feet or toes which last approximately 2 seconds (Picchietti, England, Walters, Willis, & Verrico, 1998). These episodes usually occur in stages 1 and 2 of non-rapid eye-movement sleep (Mindell & Owens, 2003). Although PLMD is associated with partial arousal or awakening, patients are often unaware that they suffer with PLMD. By contrast, RLS is a sensorimotor disorder characterized by uncomfortable sensations in the lower extremities often described as a "creepy" or "crawly" sensation. Episodes of RLS usually occur during rest with an intense urge to move the legs that is only partially relieved with movement (Mindell & Owens, 2003) and is worse at night (Picchietti et al., 1998). These symptoms may result in significant sleep disturbance, including difficulty falling asleep and nighttime arousals and wakenings in childhood (Owens & Witmans, 2004).

Prevalence rates of PLMD/RLS in the pediatric population are unknown. Until recently, these sleep disorders were believed to only occur in middle or old age. In adults, 70 to 90% of patients with primary RLS have PLMD but 20% of patients with PLMD have RLS. Adults with PLMD/RLS retrospectively reported "growing pains" or

similar feelings in childhood pointing toward an early onset and chronic pattern of suffering (Picchietti et al., 1998). Walters, Picchietti, Ehrenberg, and Wagner (1994) described the first five detailed cases in the literature of PLMD and RLS in children.

As with sleep disordered breathing, there is mounting evidence that neurobehavioral consequences of PLMD/RLS may present as symptoms of ADHD (Picchietti et al., 1998; Picchietti & Walters, 1999). In a series of studies, Picchietti and colleagues (1998) and Picchietti and Walters (1999) found between 26% and 64% of children diagnosed with ADHD met criteria for PLMD on PSG. They concluded that sleep disruption resulting from PLMD and RLS as well as the symptoms of RLS while the children were awake could contribute to poor sleep efficiency, resulting in inattention and hyperactivity in some children diagnosed with ADHD (Picchietti et al., 1998; Picchietti & Walters, 1999).

To further examine the association between hyperactive behaviors and PLMD, Chervin et al. (2002) surveyed 866 children with a mean age of 6.8 years. The sample was drawn from two university affiliated pediatrics clinics. Parents completed the Pediatric Sleep Questionnaire (Chervin et al., 1997), Inattention/Hyperactivity Scale (IHS), and the Connors' Parent Rating Scale (CPRS-48). Higher parent reported Periodic Limb Movement scores were associated with higher levels of parent reported inattention or hyperactivity. Elevated hyperactive scores were found in 13% of all subjects including 18% with RLS and 11% without RLS. In conclusion, PLMD and RLS appeared to be related to inattentive and hyperactive behavior. Twelve percent of hyperactive children may be effectively treated with identification and treatment of PLMD/RLS (Chervin et al., 2002). Unfortunately, the gold standard for identifying PLMD, overnight

polysomnogram, was not used. Instead, this study relied on parent report of both PLMD and RLS which could be problematic if parents were not actively watching their children sleep. Likewise, hyperactive and inattentive behaviors were based solely on parent report and did not involve assessing behaviors across two or more settings such as home and school. ADHD behaviors were not assessed by school personnel where they may be more likely to influence optimal functioning.

Gaultney, Terrell, and Gingras (2005) compared the strength of association between symptoms of ADHD, Sleep Disordered Breathing (SDB), Periodic Limb Movement Disorder (PLMD), and bedtime resistance behaviors (BRB). The sample was drawn from a larger study related to cardiovascular risk factors and included 283 students who were 7 to 14 years old with a mean age of 9.84 years. Sixty-six percent were identified as Caucasian and 22% were African American with 52% of the sample eligible for free or reduced price lunch. ADHD, SDB, PLMD, and BRB were determined by parent report on the Pediatric Sleep Questionnaire and other scales developed by the researcher for this study.

Correlations were found among and between the various disorders. Specifically, there were correlations between ADHD and SDB, PLMD, and BRB when controlling for age (Gaultney, et al., 2005). All ADHD-like behaviors measured were correlated with PLMD and bedtime resistance. Thus, children who had been diagnosed with ADHD had higher scores on measures of PLMD and bedtime resistance, but not SDB (Gaultney et al.).

Gaultney et al. (2005) concluded that PLMD may be related to the externalizing behavioral aspects of ADHD. Their explanation of the association between PLMD and

ADHD was that students with PLMD get both poor quality of sleep and insufficient duration (quantity) of sleep. This so called "dual insult" may contribute more than poor quality sleep experienced by children with SDB. This hypothesis is corroborated by Picchietti and Walters (1999) who reported that children with PLMD often present with difficultly in sleep initiation and maintenance. In addition, ADHD and PLMD may result from a common underlying neurological etiology in terms of deficits in the dopaminergic areas of the brain (Chervin et al., 2002).

There were several limitations to the study by Gaultney et al. (2005). As with the Chervin et al. (2002) study, data were gathered solely by parent report for the various sleep disorders and for ADHD. In addition, the authors stated that the items on the PLMD scale may be characteristics of ADHD as well as PLMD though a causal relationship was not determined (Gaultney et al., 2005). Further exploration into this relationship is warranted.

Crabtree, Ivanenko, O'Brien, and Gozal (2003) also investigated the relationship between PLMD and ADHD in a clinic sample and a community sample. The clinic sample was a retrospective study of all children referred to a sleep disorders clinic during a two year period. Children were included if they had undergone a polysomnogram and were either classified as ADHD per parent report or had a formal ADHD diagnosis.

The community sample included children ages five to seven years who were involved in a larger study. After data were gathered as part of the larger study, children were included in the community sample if parents reported that the child had an ADHD diagnosis, if the child was reported to snore, or if the child had no ADHD/hyperactivity or snoring. Children who were found to have PLMD on polysomnography (PSG) and

ADHD per parent report were included in the PLMD/ADHD group (n = 40), those children who were identified with PLMD on PSG but not ADHD per parent report were in the PLMD only group (n = 50), and those children who did not have PLMD on PSG were included in the control group (n = 52).

Overall, there were several differences between the three groups. Demographically, the PLMD/ADHD group was significantly older with more males in the sample than the other two groups. In addition, the PLMD/ADHD group was significantly more likely to have parents endorse enuresis, nightmares, difficulty initiating sleep, and sleep walking than the other two groups. On polysomnogram, the PLMD/ADHD group had significantly more periodic limb movements (PLMs) with periodic limb movement arousals (PLMa) than the PLMD/no-ADHD group (Crabtree et al., 2003). As in the study by Gaultney et al. (2005), the relationship between PLMa and ADHD supports the notion that fragmented sleep may be linked with hyperactive behavior. The relationship between PLMD and ADHD may be due to reduced REM sleep and sleep fragmentation associated with PLMas (Crabtree et al., 2003).

Although these findings are noteworthy, there are several limitations to this study. Most notably, ADHD diagnosis was determined by parent report of professional diagnosis in both the clinic and community samples. There was no known input from an additional source such as school. In addition, the retrospective nature of the clinical group is a limitation as there were different selection criteria between the groups which may yield selection bias.

In summary, these studies suggest a relationship between ADHD-like behaviors and PLMD (Chervin et al., 2002; Crabtree et al., 2003; Gaultney et al., 2005). It is

probable that these children's sleep quality is poor and that sleep duration is too short. The causal nature of the relationship between PLMD and ADHD-like behaviors remains unknown as does the impact of PLMD beyond ADHD-like symptoms in some children. Additional studies on the behavioral and academic effects of PLMD are necessary to further understand the impact of PLMD in children.

Effects of Sleep Disorders on Neurobehavioral Performance

With heightened recognition of behavioral and cognitive consequences of sleep disordered breathing in children, several studies sought to examine both variables. In a comprehensive meta-synthesis, Ebert and Drake (2004) examined studies of the effects of SDB on cognition and behavior between 1966 through 2001. Specifically, they examined studies involving children ages 2 to 18 years. Seventeen studies with a total of 5,312 participants were identified including nine that compared children with SDB to children without SBD and eight that considered the impact of treatment on cognition and behavior. Ebert and Drake (2004) found that every study reported an association of the effects of sleep disordered breathing on cognition or behavior including grades, math skills, IQ, memory, inattention, hyperactivity, daytime sleepiness, or irritability.

O'Brien, Mervis, Holbrook, Bruner, Smith et al. (2004) and O'Brien, Mervis, Holbrook, Bruner, Klaus et al. (2004) further examined the relationship between SDB, behavior and cognition. In conducting a set of studies with a community sample of children ages five to seven years, they found significant differences between children and matched controls on both polysomnograph defined sleep disordered breathing (SDB) and primary snoring (PS). Children with SDB performed significantly below matched controls on neurocognitive tests taken from the Differential Abilities Scales (DAS) and

the NEPSY. The subtests were specifically related to global cognitive ability and non-verbal skills, attention and executive function, and phonological processing . The researchers found no difference in verbal skills between the SDB group and matched controls (O'Brien, Mervis, Holbrook, Bruner, Smith et al., 2004). In a second study from the same large community sample, children with PS had significant neurobehavioral difficulty as reported by parents on the Connors' Parents Rating Scale, Child Behavior Checklist (CBCL), DAS, and NEPSY relative to controls, but the magnitude of differences was small (O'Brien, Mervis, Holbrook, Bruner, Klaus et al., 2004).

In another community study, Gottlieb et al. (2004) administered neurocognitive tests including the NEPSY Attention and Executive Core Domain and Memory Core Domain and the Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI-R) as well as overnight polysomnogram to 180 five year olds. On the WPPSI-R, children with sleep disordered breathing had full-scale IQs, and performance IQs that were significantly lower than controls. However, similar to the findings by O'Brien, Mervis, Holbrook, Bruner, Smith, et al (2004), on the verbal IQ, there were no significant differences between the SDB group and controls.

Unfortunately, this sample was not demographically representative of the general population and results may have limited generalizability. Specifically, the sample was primarily Caucasian (82%) and most children came from two parent families (82%). Parents of children in the sample were well educated (62% of mothers completed college) and upper-middle class (64% came from families making more than $55,000 annually). In addition, both the SDB and control groups had IQs above the population mean though the SDB group had a lower mean IQ than controls (Gottlieb et al., 2004).

Blunden et al. (2000) also found lower neurocognitive performance in 16 school-aged children who snored compared with 16 control children. Participants underwent both overnight polysomnography and neurocognitive testing, and parents completed behavior measures. Though there were no significant differences in problematic behavior as determined by the Child Behavior Checklist (CBCL), children who snored showed significantly impaired attention relative to controls, fewer memory skills, and lower intelligence scores on the Wechsler Intelligence Scale for Children-III (WISC-III). The authors concluded that mild sleep disordered breathing may have an impact on daytime functioning, particularly academic progress (Blunden et al., 2000).

Lewin, Rosen, England, and Dahl (2002) found different results than O'Brien, Mervis, Holbrook, Bruner, Smith, et al. (2004) and Blunden et al. (2000). Twenty eight school age children with OSAS and 10 healthy controls were compared on behavioral and cognitive performance. Parent ratings on the CBCL indicated that OSAS in children was associated with increased behavioral and emotional problems but that children with mild OSAS had more behavioral and emotional problems than children with severe OSAS. There was no evidence of broad cognitive, perceptual, memory, or specific learning deficits associated with OSAS (Lewin et al., 2002).

Kaemingk and colleagues (2003) sought to determine the relationship between SDB and learning in children from the general population. Participants were recruited from the Tucson Unified School District over a two year period. Specifically, 149 students including 95 Caucasian students and 54 Hispanic students ages 6 to 12 years with a mean age of 8.36 years and their parents participated. Parents completed a 15-item screening questionnaire related to sleep disordered breathing. After returning the

questionnaire, parents were recruited for study participation. However, children were excluded from study participation if they had a history of asthma, head injury, attention or learning problems, or other medical problems (Kaemingk et al.).

Participants' sleep was characterized using one night of polysomnography. Within several weeks of the polysomnogram, children were administered the Wechsler Abbreviated Scale of Intelligence (WASI) to identify full-scale, verbal, and performance IQ scores. Letter-Word Identification, Applied Problems, and dictation from the Woodcock-Johnson Psychoeducational battery-Revised Tests of Achievement (WJ-R) also were administered to determine letter and single word reading, math skills, and spelling and grammar skills. The Children's Auditory Verbal LearningTest-2 was administered to assess learning and memory for novel information. Finally, parents completed the Connors' Parent Rating Scale – Revised (L) to evaluate attention. For the purpose of statistical analyses, participants were divided into two SDB groups after polysomnography. One group had an apnea/hypopnea index of five or more and the other group had an apnea/hypopnea index below five (Kaemingk et al.).

Significant differences were found between children who had an apnea/hypopnea index of five or more (77 children) and those with scores below five (72 children) when children were asked to recall information. Full scale IQ and verbal IQ scores yielded no significant differences, though performance IQ scores showed a trend toward significance. There were no differences in academic achievement as measured by select subtests of the WJ-R. In addition, there were no differences in parents' rating of student behavior and attention between the groups (Kaemingk et al.).

Similar to O'Brien, Mervis, Holbrook, Bruner, Smith, et al. (2004) and Gottlieb et al. (2004), there was no impairment in verbal learning. These authors also found that children who snored had poorer performance on memory and learning, though overall performance was in the average range. Thus, there was little support in the current study for a linear negative relationship between respiratory disturbance and learning or memory. However, there were several limitations to the study such as inclusion of a racially and socioeconomically homogeneous group of students and exclusion of students with learning and attention problems. These are often the students with significant cognitive problems related to respiratory disturbance. In addition, the measures that were included to determine cognitive performance and achievement may not be sensitive to school performance (Kaemingk et al., 2003).

Beebe et al. (2004) compared the neuropsychological functioning of children ages 6 to 12 years with OSAS to healthy controls. Forty-nine children including 32 clinic referred children with OSAS as determined by overnight polysomnogram and 17 age-and gender matched controls participated. The children with OSAS were divided into three groups based on their apnea/hypopnea index (AHI): simple snorers (AHI<1), mild OSAS (AHI= 1-5), and moderate to severe OSAS (AHI>5). All children were administered tests to assess intelligence, verbal memory, processing speed, attention and executive functioning. Specifically, Vocabulary and Block Design on the Wechsler Intelligence Scale for Children (WISC-III) were administered as a measure of intelligence. Verbal memory was screened by the Verbal Learning subtest of the Wide Range Assessment of Memory and Learning (WRAML). Processing speed was measured by the Word Reading and Coloring naming trials of the Stroop Test. Attention and executive function

were assessed with the Digit Span subtest of the WISC-III, the Gordon Diagnostic System, the NEPSY Visual Attention and Verbal Fluency subtests. Children eight years of age and older were administered the Color-Word Interference score from the Stroop test and the Wisconsin Card Sorting Test. Finally, parents and teachers completed two behavior measures, the Behavior Assessment Scale for Children (BASC) and the Behavior Rating Inventory for Executive Functions (BRIEF) to measure externalizing and internalizing problems as well as executive dysfunction.

The three clinical groups and the control group were compared on demographic characteristics. The mild- and moderate OSAS group had about twice the proportion of minorities than the other two groups. There were no other differences among the groups. In order to compare the mean performance across groups on neuropsychological assessments, five sets of main analyses were conducted based on conceptual and pragmatic grounds. There were no significant differences found on intelligence, memory, or processing speed. There were significant differences between the groups on attention and executive functioning, specifically visual attention and verbal fluency. There were no significant differences between groups on the attention and executive functioning tests administered to children ages eight and older. Parents and teachers also noted differences between groups on reports of behavior. Parents noted differences in impulsivity, aggression, appropriate task initiation, and the ability to adapt to change as well as small differences on behavior regulation and executive function. Teachers reported group differences in aggression, conduct, and emotional control though these reports did not reach significance (Beebe et al.).

Overall, OSAS was associated with lower verbal fluency and visual attention as well as greater levels of parent-reported behavior problems. There was a slight effect of OSAS on teacher reported behavior problems and executive function deficits. However, as with the large study by Kaemingk et al. (2003), this study showed no difference between groups on intelligence and memory. Similar to the study by Lewin et al. (2002), the simple snorers showed more deviant behavior problems as reported by parents than children with more severe OSAS. This is purported to be the first study to collect data from teachers on children with defined OSAS. The authors suggest that further research include larger samples and consider teacher input rather than relying on parent report of office-based tests (Beebe et al., 2004).

In summary, there remains mixed evidence of neurobehavioral deficits in children with sleep disordered breathing compared to controls. Previous studies used small and large samples and sampled a variety of cognitive functions through the use of standardized instruments. Cognitive tests may not be the most effective way to tap into verbal or thinking skills that are required everyday. Instead, academic performance may be a better way to compare children's skills.

Effects of Sleep Disorders on Student Academic Performance

Sleep Disorders, particularly OSAS, in children can result in poor cognitive and academic performance which appear to be remedied after early and effective treatment (Friedman et al., 2003; Gozal, 1998; Guilleminault, Winkle, Korobkin, & Simmons, 1982; Montgomery-Downs et al., 2005). The effects of OSAS on cognition and academic performance have been studied in part because oxygen desaturation of the body and brain exists when there is an apnea event. The amount of oxygen deprivation

depends on the frequency and length of the event. The more frequent and lengthy the episode, the more the brain may be deprived of oxygen and effect a variety of cognitive functions. The central nervous system is particularly sensitive to hypoxemia and under OSAS conditions, cognitive functioning may worsen (Beebe & Gozal, 2002).

Attention, concentration, and memory appear to be affected with frequent awakenings due to OSAS and a decrease in REM sleep and poor quality sleep (Guilleminault et al., 1982). Unfortunately, little is known about the extent of these problems in children. Although there has been much focus on cognitive deficits in children with sleep disordered breathing, these studies have been primarily conducted in clinic settings. Few studies have assessed the academic performance of these children in schools.

There appears to be convincing evidence that early treatment for OSAS, particularly tonsillar adenoidectomy, may result in rapid cognitive recovery. For example, a recent study by Montgomery-Downs, Crabtree, and Gozal (2005) compared 19 preschool students who underwent tonsillar adenoidectomy for sleep disordered breathing with 19 matched controls. All students attended a state sponsored Early Jump Start preschool program. Prior to tonsillar adenoidectomy, the group meeting criteria for SDB scored significantly lower on Global Cognitive Ability scores on the Differential Abilities Scales (DAS) than controls. After tonsillar adenoidectomy, DAS scores of this group improved significantly and were not different than matched controls (Montgomery-Downs et al.).

Significant improvements were also found in a sample of 39 Hebrew speaking Israeli children with OSAS and 20 controls without OSAS (Friedman et al., 2003). The

students ranged in age from five to nine years. All students completed neurocognitive testing with the Kaufman Assessment Battery for Children (K-ABC) and the vocabulary subtest from the Wechsler Intelligence Scale for Children revised (WISC-R) to measure Verbal IQ. Pre-surgery, the OSAS group showed impaired neurocognitive performance compared with controls. However, there were no significant differences in the vocabulary subtest of the WISC-R, nor were there differences in impairment related to OSAS severity. Six to 10 months after tonsillar adenoidectomy, the OSAS group showed significant improvement in neurocognitive performance. The control group did not significantly change (Friedman et al., 2003)

Results of these studies demonstrate that children with OSAS may be at risk for underachievement on cognitive tasks, however, this risk subsides with early and effective treatment. Intelligence tests performed in the laboratory setting are very different than most academic tasks students are asked to perform in the classroom. Additional information derived in the classroom setting is necessary before conclusive statements can be made.

In order to assess the impact of sleep disordered breathing on school performance, Gozal (1998) studied the sleep-associated gas exchange abnormalities (SAGEA) in first-grade children with academic difficulties. Parents of 297 first graders who were academically ranked in the lowest 10^{th} percentile of their public school class in one large metropolitan school district completed a questionnaire on sleep disordered breathing. Afterwards, the children underwent an overnight recording of pulse oximetry, pulse signal and transcutsncous carbon dioxide tension. Academic grades were obtained from the school for the year preceding (first-grade) and the year following (second grade) the

study. In addition, at three months and one year following the study, parents whose children were suspected of sleep disordered breathing were contacted to determine whether or not they sought treatment (Gozal).

Twenty-two percent of the sample met criteria for primary snoring (PS) and 18 percent met criteria for SDB, comprising 40% of first-graders in the lowest 10^{th} percentile academically. Forty-four percent of the students who met criteria for SDB underwent surgical tonsillar adenoidectomy while 56% did not. Overall, mean grade point average increased for students who elected to have surgery from a "C" level (GPA=2.43) during first grade to a "C+" level (GPA=2.87). In addition, only two of the 24 children who received treatment remained in the lowest 10^{th} percentile of their class after treatment. There were no differences between first-grade and second-grade grades for the untreated group and their grades stayed at the "C" level (Gozal, 1998). These results suggest a relationship between SDB and learning ability which appears to be remedied with early identification and intervention.

Urschitz et al. (2003) performed a population-based cross-sectional study on the prevalence of sleep-disordered breathing in third graders and its impact on academic performance. The participants, comprised of 1,144 students with an average age of 9.6 years, returned a sleep-disordered breathing questionnaire, underwent one night of home pulse oximetry and provided grades from the previous marking period. Researchers were particularly interested in the percentage of students who were reported to snore. Approximately 10% of the sample was reported to snore "frequently" or "always."

Children who snored were at higher risk of performing poorly in academic subjects including mathematics, science, reading, spelling, and handwriting as

determined through report cards as compared to their peers who did not snore. None of the associations were statistically significant, though mathematics was close. The results were practically significant, however, since the children who snored were in the lowest quintile of the class. Limitations of the study included wide variation in academic performance across different school classes which is a problem with using a subjective measure of academic performance (Urschitz et al., 2003). School grades provide a rudimentary assessment of cognitive, behavioral, and learning capabilities and a standardized, objective measure of student performance is needed.

Unfortunately, there is research that suggests when sleep disordered breathing is not identified and treated early, severe academic difficulties may persist even after the sleep disorder appears to resolve. Gozal and Pope (2001) matched 13 to 14 year old students in the bottom or top 25th percentile of the class. Students were matched on age, gender, race, school, and street as an indicator of SES. Questionnaires were developed that asked caregivers to recall whether or not the child snored in early childhood (e.g., "Does your child snore now," and "did the child snore between the ages of 2 to 6 years old?"). The authors sought to determine whether snoring in early childhood that had resolved could impact academic performance in middle school.

The questionnaires were completed and returned by caregivers of 797 students in the low performing (LP) group (bottom 25th percentile) and 791 students in the high performing (HP) group (top 25th percentile). Average grade point averages for the LP group were 2.75 (C+) which were significantly lower than the average HP group averages 3.78 (B+).

Results of the study showed that frequent and loud snoring during early childhood was endorsed by caregivers of 12.9% of LPs versus only 5.1% of HPs in middle school. Therefore, early childhood snoring was more common among 13 to 14 years olds in the lowest 25% of class compared to higher performing students. Young children who snore loudly and frequently may be at- risk for poor later school performance even after the snoring has stopped. This study substantiates the hypothesis that adverse and sustained cognitive outcomes and diminished academic achievement may be associated with SDB (Gozal & Pope, 2001).

These seminal studies of the effects of sleep disordered breathing on academic performance result in powerful conclusions. These conclusions attest to the necessity for early identification and treatment of sleep disorders as these disorders appear to have serious and lasting consequences (Gozal & Pope, 2001). However, the use of grade point average as the sole measure of academic performance may be fraught with inconsistencies. Different criteria are often used across classrooms and levels in schools. Instead, comparing students with and without symptoms of sleep disorders using a standardized measure of academic performance may address this limitation. In addition, direct assessment of students in schools may tap into areas of concern regarding academics as well as functional well-being.

Effects of Sleep Disorders on Student Quality of Life

Quality of life experienced by children with sleep disorders has been described in the sleep literature through behavior problems, hyperactivity, neurocognitive deficits, and poor school performance (Ali, Pitson, & Stradling, 1994; Chervin et al., 1997; Gozal, 1998; O'Brien et al., 2003). However, little is known about the relationship between

sleep problems and children's health related quality of life (HRQOL). HRQOL has been defined as children's sense of subjective well-being and functioning within physical, emotional, and social domains (Levi & Drotar, 1999). It is important to asses HRQOL to measure the impact of sleep disorders as well as any treatments for sleep disorders in order to ensure that health care needs are being met (Hart, Palermo, & Rosen, 2005).

A study by Rosen, Palermo, Larkin, and Redline (2002) assessed the effects of sleep disordered breathing (SDB) on HRQOL in an ongoing community-based sample of 298 children ages 5 to 17 years from 132 families. Sixty-one percent of the sample was considered of minority status with 57% of those classified as African American. Caregivers completed the Children's Sleep and Health Questionnaire (CHSQ) and the Child Health Questionnaire – Parent Form (CHQ-PF50) as the measure of HRQOL. The CHQ-50 considers children's physical, emotional, and social functional status and well-being. It consists of 50 items and 12 subscales as well as two summary scores for physical and psychosocial health. It is purported to have good reliability and validity in normative and chronic illness samples. For the current study, SDB was determined by overnight in-home cardiorespiratory monitoring during sleep.

Four groups were compared on HRQOL scores. These included a no symptom group, a primary snoring group, a mild-moderate sleep disordered breathing group, and a moderate to severe sleep disordered breathing group. However, only 15% of the sample had sleep disordered breathing and 17% had primary snoring. Results of the study found that a greater degree of sleep disordered breathing was significantly associated with reduced HRQOL in domains related to physical health outcomes and increased reports of bodily pain (Rosen et al., 2002). Limitations of this study include a small sample relative

to group membership as well as the use of the CHQ-50 as a measure of HRQOL. Instead, a measure developed for children with sleep disorders may be appropriate as their may be a difference between a parent's perception and a child's experience.

Both Goldstein, Fatima, Campbell, and Rosenfeld (2002) and Mitchell, Kelly, Call, and Yao (2004) studied changes in quality of life in children after a tonsilectomomy to correct OSAS. Both studies used the OSA-18 as a measure of HRQOL. The OSA-18 is purported to be a validated quality of life survey of pediatric OSAS and asks questions across five domains including sleep disturbance, physical suffering, emotional distress, daytime problems, and caregiver concerns.

In the study by Goldstein et al. (2002), 64 parents of children ages 2 through 18 years with a mean age of 5.8 years participated. These children underwent tonsilladenoidectomy or tonsillectomy for OSAS over a one and a half year period. Most families reported to be middle- or upper-class and 38% identified themselves as Caucasian, 33% African American, 22% Hispanic, 3% East Asian, and 5% mixed. Children were diagnosed with OSAS by clinical interview though polysomnogram was not routinely performed. Parents completed the CBCL and OSA-18 sometime before surgery, although the exact time frame was not noted. Parents also completed the CBCL and OSA-18 three months post operatively.

HRQOL impact was large or moderate in two-thirds of participants that significantly improved post-operatively. Post operatively, HRQOL increased most in the domains of sleep disturbance, physical symptoms, and caregiver concerns which represented a large change in quality of life. The emotional symptoms and daytime functioning domains also showed an increase in HRQOL post-operatively, though lower

(Goldstein et al., 2002).

The mean CBCL score was 7.3 points lower postoperatively resulting in a statistically significant decrease with both internalizing and externalizing scores. Scores on the CBCL improved significantly with treatment. The relationship between HRQOL and CBCL score was significant both pre- and post-operatively which demonstrated that this relationship was static and dynamic (Goldstein et al., 2002).

Mitchell et al. (2004) measured changes in HRQOL in children after adenotonsilectomy for OSAS. Sixty children ages 3 to 12 years with a mean age of 7.1 years participated. These children were referred to the Pediatric Otolaryngology service at a hospital after being diagnosed with OSAS. The effectiveness of adenotonsillectomy for relieving OSAS and improving HRQOL was evaluated using the OSA-18 which was administered to parents twice, once prior to polysomnogram and a second OSA-18 within six months after surgery with a mean interval between pre- and post-test of 126 days. Children's post-surgery score was subtracted from the pre-surgery score to reveal a difference score.

The total OSA-18 score, the scores for all domains and even all items showed improvement after surgery. The sleep disturbance domain evidenced the greatest change followed by caregiver concerns. The smallest change was in the emotional distress category. Children with the worst HRQOL pre-operatively (scores above 80) showed the greatest improvement post-operatively followed by children with moderately poor HRQOL (scores of 80 – 60) who showed an intermediate level of improvement. Children with the best HRQOL preoperatively (scores of less than 60) showed the least improvement (Mitchell et al., 2004).

There were several limitations to the studies by Goldstein et al. (2002) and Mitchell et al. (2004). Control groups were not used in either study to assess and compare HRQOL. The samples chosen were comprised of children referred to sleep disorder clinics. Parents may have been biased as to some of the consequences of OSAS including impaired HRQOL. The OSA-18 was in parent report form which may not tap into children's actual or perceived HRQOL. Further analysis into the consequences of HRQOL on sleep disorders other than SDB is warranted.

Hart et al. (2005) addressed several of these limitations in their study of HRQOL in children with physiological sleep disorders, behavioral sleep disorders, and no sleep disorders. Specifically, they investigated whether children presenting at a sleep disorders clinic would have poorer HRQOL than a normative sample. Caregivers of 80 children ages 5 to 18 years participated. This comprised an older cohort than subsequent studies as the mean age was 11.2 years old. Of note, the sample was non-normative with approximately 63% of the sample male and 75% Caucasian. In terms of sleep problems, 30 children (37.5%) had a behavioral sleep problem, 50 children (62.5%) had a physiological sleep problem, and 27 children (33.8%) were diagnosed with a secondary sleep disorder. The children were compared to the normative sample on the Child Health Questionnaire – Parent Form (CHQ-50) which was used to assess HRQOL. Sleep disturbance was measured using the CSHQ (Owens, et al., 2000) and sleep diagnosis was made by a multidisciplinary staff. For a diagnosis of OSAS, polysomnography was required (Hart et al., 2005).

Health related quality of life in children with sleep disorders was lower than children without symptoms of sleep disorders. Several ANOVAs were conducted to

determine differences in groups and found that the sleep clinic sample scored significantly lower than published norms on all subscale and summary scores on the CHQ-50 except family cohesion. The three sleep disordered groups did not differ on CHQ-50 subscales meaning that all children with sleep disorders had equally poor HRQOL regardless of diagnosis relative to a healthy comparison group (Hart et al., 2005). These results have ramifications for all children suffering with a sleep disorder whether physiological or behavioral in nature. Children with all types of sleep disorders may suffer from impaired HRQOL, effecting daily functioning and social relationships. However, this study also only considered parent or caregiver report of HRQOL.

Crabtree, Varni, and Gozal (2004) studied HRQOL as reported by both caregivers and children themselves. In this study, there were three groups including obese children with sleep disordered breathing, non-obese children with sleep disordered breathing and a control group. One hundred twenty children ages 8 to 13 years and their caregivers participated in the study including 44 children in the obese sleep disordered breathing group, 41 children in the non-obese sleep disordered breathing group, and 31 children in the control group. There were significantly more Caucasian children in the non-obese group. Caregivers and children completed the PedsQL™ 4.0, a 23-item, non-disease specific pediatric HRQOL instrument that taps into the domains of physical functioning, emotional functioning, social functioning, and school functioning. The addition of school functioning on the PedsQL™ 4.0 is of extreme importance when assessing HRQOL in children. Children also completed the Children's Depression Inventory (CDI) (Crabtree et al.).

Results of the study indicated impaired HRQOL experienced by children with sleep disorders. Both sleep disordered breathing groups had significantly lower scores than controls on the PedsQL™ 4.0 in total parent and child reported HRQOL. All areas of parent and child reported HRQOL differed between the sleep disordered breathing groups and control group. Although caregivers of children in the obese, sleep disordered breathing group rated their children significantly lower on total quality of life and physical health than parents of the non-obese sleep disordered breathing group, there were no differences between the two groups on child-reported HRQOL. There were no differences found on HRQOL between racial groups. In terms of gender, parents of girls reported significantly better HRQOL than parents of boys, and girls themselves reported better overall quality of life and social functioning than their male counterparts (Crabtree et al., 2004).

In a second component of the study, the sleep disordered breathing groups completed polysomnogram. They were then further divided into sleep disorders groups including primary snoring, sleep disordered breathing and other sleep disorders groups. Upon further analysis of HRQOL, there were no differences in HRQOL between the groups. Therefore, children with snoring, sleep disordered breathing, and/or obesity were all likely to report poor HRQOL. Children whose only symptom was snoring were at high risk for poor HRQOL. The author's assumptions were that the sleep disturbance associated with snoring led to such daytime fatigue that increased irritability, depressed mood, impaired concentration, and decreased interest in daily activities result which may impact family, school, and peers (Crabtree et al., 2004). In summary, 8 to 13 year old children who snore may have substantially impaired mood irregardless of OSA or

obesity. The authors recommended that all school age students with symptoms of snoring have an assessment of mood and emotional functioning.

There were several limitations to the study by Crabtree et al. (2004). First, the sample used was a clinical sample. In all cases, even snorers, there was cause for alarm that caused caregivers to seek medical attention. Second, socioeconomic status, parental education, and neurocognitive functioning were not measured which could impact psychosocial functioning and confound ratings of HRQOL. Third, the control group was recruited from the community and there were no obese children in the control group. Although this study was unique in that it allowed for child report of quality of life, there is much more research that needs to be conducted on a school or community based sample to further understand HRQOL as reported by children and their caregivers.

Purpose of the Current Study

Pediatric sleep is a field that is just beginning to emerge. Although there have been several studies conducted on sleep disorders and the relationship between behavior, cognition, academic performance, and quality of life, there remains a dearth of information on these matters. For example, the prevalence rates of sleep disorders in a diverse community-based sample of children is unknown. Most studies on pediatric sleep have been conducted with children who were referred to sleep clinics or sleep specialists. It does not appear that large epidemiological studies have been conducted in schools using a validated screening instrument. Instead, several studies conducted on children in schools have used instruments created by researchers that were not psychometrically sound (Montgomery-Downs et al., 2005; Montgomery-Downs et al., 2004; O'Brien, Mervis, Holbrook, Bruner, Smith et al., 2004; O'Brien, Mervis,

Holbrook, Bruner, Klaus, et al., 2004). There is a need for studies conducted in the school system in order to determine the prevalence rates of pediatric sleep disorders.

Despite the fact that there have been few studies conducted in the school setting, there have been several studies linking externalizing behaviors such as ADHD to sleep disorders. These behaviors can greatly impact a student's functioning in school, yet there have been no studies soliciting the perceptions of the classroom teacher. Teacher's assessment of students' behavior appeared to be much needed in the literature on sleep disorders.

Related to school performance, there is evidence that sleep disorders, particularly sleep disordered breathing, in children have been associated with poor cognitive and academic performance (Gozal, 1998). However, most studies have used cognitive or neurocognitve measures which may not be sensitive to small changes over time or are not directly related to classroom performance expectations. Direct assessment of students in specific academic skill areas will contribute to the literature on the impact of pediatric sleep disorders.

School performance is an important domain to include when considering quality of life in children with sleep disorders. In order to best study quality of life, children suffering with a disorder and not parents are the best reporter. Children with a sleep disorder reporting their quality of life is much needed in the literature.

In conclusion, there appears to be a need for school-based research on the effects of sleep disorders on the behaviors, academics and quality of life in children. The current study addressed these concerns and attempts to add to the literature base regarding sleep disorders in children.

Chapter Three

Methods

This chapter outlines the procedures and instruments that were utilized to determine whether or not a difference exists between students with and without symptoms of sleep disorders on measures of behavior, academics, and quality of life. First, a description of the participants and setting will be presented. Next, the instruments, independent and dependent variables will be discussed followed by a description of data analysis.

Participants

One elementary school in a suburb of a large city in the Northeast was selected as the site for data collection. The elementary school accommodated the second and third grades for the entire district. For the 2004-2005 school year, there were approximately 585 students enrolled in the second and third grades in the district.

The school was more racially diverse than the national census data and the data from the state for the 2004-2005 school year. Students were identified by their parents as 39% Caucasian, 37% Hispanic, 17% African American, and 7% Asian (Great Schools, 2005). Students learning English as their second language constituted 11 percent of the population. Students with an Individualized Education Plan (IEP) represented 13% of the school. Thirty-seven percent of the students were eligible for free or reduced price lunch which is an indicator of socioeconomic status.

This convenience sample was selected for several reasons. First, the district had been involved with studies of students' sleeping behavior. Second, there was little research related to prevalence rates of sleep disorders in community and school samples. Third, this was the first study that addressed behavior, academic, and quality of life in a community or school sample of students. Finally, the selected school district was diverse, more so than United States averages or the state averages.

Second and third graders were selected as the sample for the current study to align with clinic prevalence rates of sleep disorders and the average age of special education placement, which may involve overlap. There is little information on the prevalence of sleep disorders in school-age children sampled in the school. In a meta-synthesis of studies on Obstructive Sleep Apnea (OSA), behavior, and academics, between 1966 and 2001, the average age of clinic-based participants was seven years old (Ebert & Drake, 2004). Thus, involving second and third graders was consistent with previous studies on OSA. The peak age or prevalence rates of Restless Legs Syndrome (RLS) and Periodic Limb Movement Disorder (PLMD) in the general pediatric population is unknown.

Severe academic problems which may be long term and devastating may result from lack of treatment for sleep disorders (Gozal & Pope, 2001). Concomitantly, there is a disproportionate increase of special education identification and placement during the late elementary school years due to socio-educational factors with schools, limited effectiveness of remediation after nine years old, and biased measurement practices against students under nine years old (Lyon et al., 2001). If there is a relationship between sleep disorders and special education classification which some have suggested (Luginbuehl, Bradley-Klug, & Benbadis, 2005), then early identification and treatment of

students with sleep disorders may avoid behavior and academic failure and special education placement.

Sample Size

All students in the second and third grades of one school district in a diverse suburb of New York City were eligible for study participation. For experimental, quasi-experimental, and causal-comparative studies, a minimum of 30 individuals per variable was recommended (Stevens, 2002).

Participant Characteristics

The study's sample consisted of 216 second and third grade participants. Parents/guardians of 218 students completed and returned informed consent forms which represented 37.3% of the total eligible population. However, parents/guardians of 216 students completed and returned informed consent forms and the SDIS-C which was necessary for study participation. Two students were dropped from study participation because their parents/guardians did not complete a SDIS-C. Thus, 216 students participated in the study which represented 36.9% of those eligible for participation.

Descriptive information for the participants can be found in Table 1. Fifty-six percent of the sample was male and 44% was female. Additionally, 60.2% of the sample was second graders with third graders comprising 39.8% of the sample. Twenty-four (11.1%) were classified as students with a disability. Parent/guardian assessments indicated that 37 (17.1%) students fell in the cautionary or at-risk range of symptoms synonymous with sleep disorder diagnosis.

Table 1

Study Participant Characteristics by Potential Sleep Disorder Category

Characteristic	No Sleep Disorder (n=179, 82.9%)	Sleep Disorder (n=37, 17.1%)
Gender		
Female	79 (44.1%)	16 (43.2%)
Male	100 (55.9%)	21 (56.8%)
Grade		
Second	109 (60.9%)	21 (56.8%)
Third	70 (39.1%)	16 (43.2%)
Special Education Classification		
Learning Disabled	1 (0.6%)	2 (5.4%)
Speech/Language Impaired	9 (5.0%)	6 (16.2%)
Autistic	2 (1.1%)	0 (0%)
Multiple Disabilities	0 (0.0%)	1 (2.7%)
Other Health Impaired	1 (0.6%)	0 (0%)
504[a]	1 (0.6%)	1 (2.7%)
None	165 (92.2%)	27 (73.0%)
Ethnicity		
Caucasian	84 (46.9%)	17 (45.9%)
Hispanic	55 (30.7%)	12 (32.4%)
Black/African American	29 (16.2%)	8 (21.6%)
Asian	11 (6.1%)	0 (0%)
Language Spoken at Home		
English	111 (62.0%)	24 (64.9%)
Spanish	35 (19.6%)	7 (18.9%)
Other	8 (4.5%)	1 (2.7%)
Not Reported	25 (14.0%)	5 (13.5%)
Lunch Status		
Full Priced Lunch	116 (64.8%)	21 (56.8%)
Free or Reduced Lunch	63 (35.2%)	16 (43.2%)

[a]Section 504 requires a written accommodation plan. A student is eligible as long he/she currently has, has had, or is regarded as having a physical or mental impairment which substantially limits a major life activity.

Participants in the study were ethnically, linguistically and socioeconomically diverse. The student sample was comprised of the following ethnicities: 46.8% Caucasian, 31.0% Hispanic, 17.1% Black/African American, 5.1% Asian. English was the dominant language spoken at home (62.5%) followed by Spanish (19.4%) and finally other languages or not reported (18.1%). Approximately one-third (36.6%) of the total sample was eligible for free or reduced lunch as an indicator of socioeconomic status.

Chi-square tests were conducted to examine differences in the proportions of demographic groups represented in the sample. Results were as follows: Caucasian students (x^2=2.7, p=.10), Hispanic students (x^2 =1.5, p=.21), Black/African American students (x^2 =.0, p=1.0), Asian students (x^2 = .61, p=.4), students with an IEP (x^2 = .4, p=.6) and students receiving free and/or reduced price lunch (x^2 = .0, p=1.0). All of the p-values were under .05, therefore, none of the differences between the sample and the population from which the sample was drawn were statistically significant.

Sleep Disorder group membership was defined as a T-score falling in the cautionary or at-risk range for any of the sleep disorders (OSAS, PLMD, DSPS or EDS) screened by the SDIS-C. Interestingly, prevalence rates of sleep disorders symptoms corresponded with the overall student sample. Caucasian students with symptoms of a sleep disorder comprised 45.9% followed by Hispanic students (32.4%) and Black/African American students (21.6%). No Asian students were reported to display symptoms of a sleep disorder. Sleep disorder group membership also paralleled the overall sample linguistically. A slightly higher number of students in the sleep disorder group (43%) were eligible for free or reduced price lunch.

Instrumentation

Sleep Disorders Inventory for Students (SDIS). The independent variables sleep disorder or no sleep disorder was obtained by student score on the Sleep Disorders Inventory for Students - Child Form (SDIS-C) (Luginbuehl, 2004; see Appendix A). The SDIS was developed due to the lack of a school-based screening instrument to recognize the main five sleep disorders that affect behavior and academic sequelae. Specifically, the SDIS identifies a range of risk for the sleep disorders Obstructive Sleep Apnea Syndrome (OSAS), Restless Legs Syndrome (RLS), Periodic Limb Movement Disorder (PLMD), Delayed Sleep Phase Syndrome (DSPS) and Narcolepsy.

The SDIS is available in two forms so as to distinguish developmental differences in sleep habits and sleep disorders. The SDIS-C was normed on children ages two to ten years old and the SDIS-A was normed on adolescents ages 11 to 19 years old (Luginbuehl, 2004). The current study utilized the SDIS-C.

The SDIS was normed on a national sample of 821 students in both clinic and school settings. Students participated in the norming sample from four major geographical regions of the United States. The racial/ethnic demographics of the sample were similar to the 2000 United States Census breakdown for race/ethnicity (Luginbuehl, 2004).

The SDIS was nationally validated over a four year period. It was validated for use by parents, psychologists, and physicians to screen children and adolescents for the five major sleep disorders, which include obstructive sleep apnea syndrome (OSAS), periodic limb movement disorder (PLMD), restless legs syndrome (RLS), delayed sleep phase syndrome (DSPS), and narcolepsy (N), and five parasomnias that affect children

and adolescents including bruxism (teeth grinding), somnambulism (sleep-walking), somniloquy (sleep talking), night terrors, and nocturnal enuresis (bed wetting). The SDIS also measures excessive daytime sleepiness (EDS) and provides a total sleep disturbance index (Luginbuehl, 2004).

Validation of the SDIS took place in the form of a pilot study followed by a main study. Prior to the pilot test, the SDIS underwent a process of content validation. A culturally diverse expert test review panel that spanned the disciplines of sleep medicine, school psychology, and measurement reviewed the instrument for linguistic and cultural bias as well as accuracy of sleep disorder measurement. To address content validity, the expert review panel was asked if each item described one or more of the five major sleep disorders accurately and if it should remain on the SDIS. The expert test review panel obtained 94% agreement on the final 38-items of the SDIS (Luginbuehl, 2004).

The pilot study conducted on the SDIS included 226 students from one large metropolitan area in the Southeast. Exploratory factor analysis was conducted on the data and five factors OSAS, PLMD, DSPS, EDS and combined RLS and narcolepsy emerged when all age groups were combined. Qualitative data suggested that parents of younger children answered items differently than parents of older children.

The main study validating the SDIS included 595 students recruited from the same large metropolitan area in the Southeast as well as sleep disorder centers in the West, Midwest, Mid-Atlantic, and South. A second exploratory factor analysis conducted on children ages 2 to 10 years as a result of parents' comments yielded four factors including OSAS, PLMD, DSPS, and EDS. Using these results, the SDIS was then developed and validated for two age groups, the SDIS-C, for children ages 2 to 10

and the SDIS-A, for children ages 11 to 18. Through confirmatory analysis, the four factors of the SDIS-C were confirmed and showed excellent construct validity. Though narcolepsy was not confirmed for the SDIS-C, the EDS scale was a good indicator of narcolepsy in children under 11 years (Luginbuehl, 2004).

Using discriminate function analysis, the SDIS-C had a predictive validity of 86% to determine which children were referred to sleep specialists for a comprehensive evaluation. When sleep disorders that the SDIS did not screen were removed, the hit rate jumped to 93%. The SDIS-C predicted diagnosis as determined by a sleep specialist through a multiple sleep latency test 68% of the time. When cut-off levels were lowered to improve screening accuracy, the predictive validity became 82% (Luginbuehl, 2004).

The SDIS-C was found to have good concurrent validity. The OSAS scale correlated with the Polysomnography (PSG) Respiratory Distress Index (RDI) at .33 ($p<.0005$). The single item on the SDIS-C that measured snoring severity correlated with PSG snore index at .43 ($p<.0001$). The SDIS-C PLMD scale when compared to the Periodic Limb Movement Index on PSG was not statistically significant due to scoring errors. Finally, the SDIS-C EDS scale was correlated with the Multiple Sleep Latency Test (MSLT) Average Sleep Latency Index at .85 ($p<.01$). The SDIS-C also had high internal consistency (.91) and test-retest reliability (.97) which indicated that the SDIS is a reliable instrument (Luginbuehl, 2004).

Available in both English and Spanish versions, the parent report SDIS takes approximately 10 to 15 minutes to complete. Parents are asked to complete the SDIS-C based on their child's sleep behaviors over the past six to 12 months. The screening

instrument includes 30 behavioral questions that parents answer on a seven-point likert scale and 11 questions that require a "yes" or "no' response (Luginbuehl, 2004).

In the validation of the SDIS-C, the Spanish form was completed by parents of 42 children. These parents spoke Spanish as their primary language. These results were included in the analyses after qualitative analyses were conducted, no differences were noted between Spanish and English-speaking parent responses. However, no statistical analyses were conducted independently on the Spanish data due to the small numbers of Spanish participants. The author noted that independent validation studies on the Spanish-speaking group should be an area of future research given the rapid growth expected for this population (Luginbuehl, Bradley-Klug, & Benbadis, 2005).

Parent responses to the SDIS-C are entered into a computerized scoring program that provides a bar graph of the standard scores for each of the three sleep disorders as well as and excessive daytime sleepiness (EDS) score and total sleep disturbance index. Standard scores fall into one of three categories; "normal," "cautionary," or "high risk." Finally, parents are provided a report that explains sleep disorders as well as recommendations depending on category membership.

Behavior Assessment System for Children, Second Edition (BASC-2). The Behavior Assessment System for Children, Second Edition (BASC-2); (Reynolds & Kamphaus, 2004) is a mulitmethod, multidimensional system used to assess behavior of children, adolescents, and young adults. It has three rating scales which may be used individually or in any combination. The components include Teacher and Parent Rating Scales (TRS and PRS), and a self-report of personality scale (SRP). The Teacher Rating

Scales (TRS) will be discussed because it is the only component of the BASC-2 that was employed in this study.

The TRS is designed for use by classroom teachers and measures both problem and adaptive behaviors in schools. This measure has three versions (preschool, child, adolescent) that can be used depending on developmental level of the student. The TRS assesses the broad domains of Externalizing Problems, Internalizing Problems, and School Problems, as well as Adaptive Skills through descriptors of behavior that the teacher rates on a four-point scale of frequency. It includes 139 items and is said to take 10 to 15 minutes to complete (Reynolds & Kamphaus, 2004). Teacher responses on the TRS are entered into a computerized scoring program or hand scored. T-scores fall into the normal/typical, at-risk or clinically significant categories.

The Behavioral Assessment System of Children (BASC) was created by researchers, teachers and students and is now in its second edition (BASC-2). The second edition included improved reliabilities, and a standardization sample to match U.S. population figures. Teachers and students helped with item-generation which, along with items generated by the authors, underwent pilot, tryout, and standardized testing. This process included more than 6,000 teacher ratings, 8,000 parent ratings, and 12,000 student self-reports. Items passed though expert and statistical review panels before the final forms were made. The BASC is purported to have strong psychometric properties including traditional correlations as well as confirmatory factor analyses (Reynolds & Kamphaus, 2004).

Standardization of the TRS of the BASC-2 included 252 items and over 2,000 participants including General and Clinical norm samples. The BASC-2 was

standardized in order to ensure reliability, distinctiveness, and interpretability. Analyses were performed in scale-by-step and analysis of all scales simultaneously using Covariance Structure Analysis. The TRS is written at a 4.1 through 4.4 grade level according to readability indices. Correlations between the BASC and BASC-2 were high with most being .90 or higher (Reynolds & Kamphaus, 2004).

Reliability of the BASC-2 was reported for internal consistency, test-retest reliability, and interrater reliability. For the General norm samples, the reliability coefficient ranged from .90-.97 for children ages 8 to 11 years. Test-retest reliabilities for the composites fell between .84 and .94. Interrater reliabilities between two teachers ranged from .45 to .68. The validity of the TRS was discussed three ways. First, validity of the TRS was assessed through empirical support from scale intercorrelations and factor analysis for the grouping of scales into composites. Second, validity was discussed relative to the pattern of correlations of the TRS composite score and scores obtained on other behavior measures. Third, TRS score profiles were compared to children with educational or clinical diagnoses. The TRS was determined to be a valid instrument (Reynolds & Kamphaus, 2004).

Studies have compared the BASC-2 TRS to other behavior-rating scales which were both filled out by the same teacher around the same time. Since the different rating scales may define behavioral dimensions differently, despite having the same or similar names, correlations must be interpreted cautiously. Despite this warning, scales on the BASC-2 TRS correlate highly with the Achenbach System of Empirically Based Assessments (ASEBA) Teacher's Report Form (TRF) for ages 6 – 18 years, and the Conners' Teacher Rating Scale – Revised (CTRS-R). On the TRS and ASEBA TRS,

correlations between scales that measured the same construct correlated highly. The overall clinical scores correlated at .78, Externalizing Problems scores correlated at .75 and Internalizing Problems correlated at .80. Scales of the BASC-2 TRS and the CTRS-R were also highly correlated. Global problems were correlated at .84, Hyperactivity was correlated at .81, the Aggression scale on the BASC-2 was correlated with the Oppositional scale on the CTRS-R at .74, and Attention Problems on the BASC-2 was correlated with the Cognitive Problems/Inattention on the CTRS-R at .81 (Reynolds & Kamphaus, 2004).

In the current study, teachers were asked to respond only to the items on the BASC-2 related to the Externalizing and Internalizing scales. The primary investigator highlighted each of the items on the TRS forms that the teachers were asked to complete. Specifically, they were asked to complete 54 items though some chose to complete the entire TRS form. Only the items that comprised the Externalizing and Internalizing scales were used for data analysis.

Curriculum-based Measurement. Curriculum-based Measurement (CBM) is a general outcome measure used to make data-based decisions about students' reading, spelling, written expression, and mathematics computation skills. In its current form, CBM is a standardized procedure where students' results can be compared to national or local norms as well as established grade level benchmarks. Initially, CBM assessed growth and development in the specific curricula being used in the classroom. Later, however, it was determined that using the specific curricula was unnecessary and generic passages yielded the same information (e.g., Powell-Smith & Bradley-Klug, 2001).

These procedures have been developed over the past thirty years and can be used to make a variety of instructional decisions.

The technical adequacy of Curriculum-based Measurement Reading (R-CBM) has been well documented over the past two decades. R-CBM was developed by Deno and his colleagues at the University of Minnesota Institute for Research on Learning Disabilities (Deno, Mirkin, & Chiang, 1982). Studies of test-retest reliability yielded coefficients ranging from .82-.97, with parallel forms ranging from .84 to .96 with most correlations above .90. In addition, interrater reliability has been found to be .99 (Marston, 1989). Studies investigating criterion related and construct validity with published norm-referenced tests of achievement have been moderate to high, ranging from .63-.90 with most correlations above .80 (Deno, Mirkin & Chaing, 1982; Fuchs, Fuchs & Maxwell, 1988; Marston, 1989; Shinn, Good, Knutson, Tilly & Collins, 1992).

R-CBM is administered to make accurate statements about students' reading growth and development. In R-CBM, students read aloud for one-minute from meaningful, connected, and grade level probes that are approximately 250 to 300 words in length (see Appendix B). The number of words read correct and errors are recorded and the student's score on the probe is comprised of the number of words read correct minus the number of errors. This score is referred to as the student's oral reading fluency (ORF). Errors are defined as stopping or struggling with a word for more than three seconds, mispronunciation of a word, substitution of a word, or word omission (AIMSweb, 2006).

Math Curriculum-based Measurement (M-CBM) was designed to measure general mathematics achievement. Included in general achievement is both math

computation and math applications. It is one tool that has been developed for formative evaluation in mathematics. Though there is a rich literature base on the technical adequacy of R-CBM, there is less information on M-CBM (Thurber, Shinn, & Smolkowski, 2002). In M-CBM, students write answer to standardized, grade-level computational problems drawn from the annual general curriculum on tests lasting two to five minutes (see Appendix C). In a study of M-CBM, Deno, Marston, and Tindal (1985) found high interrater reliability (.97), and high test-retest reliability after one-week (.87), as well as alternate form reliability (.66). In addition, correlations between parallel forms of the same measure were high (.90-.92) suggesting high alternate form reliability. In grades two and three, students are administered probes in an individual, small or large group setting in which they have two minutes to complete the addition and subtraction problems. Students receive credit for the number of correct digits produced in two minutes. They are not penalized for incorrect digits (AIMSweb, 2006).

In order to collect local norms for R-CBM and M-CBM, all students are assessed three times each year (Fall, Winter, Spring). Through this process, also known as benchmarking, students are administered three probes. The student's median probe score is determined to be their true score. The median probe score is used to control for probe difficulty level and any variance that may be due to an extreme score (Shapiro, 1996). Benchmarking is used to screen and identify at risk students in need of intervention, to monitor progress and improvement of individual students, and to make programmatic decisions. Student CBM scores are considered "Below Average" if they fall below the 25th percentile compared to same-grade peers, "Average" if they fall between the 25th

and 75th percentile compared to same-grade peers, and "Above Average" if they fall above the 75th percentile compared to same grade peers (AIMSweb, 2006).

PedsQL™ 4.0 . The PedsQL™ was developed to assess health related quality of life (HRQOL) in healthy children and adolescents as well as those with chronic health conditions (see Appendix D). This is the only non-disease specific HRQOL measure that has consistently shown excellent technical properties, is available in parent-proxy report and child self-report forms in English and Spanish and has been used in the sleep literature (Crabtree, Varni, & Gozal, 2004).

The PedsQL™ 4.0 built on instrument development over 15 years beginning with the PedsQL 1.0 which measured pain and functional status. The PedsQL 2.0 and 3.0 included additional constructs and items and a more sensitive scaling range. The PedsQL™ 4.0 was designed to measure the physical, mental, and social health dimensions delineated by the World Health Organization (WHO). The PedsQL™ 4.0 also includes school functioning (Varni, Seid, & Kurtin, 2001).

PedsQL™ 4.0 Generic Core Scales child-self report was normed on 963 children ages 5 to 18 years. Children were recruited from pediatricians' offices (6%), one of four hospital specialty clinics (26%), or were hospital inpatients or outpatients who had been seen at least three months prior to the study (68%). Children completed the questionnaire either in person (26%) or over the phone (73%). The measures were administered in both English (79%) and Spanish (21%) (Varni et al., 2001).

The average age of participants who completed the self-report was 9.3 years. The overall sample was approximately half girls and half boys. With regards to ethnicity, 37% were Caucasian, 40% Hispanic, 7% African American, 3% Asian, 1% American

Indian or Native Alaskan and 13% other or missing. Thus, the PedsQL™ 4.0 was normed on a diverse sample though not representative of the national census with an under representation of African American children. The sample was also socioeconomically diverse as noted by maternal education level. Participants included children who were chronically ill (41%), children who were acutely ill (12%), and children who were healthy (44%) (Varni et al., 2001).

The PedsQL™ 4.0 consists of 23-items across the domains Physical Functioning, Emotional Functioning, Social Functioning, and School Functioning which were determined through focus groups and interviews. The child self-report is delineated by age with similar forms for ages 5 to 7, 8 to 12, and 13 to 18 differing in developmentally appropriate language. On the PedsQL™ 4.0, children are asked to determine how much of a problem each item has been over the past month using a 5-point response scale. Items are reverse scored and linearly transformed to a 0 to 100 scale corresponding to the 5-point response scale. Higher scores indicate better HRQOL. The PedsQL™ 4.0 takes approximately 10 minutes to complete (Varni et al., 2001).

Internal consistency reliability for the PedsQL™ 4.0 self-report ranged from .68 for School Functioning to .88 for Total Score. Validity was demonstrated using the known-groups method, correlations with indicators of morbidity and illness burden, and factor analysis. Scales demonstrated differences among the groups of children with chronic illness, children with acute illness and children with no known illness. Children with no known illness scored higher than chronically or acutely ill children. Scores from children with chronic or acute illness were correlated with measures of illness burden and morbidity. A five factor solution resulted for self-report accounting for 52% of the

variance. The factors that emerged were consistent with hypothesized factors though the School Functioning factor split into two different factors. Test-retest reliability and responsiveness were not reported (Varni et al., 2001).

Students' Life Satisfaction Scale (SLSS). Life satisfaction is a person's subjective evaluation of his or her wellness and strengths as well as overall life positivity or positivity within a life domain such as school experience. The Students' Life Satisfaction Scale (SLSS) measures life satisfaction in children ages 8 to 18 years, but has been used in research with younger children (Appendix E). The SLSS is a self-report measure that includes seven-items which are considered domain-free. Students are asked to respond to each question using a six-point frequency scale ranging from 1=strongly disagree to 6=strongly agree. It is brief, intended for children, and is purported to have adequate reliability and validity. Additionally, the SLSS is intended for use in large-scale studies in order to measure life satisfaction (Suldo & Huebner, 2004).

Over the past decade, the SLSS has been employed in studies of approximately 200 to more than 1000 students in Midwestern and southern states (e.g., Huebner, 1991; Suldo & Huebner, 2004). All of the studies have considered the relationship between life satisfaction and another domain of functioning such as academic achievement and psychopathology. However, cutpoint of levels of life satisfaction have not been established (Huebner et al., 2005). One study (Suldo & Huebner, 2004) suggested that scores between 1 and 3.9 represented low life satisfaction and scores above indicated high satisfaction.

Psychometric properties of the SLSS are well documented through large-scale studies. Distribution of responses on the SLSS tend toward the positive range of life

satisfaction (Suldo & Huebner, 2004). Coefficient alphas in the .70-.80 range have been reported across all age groups. Specifically, a coefficient alpha of .73 was found with 183 students in third through fifth grades (Terry & Huebner, 1995) and a coefficient alpha of .84 was found with 254 students in third through eighth grades (Huebner, 1991). Test-retest reliability is also reported to be strong and range from .76 across one to two weeks to .64 across one month and .53 across one year (Huebner et al., 2000).

The SLSS has been determined to be a valid measure. Factor analyses have supported a one-factor structure for the SLSS (e.g., Huebner, 1991). The SLSS is correlated with other life satisfaction self-report measures including the Perceived Life Satisfaction Scale (r=.58), the Piers-Harris Happiness subscale (r=.53), Andrews and Withey one-item scale (r=.62), and DOTS-R Mood scale (r=.34) (Huebner, 1991). Construct validity of the SLSS has been supported. Negative environmental experiences were associated negatively with SLSS scores and positive life experiences were associated positively with SLSS scores. When considering discriminant validity, the SLSS has been distinguished from other constructs with which life satisfaction does not relate such as social desirability, IQ, and poor grades (e.g., Huebner, 1991). Additionally, the SLSS distinguished between students with and without emotional disorders (Huebner & Alderman, 1993) though it did not distinguish between students who were and were not considered gifted or learning disabled (Ash & Huebner, 1998; McCullough & Huebner, 2003). Predictive validity studies have also supported use of the SLSS (e.g., Suldo & Heubner, 2004).

Procedure

In order to maintain ethical standards in conducting research, Institutional Review Board approval was obtained from both the University of South Florida and the school district in early March 2006. After IRB approval was obtained, an endorsement letter from the school principal, a letter explaining the nature of the research project and requesting participation and consent (Appendix F), and the SDIS-C was sent home to the parents of all second and third grade students. The explanation letter, consent form and the SDIS-C were written in both English and Spanish. Parents were requested to watch their children sleep for two nights which is recommended by the SDIS-C for accurate reporting. They were requested to return the consent form and SDIS-C to the school either through their child, in person, or during their scheduled winter conference within one week.

At the end of one week 82 complete packets were returned. Due to this low response rate, the principle investigator pursued a number of opportunities. First, the principle investigator sat at the check-in desk during the half-day winter conference session and asked parents to complete the consent form and SDIS-C if they had not yet done so. Additional forms were available. Second, the researcher met with all second and third grade teaching teams and explained the nature of the research project. Third, the researcher offered incentives to the teachers and class with the highest return rate. Teacher incentives included sport tickets, lunch delivery and coffee. The class incentive was a class party or play time outside. After incentives were offered, the compete research packet including the explanation letter, consent form and the SDIS-C in English and Spanish was sent home again with all students. One-hundred twenty five participants

were enrolled during that time period. Approximately one and one-half months after the first packet was sent, a third and final packet was sent home with all second and third grade students. A final group of 11 chose to participate through the final packet. Overall, 37.6% of the sample was recruited from the first letter, 57.3% was recruited from the second letter including incentives, and the final 5.1% was recruited from the third and final letter including incentives.

After the study was closed to participation, teachers of those students whose parents completed the SDIS-C were asked to complete the TRS. Through an explanation and consent letter, the principle investigator explained the nature of the study and the teachers' role in study participation and asked for consent (Appendix G). The principle investigator also gave the teachers packets with the TRS forms for each of the student participants in their class. Teachers were given approximately two weeks to complete the TRS forms. Teachers who did not complete the forms within two weeks were given written and verbal reminders to complete the forms. There was a 100% completion rate for the TRS forms. The principal investigator provided refreshments in the teacher's lounge one morning to thank all teachers for participation.

Student data were collected on those students whose parents completed the SDIS-C. R-CBM data was archival and scores were obtained by the principle investigator from AIMSweb. AIMSweb is an online database that is comprised of both standard generic curriculum assessment passages and a data management system to report and graph the results of R-CBM (AIMSweb, 2006). The spring benchmarking scores were used in the study. For R-CBM data collection, trained data collectors administered the three probes to each student individually using standardized instructions and scoring. The median

score was counted as the student's true score. M-CBM probes were administered by classroom teachers to their entire class. Teachers read standardized directions and gave the students two minutes to complete each probe. The principal investigator scored the M-CBM probes and the median score was used as the student's true score.

Finally, the PedsQL™ 4.0 and the SLSS were administered to all study participants. Students were administered the PedsQL™ 4.0 and the SLSS by class either in the classroom, hallway or library depending on the number of study participants in the class. Regardless of location of administration, similar procedures were followed. First, the principle investigator passed out the student assent form and explained the study (Appendix H). After assent was obtained, the principle investigator handed out the SLSS and PedsQL™ 4.0. Directions were explained for the SLSS and the principal investigator gave two sample items using visual cues (smiley faces) to represent the likert scale. Each item on the SLSS was orally administered. The principle investigator then read the directions and each individual item on the PedsQL™ 4.0. Throughout data collection, the principle investigator answered individual questions but students were instructed not to make comments that might have swayed others' opinions and responses. Make-up administration occurred individually and small groups in the weeks following initial administration. Data for the PedsQL™ 4.0 and SLSS was only included for students ages 8 years and older due to instrument cut-offs.

Data Entry/Scoring

The researcher used two software packages to organize and analyze the data. Specifically, these software packages were Microsoft Excel XP (Microsoft Excel, 2002) and the Statistical Package for the Social Sciences (SPSS) software (Statistical Package

for Social Sciences Version 14.0 [SPSS], 2005). The researcher entered all data into Excel and SPSS after the measures were scored.

The SDIS-C was computer scored with a publisher provided CD-ROM. Data from the TRS, M-CBM, PedsQL™ 4.0 and SLSS were hand scored. Independent interrater checks were performed by a research assistant working with the primary investigator on 20% of the completed batteries. The research assistant verified accuracy in data entry. One inconsistency arose in data entry. The entered number on the EDS scale of the SDIS-C for one participant was reversed. The number was corrected in the data base. No other scoring or data entry inconsistencies arose.

Research Design

A non-experimental research design was used in the current study. This design does not include manipulation of intervention or the use of random assignments. Rather it relies on naturally occurring phenomena.

Statistical Analyses

Several statistical procedures were used to analyze the data in order to answer the research questions. First, the data was summarized by conducting frequency polygons for each group and checking for outliers. Second, the mean and standard deviation for each group were calculated. Third, descriptive statistics were reported for each of the variables including grade, gender, ethnicity, socioeconomic status, sleep disorder category, as well as scores on the BASC-2, R-CBM, M-CBM, PedsQL™ 4.0, and SLSS. For each variable number of cases, minimum, maximum, and standard deviation were determined. Children across sleep disorder category were compared on gender, ethnicity, socio-economic status, and scores on the BASC-2, R-CBM, M-CBM, PedsQL™ 4.0, and

SLSS. Fourth, reliability analyses were performed to determine correlations among the dependent variables. A Multivariate Analysis of Variance (MANOVA) was conducted to determine whether or not there was a difference between students with and without symptoms of sleep disorders on behavior, academics, and quality of life.

Chapter 4

Results

This chapter presents the results of the relationships between symptoms of sleep problems, behavior, academic achievement and quality of life in a school-based sample of students. The analyses used to address each research question are described in detail. For ease of reference to the two groups of students, those students who demonstrated symptoms of sleep disorders will be referred to as the 'Sleep Disorder' group and those who were not rated as having symptoms of sleep disorders will be referred to as the 'No Sleep Disorder' group.

Descriptive Statistics

Descriptive information for the study instruments can be found in Table 2. Table 2 displays statistics for Externalizing and Internalizing Scales of the Behavior Assessment System for Children, Second Edition (BASC-2), Curriculum-based Measurement Reading (R-CBM), Curriculum-based Measurement Math (M-CBM), PedsQL™ 4.0, and the Students' Life Satisfaction Survey (SLSS). For each measure, the number of cases, mean, minimum and maximum scores and standard deviation are included.

As a group, study participants' scores fell within the average range for most instruments. On the Externalizing and Internalizing scales of the BASC-2, "typical" t-scores fall below 60, "at-risk" t-scores fall between 60 and 70 and "clinically significant"

t-scores fall above 70. For this study, total group Externalizing t-scores fell between 41 and 86 with the group mean t-score of 49.84. The group mean fell within the typical range. Total group Internalizing t-scores fell between 39 and 98 with the group mean t-score of 48.27 which is also in the typical range.

Table 2

Descriptive Information for Study Instruments

Instrument	α	M	Minimum	Maximum	SD
BASC Externalizing[a]	.98	49.84	41.00	86.00	10.28
BASC Internalizing[a]	.94	48.27	39.00	98.00	11.57
R-CBM[a]	-	114.37	11.00	216.00	42.03
M-CBM[a]	-	22.98	4.00	58.00	10.21
PedsQL™ 4.0[b]	.88	76.75	1.00	100.00	15.24
SLSS[b]	.80	4.54	1.00	6.00	1.13

[a]n=216. [b]n=206

Curriculum-based measurement scores were collapsed across second and third grades for the purpose of analyses. Students were administered grade level passages (e.g., second graders read second grade material). The mean group R-CBM score was 114.37 words read correct per minute which fell in the average range based on local norms for both second and third grades. Local R-CBM norms can be found in Appendix I). The mean group M-CBM score was 22.98 digits correct which fell in the above average range for second grade and the average range for third grade. These ranges of scores were extrapolated from data obtained in the 2004-2005 school year and practically categorized using the criteria set by Shapiro (1996) of average expected grains per week

of .28 digits for second grade and .30 digits for third grade. Thus, scores are based on national gains and norms rather than local norms (Appendix J).

Quality of life and subjective well-being scores fell at the upper end of the continuum indicating an overall positive report. Scores on the PedsQL™ 4.0 ranged from a low of 1 to a high of 100 with an average of 76.75. Scores on the SLSS ranged from 1 to 6 with a mean score of 4.54. On both measures, high scores are indicative of better reported quality of life. Of note, ten study participants did not have complete PedsQL™ 4.0 or SLSS data. Four of the ten participants were in a self-contained special education class and the classroom teacher did not think that the students would comprehend the questions. Due to the nature of the analysis, only the 206 complete cases were included in the MANOVA and follow-up tests.

Prevalence Rates

Responses on the Sleep Disorders Inventory for Students, Children's Form (SDIS-C) were used to determine presence or absence of symptoms of a sleep disorder. Two hundred and sixteen parents or guardians consented to study participation and completed the SDIS-C. One hundred and seventy-five parents or guardians completed the SDIS-C English form which comprised 81% of the sample. Forty-one parents or guardians (19.0%) chose to complete the Spanish form of the SDIS-C. For subsequent analyses, English and Spanish form responses were collapsed.

Percentages of students falling in the normal versus cautionary or at-risk categories were calculated to determine prevalence rates of symptoms of sleep disorders (Table 3). Overall, parents and guardians of 37 students (17.1%) endorsed sleep behaviors that placed their children in at least the cautionary range of displaying

symptoms of one or more of the most common sleep disorders in children, Obstructive Sleep Apnea Syndrome (OSAS), Periodic Limb Movement Disorder (PLMD), Delayed Sleep Phase Syndrome (DSPS), or Excessive Daytime Sleepiness (EDS). A confidence interval was computed to determine the range in which a student from the given population would fall 95% of the time. The 95% confidence interval was ±5.1% or 12 to 22.2%.

Twenty-one children (9.7%) were reported to have symptoms synonymous with DSPS and seventeen children (7.9%) were reported to have symptoms of OSAS. Parents reported EDS in 11 children (5.1%) and PLMD in 9 children (4.2%). Characteristics of the children screened as being in the cautionary or at-risk range for one or more sleep disorder are displayed in Appendix K.

Table 3

Prevalence of Symptoms of Sleep Disorders

Sleep Disorder	No Sleep Disorder	Sleep Disorder
OSAS	199 (92.1%)	17 (7.9%)
PLMD	207 (95.8%)	9 (4.2%)
DSPS	195 (90.3%)	21 (9.7%)
EDS	205 (94.9%)	11 (5.1%)

Characteristics of students by number of sleep disorder categories are further explained in Appendix L. Most of the group (67%) was described as exhibiting behaviors consistent with one sleep disorder. Six students (16.2%) fell into 2 sleep

disorder categories. Three students each had behaviors that placed them into three or all four sleep disorder categories (8.1% each).

Multivariate Analysis of Variance (MANOVA)

In order to address the remaining research questions, a multivariate analysis of variance (MANOVA) was conducted to determine if there was a difference between students with and without symptoms of sleep disorders on academic achievement, behavior and quality of life. The dependent variables were the Externalizing scale of the Behavior Assessment System for Children, Second Edition (BASC-2), the Internalizing scale of the BASC-2, Curriculum-based Measurement Reading (R-CBM), Curriculum-based Measurement Math (M-CBM), PedsQL™ 4.0, and Students' Life Satisfaction Scale. Scores for 206 rather than 216 students were included in the MANOVA since complete data sets were required for the analysis.

Before proceeding with the main MANOVA analysis, the data were tested for conformity to several assumptions. Assumptions testing included considering sample size, univariate and multivariate normality and outliers. The data were also tested for multicollinearity and homogeneity of variance-covariance matrices.

The means and standard deviation for each of the dependent variables by sleep disorder category are displayed in Table 4. In order to be robust to assumptions, there should be more cases in each cell than dependent variables. In this study, there were six dependent variables and the minimum number of cases per cell was 35 which met the sample size criterion.

Table 4

Descriptive Information for Study Instruments by Sleep Disorder Category

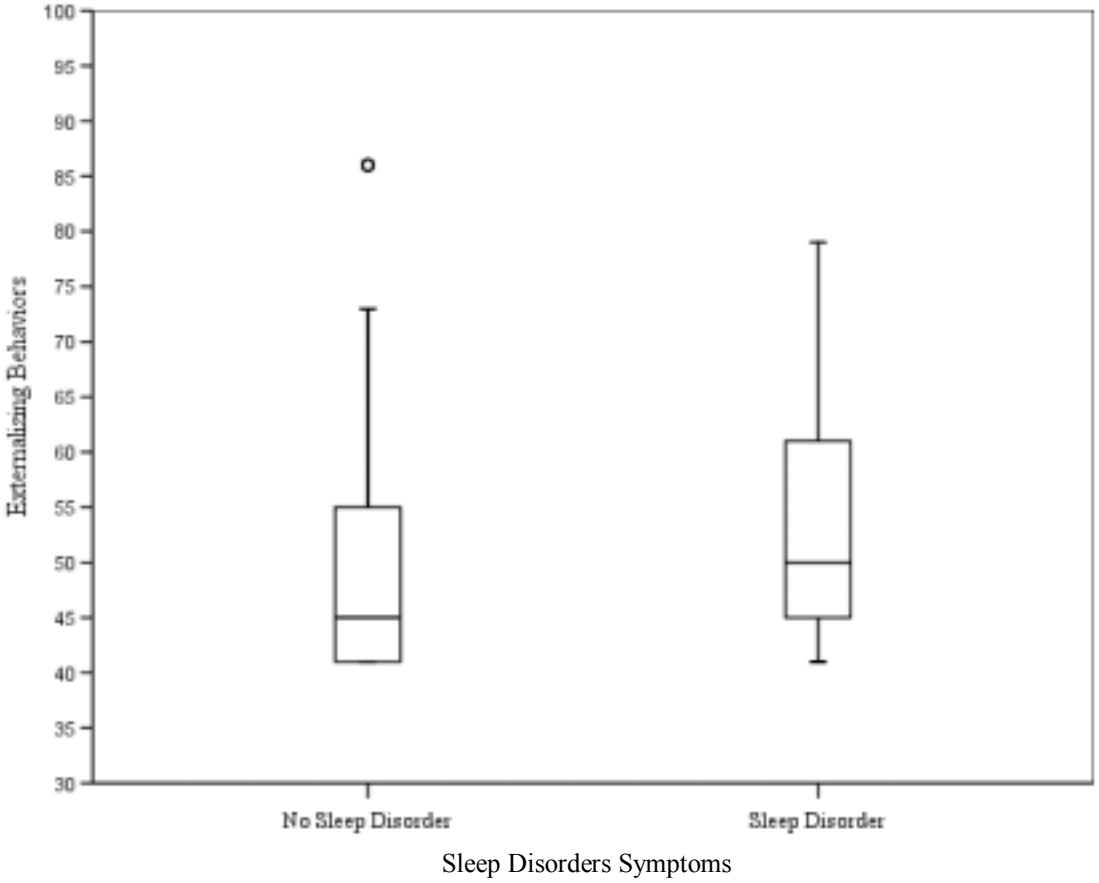
Instrument	No Sleep Disorder[a]	Sleep Disorder[b]
BASC Externalizing		
M	48.86	53.46
SD	9.59	10.93
BASC Internalizing		
M	47.09	52.40
SD	10.51	12.73
R-CBM		
M	119.22	99.26
SD	41.13	35.25
M-CBM		
M	24.04	19.63
SD	10.15	8.49
PedsQL™ 4.0		
M	76.94	75.81
SD	14.20	19.77
SLSS		
M	4.54	4.51
SD	1.13	1.18

[a] n=171. [b] n=35

Box Plots

Box plots were executed to further compare the distribution of scores by sleep disorder category. Patterns of scores and variability in scores within each group were inspected. An explanation of the visual inspection of the differences between the Sleep Disorders symptoms and No Sleep Disorders symptoms groups on each of the dependent variables follows.

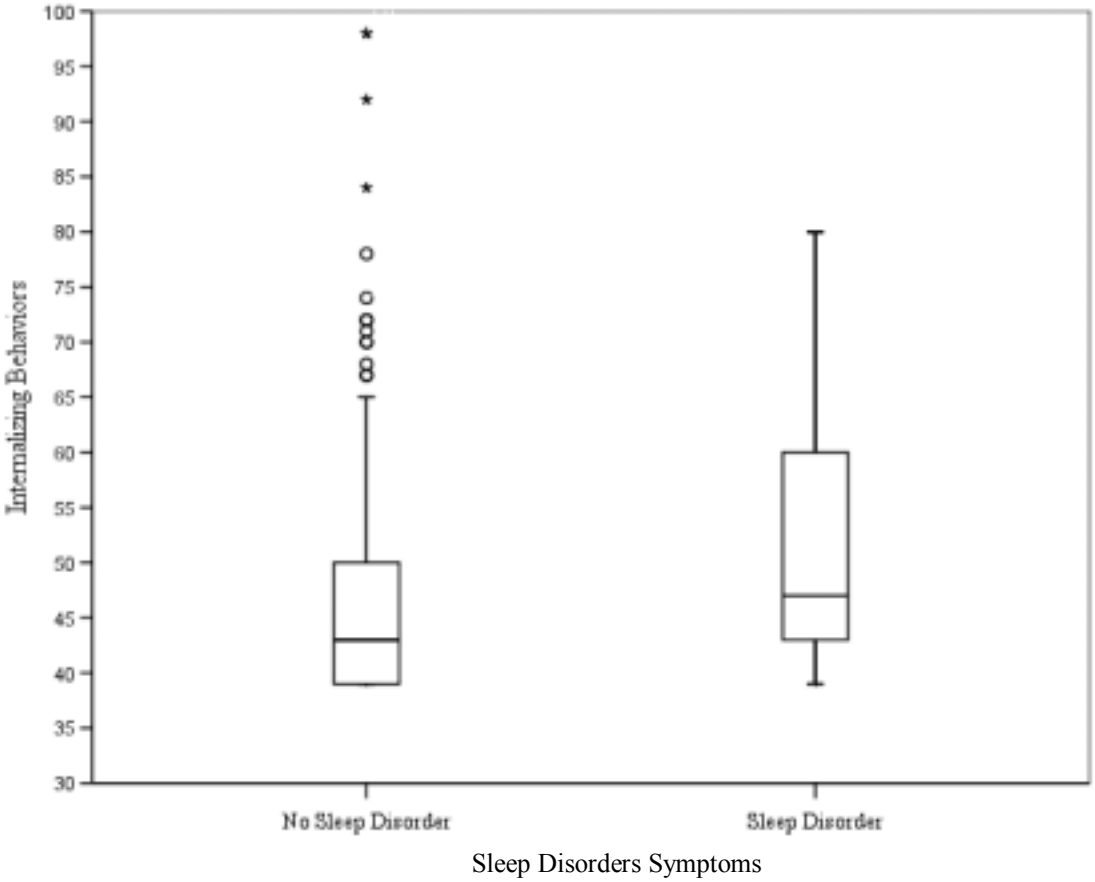
Figure 1. Externalizing Behaviors Box Plot



Behavior. Box plots indicate that teachers of students with symptoms of sleep disorders endorsed them as having more deviant externalizing behavior than students without symptoms of sleep disorders (Figure 1). Additionally, teachers of students in the

sleep disorders group endorsed them as having more deviant internalizing behaviors than students without symptoms of sleep disorders (Figure 2).

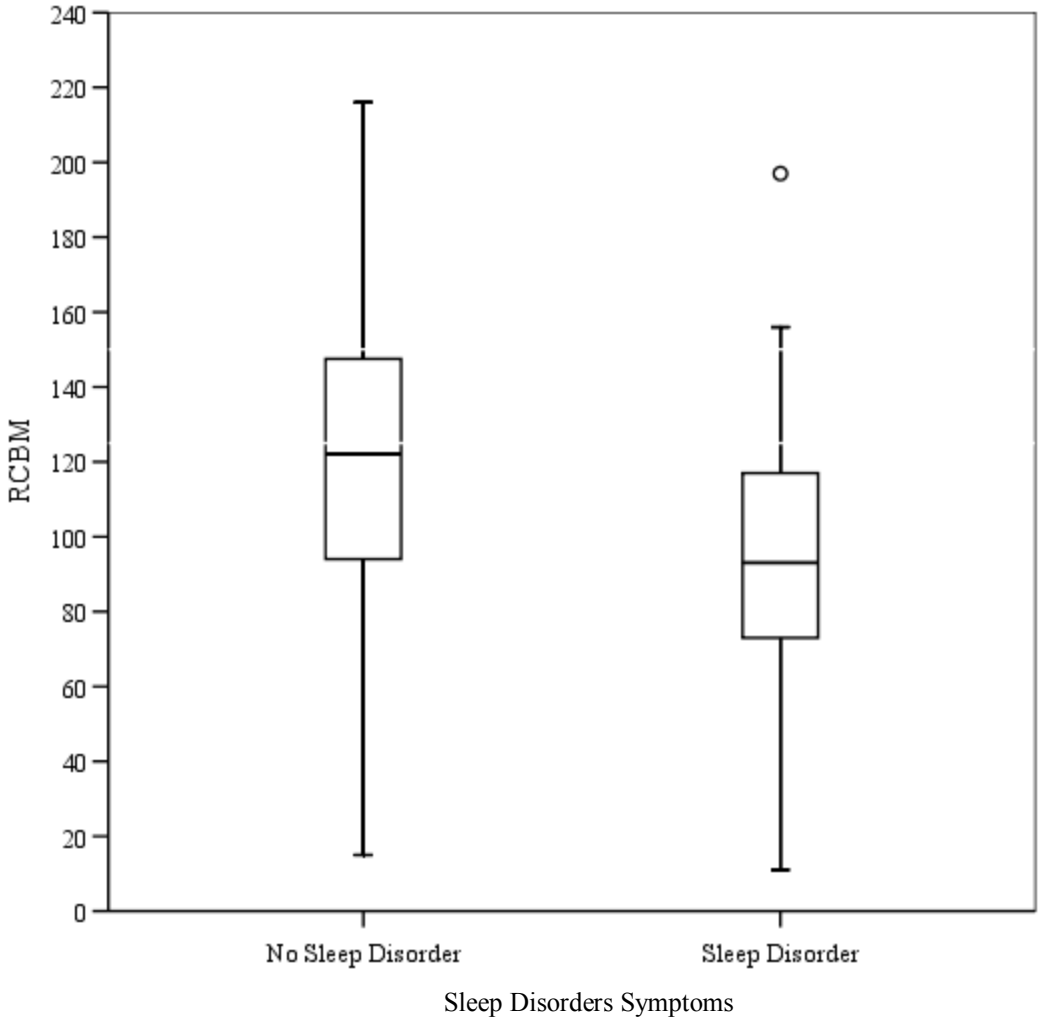
Figure 2. Internalizing Behavior Box Plot



R-CBM. Box plots indicated that students with symptoms of sleep disorders performed worse on reading achievement than their counterparts without symptoms of sleep disorders (Figure 3). Specifically, students with symptoms of sleep disorders read fewer words correct per minute than students without symptoms of sleep disorders. The student mean for the Sleep Disorders symptoms group was 96.35 words read correct per minute (WRCM) and the mean for the No Sleep Disorders symptoms group was 118.09 WRCM.

The lower whiskers end at approximately the same level indicating similar low-bound performance. However, the box comprising 50% of the scores of students without symptoms of sleep disorders is set higher than the box comprising 50% of the scores of students with symptoms of sleep disorders. In fact, the median score of students without symptoms of sleep disorders is at the same height as the third quartile of scores of the group with symptoms of sleep disorders.

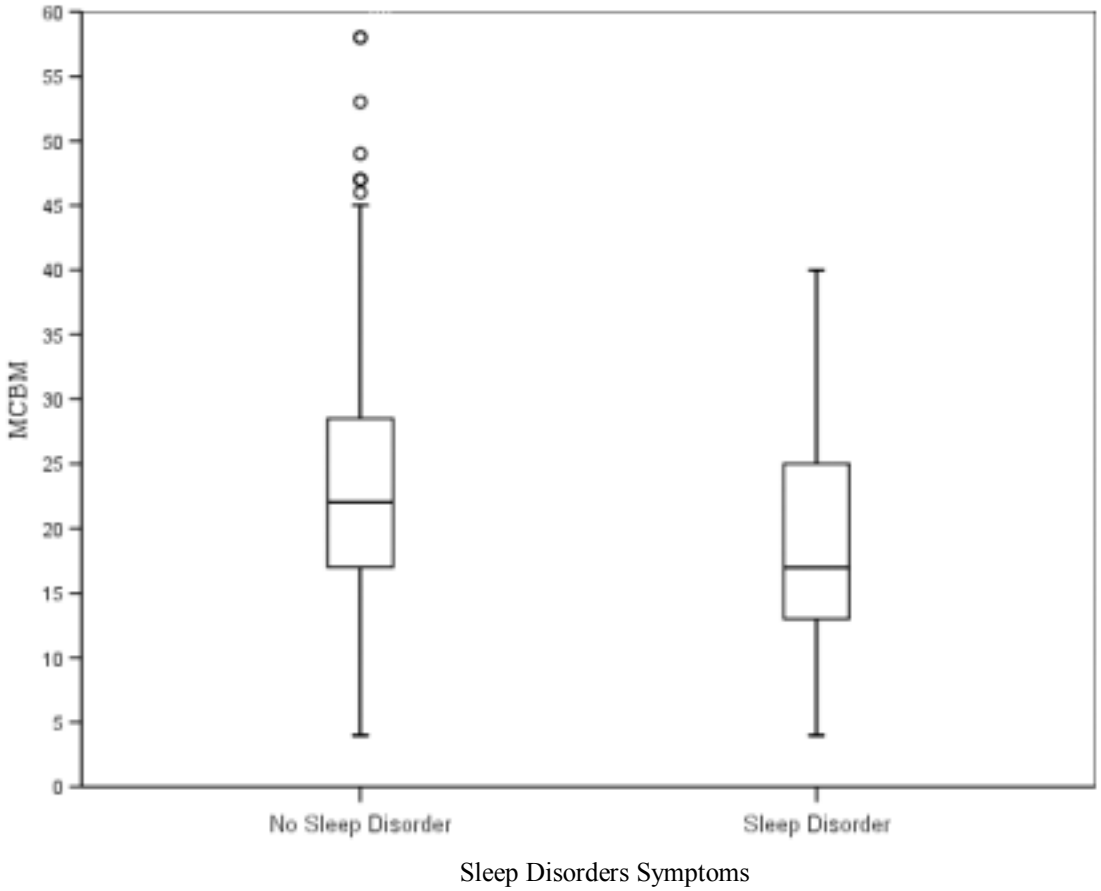
Figure 3. R-CBM Box Plot



M-CBM. Box plots indicated that as a group, students with symptoms of sleep disorders performed worse (M=19.03 digits correct) than their counterparts without

symptoms of sleep disorders (M=23.80) in mathematics achievement (Figure 4). As with reading achievement, students underperformed similarly in both groups indicated by the lower whiskers. However, the middle 50% of students without symptoms of sleep disorders performed better than the middle 50% of students with symptoms of sleep disorders. Overall, students with symptoms of sleep disorders calculated fewer digits correct than students without symptoms of sleep disorders.

Figure 4. M-CBM Box Plot



Quality of life. Box plots reveal little difference in self-reported quality of life between students with and without symptoms of sleep disorders. The plot of the SLSS (Figure 5) revealed that the middle 50% of students endorsed the same level of quality of

life. However, students without symptoms of sleep disorders reported slightly lower quality of life as noted by the lower bound whisker (lower quartile scores). The median score of students with symptoms of sleep disorders was higher than the median score of students without symptoms of sleep disorders. Student scores on the PedsQL™ 4.0 (Figure 6) followed a similar pattern. Students from both groups had similar upper quartile scores. Students without sleep disorders symptoms had lower bottom quartile scores than students with sleep disorders symptoms. The median score was highest for the group with symptoms of sleep disorders.

Figure 5. Subjective Well-Being Box Plot

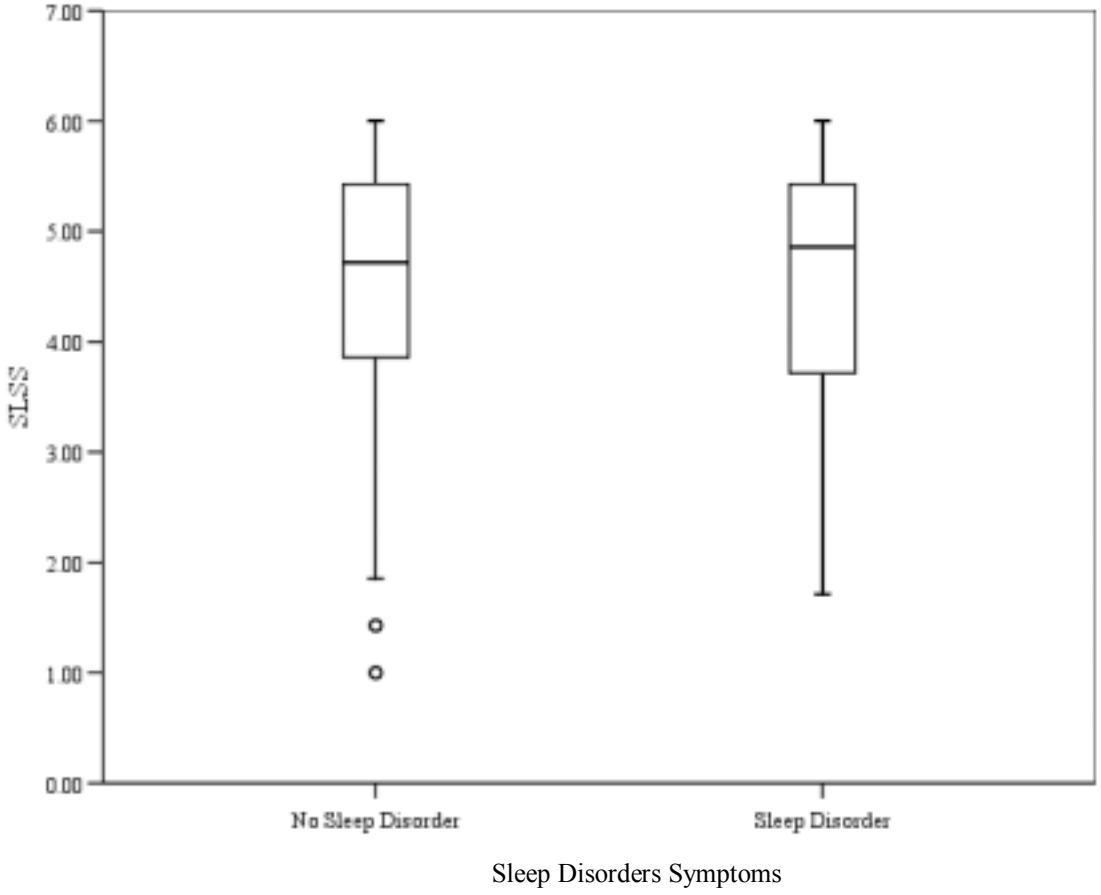
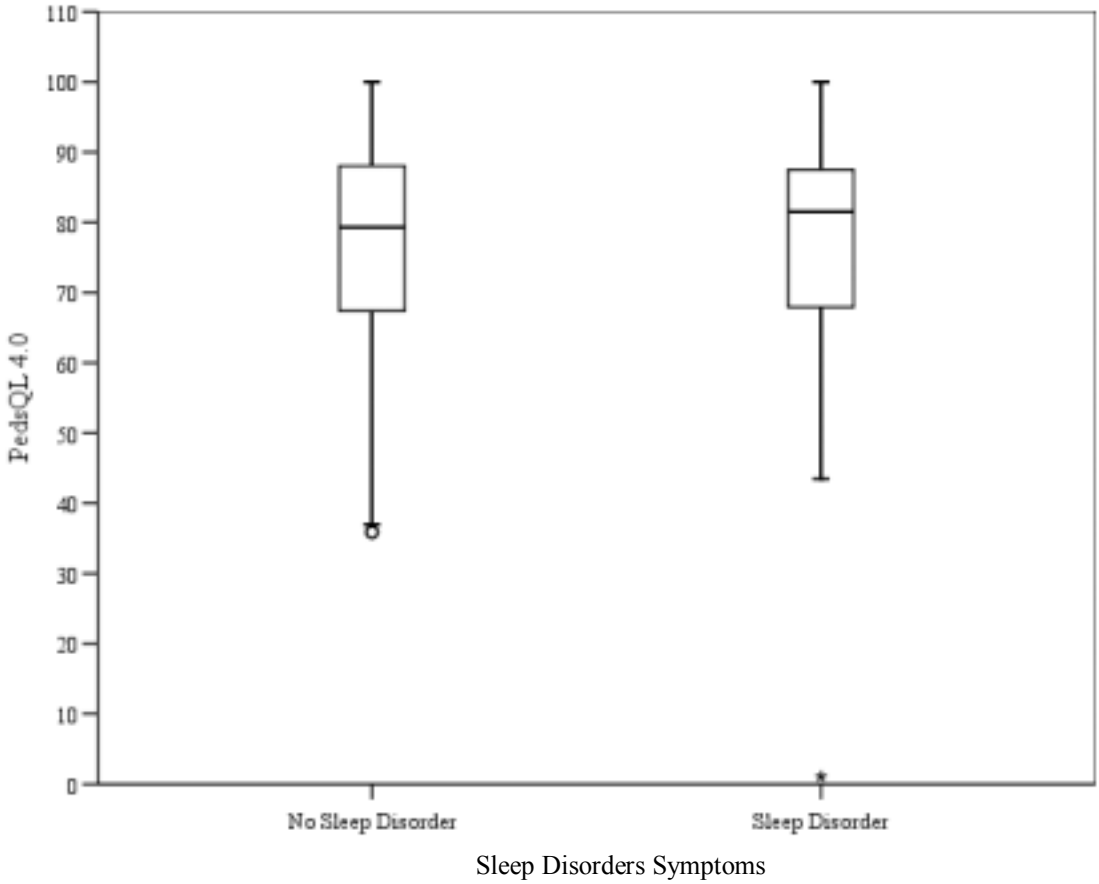


Figure 6. Health Related Quality of Life Box Plot



After visually scanning the data, the assumptions of univariate and multivariate normality were checked and outliers were identified. Univariate normality was first assessed by examining skewness and kurtosis values (Table 5). In general, positively skewed values represent low scores or ratings and negatively skewed values represent high scores or ratings. However, scores for behavior and quality of life did not follow that pattern. On the Externalizing and Internalizing scales, low scores represented typical behavior. Therefore the overall group was positively skewed. By contrast, high scores on the PedsQL™ 4.0 and SLSS represented good quality of life therefore the overall group was negatively skewed.

Table 5

Univariate Skewness and Kurtosis

Group	Outliers	Skewness	Kurtosis
Externalizing			
No Sleep Disorder	2	1.38	1.64
Sleep Disorder	0	.82	-.26
Internalizing			
No Sleep Disorder	12	2.13	5.88
Sleep Disorder	0	.76	-.81
R-CBM			
No Sleep Disorder	0	-.18	-.39
Sleep Disorder	1	.54	.32
M-CBM			
No Sleep Disorder	4	.83	1.04
Sleep Disorder	0	.58	1.12
PedsQL™ 4.0			
No Sleep Disorder	2	-.59	-.06
Sleep Disorder	1	-1.75	4.78
SLSS			
No Sleep Disorder	4	-.84	.37
Sleep Disorder	0	-.68	-.31

Table 6

Significance Values of Kolmogorov-Smirnov Test of Normality

Group	Significance Value
Externalizing	
No Sleep Disorder	.00
Sleep Disorder	.02
Internalizing	
No Sleep Disorder	.00
Sleep Disorder	.00
R-CBM	
No Sleep Disorder	.20*
Sleep Disorder	.20*
M-CBM	
No Sleep Disorder	.00
Sleep Disorder	.05*
PedsQL™ 4.0	
No Sleep Disorder	.02
Sleep Disorder	.03
SLSS	
No Sleep Disorder	.00
Sleep Disorder	.05*

*p≥ .05.

To further assess the normality of the distribution of scores, the Kolmogorov-Smirnov statistic was computed (Table 6). R-CBM for the No Sleep Disorders symptoms and Sleep Disorders symptoms groups, M-CBM for the Sleep Disorders symptoms group and SLSS for the Sleep Disorders symptoms groups were normally distributed. The values of the other categories suggested violation of the assumption of normality which is common in larger samples. Histograms, as well as normal probability plots were subsequently examined. The distribution of scores for M-CBM was normal though positively skewed. As mentioned previously, scores on the quality of life measures were negatively skewed and scores on the behavior measures were positively skewed due to the underlying nature of the constructs being measured. Though significance tests of MANOVA are based on the normal distribution, MANOVA is reasonably robust to violations of normality with a sample size of at least 20 per cell (Tabachnick & Fidell, 2001).

Univariate normality was further assessed by examining outliers. Specifically, box plots were examined for outliers (Figures 1-6). Approximately 42% of the groups met the assumption of normality (i.e., no outliers and both skewness and kurtosis values equal to or less than ± 1). An additional 33% had skewness and kurtosis values equal to or less than ± 1 but had some outliers. One student in the R-CBM Sleep Disorder group had an outlying score that deviated from the rest of the group. The score was higher than the group indicating that the student outperformed the group. Eight students in the M-CBM No Sleep Disorder group also outperformed their group on math achievement. Outlying scores for quality of life fell below the rest of the group indicating reports of

impaired quality of life by students without symptoms of sleep disorders on both the SLSS and PedsQL™ 4.0.

The final groups (25%) included student scores that represented outliers as well as skewness and kurtosis ± 1. The histogram for the Sleep Disorder PedsQL™ 4.0 group was negatively skewed and leptokurtic indicating that the one outlying score skewed the small sample. Additionally, the majority of the students tended to endorse items that indicated a good health related quality of life which may have accounted for the skewed results.

Both the Internalizing and Externalizing No Sleep Disorders symptoms group histograms were positively skewed and leptokurtic. This is not surprising as the T-score distribution of the BASC-2 is not normal. Scores indicating typical behavior fall at the low end of the spectrum and high scores on the BASC-2 indicate deviant behavior. For these groups, the outlying scores that affected the skewness and kurtosis represented deviant behavior as explained by the classroom teacher. None of the univariate outliers were removed and all participants' scores were used in the analyses.

After testing for univariate normality, multivariate outliers were considered. Mahalanobis distance was used to identify cases that had a different than normal pattern of scores across the dependent variables. The Mahalanobis distance maximum score was 36.54 which was larger than the critical value for six dependent variables of 22.46 suggesting the presence of multivariate outliers (Tabachnick & Fidell, 1996). Four study participants had multivariate outlying scores. One of the students was in the Sleep Disorders symptoms group and four were in the No Sleep Disorders symptoms group.

Because the Sleep Disorders symptoms group had more than 20 participants, even with the one outlier it seemed reasonable to keep the participants in the sample.

Multicollinearity was tested by computing correlations between the dependent variables (Appendix M). Multicollinearity occurs when the dependent variables are highly correlated. Correlations between the dependent variables ranged between -.07 and .56. There were no correlations around .8 or .9, therefore multicollinerity was not violated.

Box's test of equality of covariance matrices tests the null hypotheses that the observed covariance matrices of the dependent variables are equal across groups. Using Box's M, the null hypothesis was rejected (F = 1.64, p = .033). Given the group with larger variance was not consistent across the variables, the largest SD ratio was 1.39, and what is known about the robustness of MANOVA (e.g., Stevens, 2002), it seemed reasonable to proceed with the multivariate analysis.

A one-way between groups MANOVA was performed to investigate sleep differences on school behavior, academic achievement and quality of life. Six dependent variables were used: externalizing behavior, internalizing behavior, reading, math, health related quality of life and subjective well being. The independent variable was sleep disorder category. There was a statistically significant difference between students with and without symptoms of sleep disorders on the combined dependent variables: F (6, 199) =2.42, p=.028; Wilks' Lambda=.93; partial eta squared=.07. Due to the statistical significance, the null hypothesis that there would be no difference between the means of the groups was rejected. In order to explain the group differences, follow-up tests were conducted.

To control for Type I error, the alpha level was changed from the conventional .05 level to make it more conservative. A modified Bonferroni procedure was selected to be more conservative than the .05 level of statistical significance due to the large number of variables involved. The modified Bonferroni retains an error rate of 5% (Table 7).

Table 7

Probability Levels for Between-Subjects Effects Using a Modified Bonferroni Adjustment

Instrument	p-value	Alpha Level
R-CBM	.008*	.00833
Internalizing	.009*	.01
Externalizing	.012*	.0125
M-CBM	.017	.01667
PedsQL™ 4.0	.690	.025
SLSS	.898	.05

* p is significant at given α level

Using a modified Bonferroni adjustment, R-CBM, internalizing and externalizing behaviors were significant. Students with symptoms of sleep disorders read statistically significantly fewer words correct per minute than students without symptoms of sleep disorders. Mean words read correct for students with symptoms of sleep disorders was 99 words read correct per minute versus 119 mean words correct for students without symptoms. Students with symptoms of sleep disorders were rated by their teachers as having statistically significantly more internalizing behaviors than students without symptoms (M=47, M=52). Finally, students with symptoms of sleep disorders were rated by their teachers as exhibiting statistically significantly more externalizing behaviors than students without symptoms of sleep disorders (M=49, M=53).

Effect sizes were computed to determine the relative differences between the means. They were calculated for all effects using Cohen's d. Cohen (1988) defined effect sizes as small, *d*=0.2, medium, *d*=0.5 and large, *d*=0.8. Medium effect sizes were obtained for R-CBM (*d*=0.52), internalizing behaviors (*d*=0.45), and externalizing behaviors (*d*=0.45).

Scores on M-CBM, PedsQL™ 4.0 and SLSS did not reach statistical significance. However, students with symptoms of sleep disorders computed math fewer problems correct per minute than students without symptoms of sleep disorders (M = 20, M = 24, SD = 10). Additionally, the effect size of M-CBM was medium (*d*=0.47). Very small effect sizes were found for PedsQL™ 4.0 and SLSS (*d* = 0.07, *d* =0.03) indicating that almost none of the variance in quality of life could be explained by sleep disorder group membership. Though students with symptoms of sleep disorders indicated worse health related quality of life and subjective well being than their peers without symptoms of sleep disorders, the size of the effect renders the difference negligible.

Summary

Results of this study indicate that there may be a large number of students with symptoms of sleep disorders and that those sleep disorders impact school behavior and academic achievement. Almost one-fifth of the sample exhibited nighttime behaviors synonymous with symptoms of one or more sleep disorders. Behaviors consistent with the diagnosis of DSPS were most frequent followed by OSAS, EDS and PLMD.

A MANOVA was statistically significant indicating a difference in students with and without symptoms of sleep disorders on measures of behavior, academic achievement and quality of life. Specifically, students with symptoms of sleep disorders

exhibited more externalizing and internalizing behaviors and read less fluently than peers without symptoms of sleep disorders. The overall effect size was moderate.

On follow-up analyses, R-CBM, internalizing behaviors and externalizing behaviors were significant with medium effects. M-CBM, PedsQL™ 4.0 and SLSS did not reach significance. The effect size of M-CBM was medium and the effect size of PedsQL™ 4.0 and SLSS was none.

Chapter 5

Discussion

The purpose of this study was to determine the prevalence of symptoms of sleep disorders and the effects of sleep disorders on school behavior, academic achievement and quality of life in a school based sample. The current study extended the literature by using a reliable, valid sleep disorder measure designed for screening students at school (Luginbuehl, 2004). Additionally, the study described school success as academic achievement in reading and math. It also included teacher reports of both internalizing and externalizing behaviors and student self-report of quality of life and subjective well being. This chapter discusses the results of this study in light of the proposed research questions. Limitations of the study are presented along with implications for educators and school psychologists. The chapter concludes with suggestions for future research.

Research Questions

Research Question One: What is the prevalence of symptoms of sleep problems/disorders in one school district in the Northeast?

Two hundred sixteen students participated in the current study, which was approximately one-third of the students in the school. There were more second grade than third grade participants and more male than female participants, the result of parents' option to participate.

The study sample was representative of the diverse community from which it was drawn. The study sample was also representative of the school population with regard to free/reduced lunch status (used as an indicator of socioeconomic status) and special education classification rate. Overall, the study sample approximated the school population.

The current study used the Sleep Disorders Inventory for Students – Children's Form (SDIS-C), a nationally validated sleep screening measure whereas other studies used physician report or measures created for the study. Additionally, the current study tapped into an ethnically and socioeconomically diverse community rather than predominately Caucasian, middle-class sample typical of most studies of sleep problems and sleep disorders conducted in University clinics, sleep laboratories, or pediatricians' offices. Parents were given the opportunity to complete the SDIS-C in either English or Spanish. Almost one-fifth of the sample chose to complete the SDIS-C in Spanish. Presumably, this group would not have been represented in the study if the measure was only available in English. The author contends that it is important to screen students for sleep disorders in the native language of their parents, a step rarely taken in research or practice.

The prevalence rate of symptoms of a sleep disorder in this study sample was 17.1%. The result of nearly one-fifth of the sample reported to be at-risk of having a sleep disorder is consistent with previous studies of sleep disorders and sleep problems in children. The community-based study of school-aged children by Blader, Koplewicz, Abikoff, and Foley (1997) found that behaviorally-based sleep problems were experienced by approximately 25% of children ages 5 to 12 years. The average age in

that sample was 7.5 years old which is consistent with the average age in the current study. Sleep onset problems were reported in 11.3% of Blader et al.'s (1997) sample. In the current study, Delayed Sleep Phase Syndrome (DSPS) or Behavioral Insomnia in Children (BIC), which include sleep onset problems, was reported in 9.7% of the sample.

Results of the current study indicate that medically based sleep disorders in early elementary school-age children may be more prevalent than previously thought. Obstructive Sleep Apnea Syndrome (OSAS) and Periodic Limb Movement Disorder (PLMD) were reported more frequently than in other studies of medically based sleep disorders. It is generally accepted that Obstructive Sleep Apnea Syndrome affects 1% to 3% of children with peaks in preschool and early elementary school (e.g., Mindell & Owens, 2003) while prevalence rates of PLMD is unknown (Picchietti et al., 1998). Parents of students in this study reported symptoms consistent with OSAS in 7.9% of the sample, well in excess of the 1% to 3% estimate. Of note, however, is that the 7.9% should serve as a general finding of symptoms of sleep disorders and not an actual diagnosis of OSAS. O'Brien et al. (2003) reported snoring in 12% of students in a community-based study. Snoring alone is not indicative of OSAS but it is one criterion that sleep specialists consider when diagnosing OSAS in children. Parents in this study endorsed PLMD behaviors in 4.2% of the sample, an estimate that may serve as a baseline for future comparison.

Research Question Two: Is there a difference between students with and without symptoms of sleep disorders symptoms as measured by the Sleep Disorders Inventory for Students (SDIS-C) on teacher report of student behavior determined by high scores on the Behavioral Assessment System of Children, second edition (BASC-2)?

Multivariate Analysis of Variance (MANOVA) and follow-up tests revealed a statistically significant difference on teachers' assessments of internalizing and externalizing behaviors between students with and without symptoms of sleep disorders. Externalizing behavior is defined as a single variable comprised of hyperactivity, aggression and conduct problems. Teachers reported more externalizing behaviors in students with symptoms of sleep disorders than students without symptoms of sleep disorders. Though the mean scores for both the No Sleep Disorders symptoms and Sleep Disorders symptoms groups were in the average range, the entire top quartile of students with symptoms of sleep disorders had at-risk or clinically significant scores. Definitive statements regarding sleep disorders and behavior cannot be made since that group was only comprised of eight students.

Results of the current study are consistent with the results of other studies of externalizing behavior and sleep. Chervin et al. (1997) and O'Brien et al. (2003) both found that students with sleep disordered breathing had an increase in hyperactive behaviors. Specifically, snoring was more common in an ADHD group (33%) than a non-ADHD psychiatric (11%) and non-ADHD control group (9%) (Chervin et al., 1997), and ADHD also occurred in half of a snoring group (O'Brien et al., 2003). In addition, PLMD and RLS were related to ADHD-like behaviors and diagnoses (Chervin et al., 2002; Crabtree et al., 2003; Gaultney et al., 2005; Picchietti et al., 1998; Picchietti &

Walters, 1999). The current study considered hyperactivity in conjunction with aggression and conduct problems rather than clinical diagnostic features of ADHD.

Three major components of school success for students are academics, self-management, and social competence (e.g., Bear, 2005; Odom, McConnell, & McEvoy, 1992). Consequently, the combination of hyperactivity, aggression and conduct problems in a student (the three components of the externalizing scale of the BASC-2) can be difficult for a teacher to manage. The students in the current study whose scores fell in the at-risk or clinically significant range on the BASC-2 (t-scores above 60) were rated by their teachers as having problems with self-management (hyperactivity) and/or social competence (aggression and/or conduct problems). These students may be at-risk for alienating their peers and teachers and for suspension and expulsion. For example, the majority of offenses for which students are suspended are related to nonviolent, less-disruptive behavior rather than such things as physical assault or weapons (Raffaele Mendez & Knoff, 2003). If sleep problems contribute to externalizing problems, then recognizing and correcting sleep disorders may reduce hyperactive, aggressive and delinquent behaviors.

Students with symptoms of sleep disorders were also rated by their teachers as exhibiting significantly more internalizing behaviors than students without symptoms of sleep disorders. Internalizing behaviors included anxiety, depression and somatization. As with reports of externalizing behaviors, approximately 25% of students exhibiting sleep disorders symptoms scored at-risk or clinically significant for internalizing behaviors. There were several individual students in the No Sleep Disorder symptoms

group who were rated in the clinically significant range for internalizing problems but the group was not as large (13%).

Crabtree et al. (2004) found that depressive symptoms as measured by the Children's Depression Inventory (CDI), a self-report measure, were significantly higher in children with sleep disorders than without symptoms of sleep disorders. Approximately 20% of a sample of children who snored scored in the clinically significant range compared with approximately 7% of children who did not snore. Results of the current study are consistent with those of Crabtree et al. (2004). It is hypothesized that the sleep disturbance experienced by students in the sample increases fatigue. The increase in fatigue can lead to increased irritability, depressed mood and decreased interest in daily activities. As students become more disinterested in daily activities, interactions with peers might diminish which could lead to the presence of more depressive symptoms. Internalizing symptoms in early elementary school students are not well understood. Additional research on these symptoms and their relationship to quality and quantity of sleep is necessary.

Research Question Three: Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on academic achievement related to reading as determined by Curriculum-based Measurement Reading (R-CBM)?

Multivariate Analysis of Variance (MANOVA) and follow-up tests found a statistically significant difference between students with and without symptoms of sleep disorders on Curriculum-based Measurement Reading (R-CBM). Students with symptoms of sleep disorders read fewer words correct per minute than peers without symptoms of sleep disorders. While the range for words read correctly per minute was

large, the lower quartile of students with symptoms of sleep disorders fell in the below average range (bottom 25%) for R-CBM compared to the entire school. Thus, that group of students demonstrated reading skills below their peers to the degree that immediate reading interventions should be implemented to address the academic needs of those students. Presumably with identification and intervention, this 25% could perform better at school (e.g., Gozal & Pope, 2001).

This is the first study to compare students with and without symptoms of sleep disorders on academic achievement based in the curriculum. However, there are other studies that have considered the relationship between sleep and academics. Findings from studies on the relationship between sleep disordered breathing and academic grades, grade point average or class standing are similar to the current study (Gozal, 1998; Gozal & Pope, 2001; Urschitz et al., 2003). Specifically, students with sleep disordered breathing performed worse than peers academically. Gozal's (1998) study of first graders who were academically ranked in the lowest 10^{th} percentile of their public school class found that 40% of the sample met some criteria for sleep disordered breathing. In the current study, the lower quartile of students with symptoms of sleep disorders fell in the below average reading range (lowest quartile). Results from the study by Urschitz et al. (2003) found that students with sleep disordered breathing were at greater risk of poor performance in reading, science, spelling, handwriting or mathematics.

The results of the current study indicate that the majority of students with symptoms of sleep disorders can read fluently relative to their peers. Even though there was a statistically significant difference between R-CBM scores of students with and without symptoms of sleep disorders, 75% of this sample read in the average or above

average range compared to peers. One-quarter of students with symptoms of sleep disorders could potentially perform better in school after identification and intervention (e.g., Gozal & Pope, 2001), however, overall reading achievement of students with symptoms of sleep disorders in second and third grade is commensurate with their peers.

Research Question Four: Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on academic achievement related to mathematics as determined by Curriculum-based Measurement Math (M-CBM)?

Multivariate Analysis of Variance (MANOVA) and follow-up tests did not find a statistically significant difference between students with and without symptoms of sleep disorders on Curriculum-based Measurement Mathematics (M-CBM). However, there was a medium effect size and students with symptoms of sleep disorders calculated fewer digits correct per minute than peers without symptoms of sleep disorders. For M-CBM, more than one-third of the students in the Sleep Disorders symptoms group were below average

The mixed math results of this study contribute to the discussion of the relationship between sleep problems and mathematics achievement. Mathematics achievement in school has not been studied relative to sleep problems. Studies have, however, used results from math subtests of standardized achievement tests and performance tasks on IQ tests to extrapolate mathematics information. For example, Kaemingk et al. (2003) found no significant difference on math achievement between students ages 6 to 12 years with and without symptoms of Sleep Disordered Breathing. Though the result of no significant difference between Sleep Disorders groups is similar

to the result of this study, the sample age range was large including elementary school and middle school aged students. Standardized achievement tests are not based on classroom practices but are based rather on ideas of what students are supposed to learn at each grade. In practice, teaching and student learning varies from state to state.

Additional research on mathematics based in the curriculum and the impact of sleep on mathematics achievement is necessary. M-CBM has a strong theoretical and research base. However, the curriculum adopted by the participating school district did not include instruction in computation skills. Thus, computational skills assessed through M-CBM were not aligned with the curriculum of the study school district. That in and of itself should not effect the results of the study but should be an important consideration for future studies. As with reading achievement, mathematics and logic skills build upon each other as students progress through school. More than one-third of the probable sleep disorders group faced math deficits relative to their peers. Due to the fact that these students potentially lack basic math skills, prognosis without immediate intervention is not good. However, with identification of and intervention for sleep disorders, achievement may increase (e.g., Gozal & Pope 2001).

Research Question Five: Is there a difference between students with and without symptoms of sleep disorders as measured by the SDIS-C on student self-report of quality of life determined by high scores on the PedsQL™ 4.0 and low scores on the Students' Life Satisfaction Scale (SLSS)?

Follow-up tests to the significant Multivariate Analysis of Variance (MANOVA) effect did not find a statistically significant difference between students with and without symptoms of sleep disorders on measures of quality of life. Additionally, there were no

practical differences between student reports of health-related quality of life or subjective well-being. These results conflict with previous studies of HRQOL in children with sleep disorders.

Rosen et al. (2002) and Hart et al. (2005) found differences between children with and without symptoms of sleep disorders on parental reports of quality of life. The study by Rosen et al. (2002) found that increases in SDB lead to decrease in HRQOL in children ages 5 to 17 years old. Hart et al. (2005) found a lower HRQOL reported by parents of children with sleep disorders (behavioral sleep disorders and physiological sleep disorders). Children ranged in age from 5 to 18 years old. Finally, Crabtree et al. (2004) found significantly lower scores on HRQOL between children with SDB and controls on both parent report and self-report in children ages 8 to 13 years.

The study by Crabtree et al. (2004) included 82 children ages 8 to 13 with SDB and 31 controls. The SDB group's mean self-report PedsQL™ 4.0 score was approximately 65 and the mean score for the control group was approximately 84. The SDB group's score was lower than the score for the sleep disorders group in this study (M=75.81) and the control group's score was much higher than the No Sleep Disorders symptoms group in this study (M=76.94). The difference in results could be due to age and developmental level.

The current study used student self-report of HRQOL and subjective well-being. Though the PedsQL™ 4.0 and the SLSS were both indicated for use with students in second and third grades, the abstract nature of the questions was difficult for some of the students to fully comprehend. For example, one of the questions on the SLSS was "I have a good life." Many students verbally said "yes" and noted agreement on the

measure. Another similar question on the SLSS was "I have everything I want in life" to which many students remarked "no" and noted an ambiguous response or disagreement on the measure adding that they desired money, toys or other monetary possessions. Therefore these responses contradict each other when students should have noted similar responses for both.

The measures were administered to groups of children which follows the protocol of previous research studies. However, individual administration might have been more appropriate given the young age of the participants. Though students were trained on each of the measures prior to administration, students appeared to give socially desirable responses. The study by Crabtree et al. (2004), which was the only other student self-report study, included students that were much older than the current population (i.e., ages 8 to 13 years) and collapsed scores across ages. Thus, it is unknown whether there was a difference in HRQOL between older and younger students in that study. Additionally, the study by Crabtree et al. (2004) used students with SDB. This current study included students with symptoms of the major sleep disorders in children, not just SDB or OSAS. Students with SDB have a decreased quality of sleep whereas students with DSPS potentially obtain good quality sleep but a decrease in quantity of sleep. Perhaps quality rather than quantity of sleep has a greater impact on quality of life.

In second and third grades, students with symptoms of sleep disorders may be just beginning to experience school frustration associated with their sleep disorder. As indicated by study results, students may have more behavior problems as well as reading and potentially math difficulties. Quality of life and subjective well-being should be related to internalizing problems where an increase in fatigue associated with a sleep

disorder leads to an increase in such states as irritability, moodiness, hyperactivity and aggression. Any of those behavioral symptoms or a combination of the symptoms (as found in this study) may interfere with daily functioning including peers, school and family. When the student withdraws from or is ostracized from peers, school and family due to internalizing and externalizing behaviors, quality of life will decrease fueling the continuing cycle. Results of this study may indicate that the cycle has only just begun in second and third grade students.

An alternative explanation comes from research on childhood cancer and subjective-well being. Emerging research suggests a link between dimensions of overall health and quality of life whereby children with cancer adapted to their life circumstances. Children and adolescents with cancer did not demonstrate differences in subjective well-being from their healthy counterparts, and their level of subjective well-being did not change as a function of months since cancer diagnosis or as patients progressed through treatment (McKnight, 2004). Children may draw more on relationship variables and current social-emotional functioning when making global appraisals of their quality of life which would explain the results of the current study.

Implications for School Psychologists

Results of the current study hold implications for the practice of educators and school psychologists. This study supports a relationship between sleep, behavior and academic performance, though the causal pathway is unknown. Understanding this relationship is important since it is the responsibility of educators to teach behavior and academics.

School psychologists are charged with helping students achieve positive educational outcomes through prevention, early identification, and intervention. In the current study, 25% of the students with symptoms of sleep disorders met criteria for being at-risk or in the clinically significant range for internalizing and externalizing behaviors at school. Additionally, at least one-fourth of the students with symptoms of sleep disorders fell in the below average range in reading and math achievement, suggesting the need for academic intervention. It is probable that these students have been or will be presented to the school psychologist due to concerns with behavior and/or academics.

The necessary quality and quantity of sleep for optimal behavioral and academic success is not yet understood. What is understood is that students with sleep disorders are fatigued because they do not obtain adequate quality or quantity of sleep. Students who attend school fatigued are less likely to pay attention to and consequently retain material that is being taught. In this study, more students fell into the category of symptoms of DSPS/BIC than other sleep disorders. Most probably these students went to bed late perhaps as a result of past or current bedtime struggles augmented by their externalizing behaviors. Students who are fatigued and consequently exhibiting hyperactive or aggressive behaviors due to fatigue may miss out on learning opportunities in school as well as the opportunity to reinforce and practice skills at home through homework.

This study supported that students with suspected sleep disorders may also exhibit internalizing problems which can impact academic achievement. Students who are anxious or depressed may be unable or unwilling to complete academic assignments,

work in groups, take tests or complete homework. Without learning or practice opportunities, internalizing symptoms may increase as the student slips academically and socially behind their peers.

At the time of this study, participants were just beginning their educational career yet 25% of those with a probably sleep disorder already appeared to be in need of immediate intervention to address significant reading deficits. The transition from lower elementary school to upper elementary school is a critical time when students advance from learning to read to reading to learn. It appears that approximately one-fourth of the students with symptoms of sleep disorders have not acquired requisite reading skills and are on course for poor academic consequences. As the group with probable sleep disorders ages, additional students with untreated symptoms of sleep disorders may also join the failing group as academic rigors increase. Early identification and intervention is key. Presumably, the 25% at-risk for reading failure and others not yet at-risk would perform better in school after identification and intervention for their sleep disorder (e.g., Gozal & Pope, 2001).

Best school psychological practice takes a proactive rather than reactive stance including prevention, early identification, and intervention. In this prevention and early intervention approach, all students are universally screened on reading and preferably mathematics skills as well as behavior so that evidence-based interventions can be provided to students who are at-risk. Universal screening is a crucial time to also screen students for sleep disorders. Alternately, sleep disorder screening can be completed with Kindergarten screening or new student screening. Screening students universally for sleep disorders, alerting parents to the results of screenings in the at-risk range, and

recommending medical and/or behavioral follow-up may avoid academic and behavioral failure for some.

Limitations

Several threats to internal and external validity limit the interpretation of the results. Internal validity can be described as the stipulation that the observed differences on the dependent variable are the result of the independent variable and not something else (Gay & Airasian, 2000). Consequently, internal validity is threatened when rival hypotheses can not be eliminated. Several potential threats to the internal validity of this study exist including instrumentation, differential selection of participants or selection bias, and history. External validity, by contrast, is the extent to which study findings can be generalized to and across populations, settings, and times (Johnson & Christensen, 2000). Threats to external validity in the current study include population validity, ecological validity, and specificity of variables.

Threats to internal validity limit interpretation and generalizability of the results. First, instrumentation is a threat to internal validity. Certain measures were selected over others to determine sleep disorders, classroom behaviors, academic performance, and quality of life. The SDIS-C was selected as the measure to identify symptoms of sleep disorder. However, for the current study students were considered as having symptoms of a sleep disorder if they fell in the cautionary or at-risk range of one of the sleep disorders as indicated by their parents or caregivers. In the validation of the SDIS-C, only scores in the at-risk range were considered. Therefore, in combining categories, the data may be inflated and should be interpreted with caution.

Second, differential selection of participants or selection bias may be a threat to internal validity. Participants were self-selected for the current study based on parent and student interest, parent consent and student assent; only 36.9% of the second- and third grade population of the school (and consequently the state) participated. Third, history may have been a threat to internal validity. Some students with symptoms of sleep disorders may have had intensive academic or behavioral interventions put into place. Additionally, the quality of teaching, quantity of material covered, and outside academic and psychological supports received may have varied from student to student. Conclusions of the current study must be interpreted and extrapolated with caution outside of the measures given and individuals assessed.

Threats to external validity include population validity, ecological validity, and specificity of variables. Population and ecological validity refer to the extent to which results are generalizable from the sample of participants to the larger population, as well as across settings, contexts, and conditions (Onwuegbuzie, 2003). Due to the fact that this study was conducted with second-and third-graders in one suburb of a large city in the Northeast, results should be generalized cautiously to the larger national population. Research findings are also less generalizable due to specificity of variables or the combination of specific variables (e.g., participants, time, context, conditions, and variables).

Directions for Future Practice/Research

The results of this study are important for the practice of school psychology. In the field, there is an ongoing discussion of the importance of expanding the knowledge base of school psychology practitioners to include chronic illness and its impact on the

school (Nastasi, 2000). School psychologists must broaden their scope of identity and service delivery. As found in this study, sleep disorders may have profound effects on students' academic achievement, behavioral outcomes, and social and emotional functioning.

Definition and identification of a school psychologist begins at the preservice level. Graduate training programs must educate future school psychologists about students with chronic illness specifically sleep disorders. Future school psychologists should be familiar with the symptoms of sleep disorders as well as screening measures (such as the SDIS-C) for the identification of sleep disorders.

Future school psychologists should consider the child within an ecology including community and family. An increase in collaboration between educational and medical personnel will facilitate the dissemination of information received from the screening and identification of sleep disorders. Home–school collaboration should be stressed early in training as home factors, such as sleep, have a major impact on school.

Practicing school psychologists should continue to gain knowledge on the impact of sleep disorders on school behavior and academics. This can be done through continuing professional development such as conference attendance. School psychologists should begin to or continue to collaborate with medical personnel specifically pediatricians in the community in which they work. They can explain to pediatricians the importance of asking parents about their child's sleep. They can also share the results of sleep disorders screenings with pediatricians in order to arrive at appropriate intervention.

Practitioners may be best suited to inform educators and parents. Educators, most notably classroom teachers, are in a position to recognize daytime symptoms of sleep disorders including excessive daytime sleepiness, atypical behavioral symptoms and decreased academic performance. Educators must be trained to recognize symptoms of sleep disorders so that appropriate interventions can be implemented. School psychologists should also educate parents of children from birth through high school about the importance of sleep and the consequences of poor quality and/or quantity of sleep. Sleep requirements change as students move along the developmental continuum and parents should be educated as to normal sleeping behaviors at each age or stage of development as well as the contributions of sleep to academics and behavior. School psychologists should understand and educate parents and students about good sleep hygiene including bedtime routines (Mindell & Owens, 2003).

Practicing school psychologists and training institutions should educate the national public and policy makers on the importance of sleep and school-based consequences of poor sleep. School psychologists should stress the importance of avoiding early school start times because it is inconsistent with maximizing academic performance and can contribute to sleep insufficiency (Wolfson & Carskadon, 2003). Additionally, sleep debt and lack of societal productivity caused by sleep debt is becoming a national crisis. Policy makers should focus attention and resources to early identification and intervention in collaboration with schools in order to curtail this growing economic problem.

There are several directions for school-based research of sleep disorders. Since this is the first study to investigate the relationship between parent identified sleep

disorders using a psychometrically sound sleep disorder screening measure for use in schools, teacher report of student internalizing and externalizing behavior, student academic achievement in reading and mathematics based in the curriculum, and student report of quality of life, additional research is warranted. Specifically, school-based and community-based research should continue to collect data on prevalence rates of all sleep disorders experienced in childhood. These studies should include children of diverse ethnic and socioeconomic backgrounds.

Continued sleep disorder research on school behavior is also necessary. Students spend the majority of their day in schools and teachers may be the most appropriate individuals to rate behavior. This study found a relationship between hyperactivity, aggression, conduct problems and sleep. Further analysis into how each externalizing construct is separately related to sleep is necessary. Additionally, the question of reduction of externalizing behaviors with sleep disorder intervention remains to be answered. A relationship between anxiety, depression, somatization and sleep was also found in this study. The causal relationship of internalizing behaviors and sleep remains unknown. Is it that the internalizing behaviors lead to sleep problems or do sleep problems lead to internalizing behaviors? This question requires an answer.

More research on the difference in actual academic skills between students with and without symptoms of sleep disorders would add to the literature base. Currently, under No Child Left Behind (NCLB) legislation, all third grade students must take a state test of achievement. A comparison of scores received by students with and without symptoms of sleep disorders on the state achievement test is a necessary next step for the sleep research community. Rather than focusing on cognitive tasks and intelligence tests,

research on student performance in the curriculum and school success or failure is needed.

Additional follow-up of this cohort as well as prevention and replication studies are needed. Follow-up of this study on the long term academic outcome of students who are and are not treated would be interesting to determine if academic performance continues to decline. A preventative study would add to the literature base. If all students in a school or community were screened in early childhood, pre-kindergarten or kindergarten and interventions occurred, would 25% be at-risk for reading failure and 33% be at-risk for math failure? Lastly, replicating this study with an adolescent population is an essential next step.

Finally, since overnight polysomnography is the gold standard in sleep research, it will be important to follow-up with the students in the current study who were screened to have a sleep disorder to determine if they were in fact diagnosed using PSG. It is also important to follow-up with this cohort to determine if student behavioral problems decrease and academic achievement increase with treatment.

Conclusion

Sleep problems in childhood are prevalent and they seem to have measurable effects on a variety of life functions. In many cases, the problems are preventable and in many others they are treatable. The current study examined the effect of symptoms sleep disorders on school behavior, academic performance and quality of life in a diverse school-based sample of second and third grade students. Symptoms of sleep disorders occurred in almost one-fifth of the sample. Results supported an overall difference in school behavior and reading between students with and without symptoms of sleep

disorders. Students with symptoms of sleep disorders performed significantly worse in reading achievement and exhibited significantly more internalizing and externalizing behaviors than students without symptoms of sleep disorders. These results have several implications but must be interpreted with caution due to the limitations of the study. School psychologists can inform and advocate for early identification and intervention of sleep disorders to respond to this impending health emergency.

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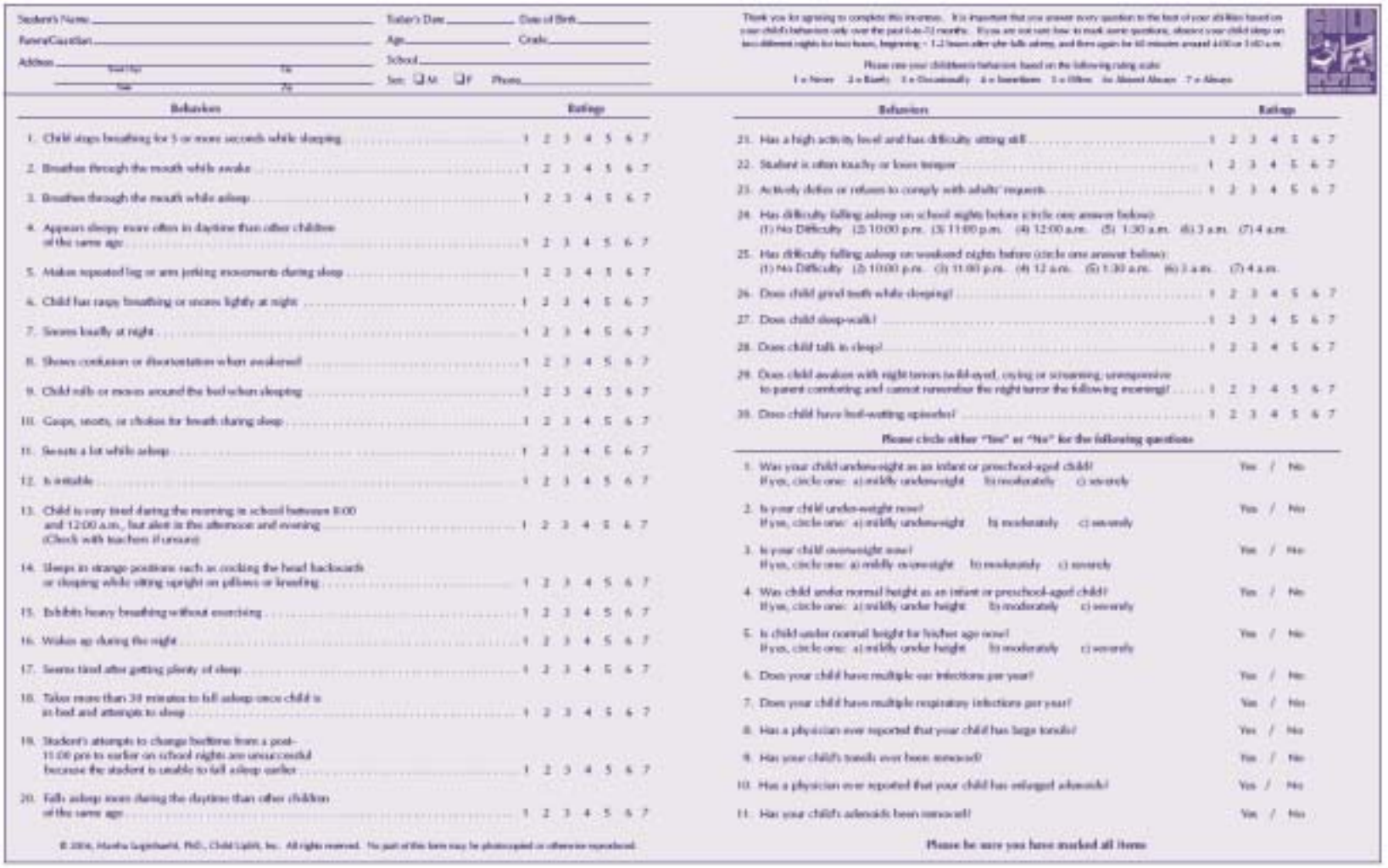
Appendices

Appendix A: Sleep Disorders Inventory for Students – Children's Form



Student's Name: _____ Today's Date: _____ Date of Birth: _____

Parent/Guardian: _____ Age: _____ Grade: _____

Address: _____ School: _____

_____ Sex: ☐ M ☐ F Phone: _____

Thank you for agreeing to complete this inventory. It is important that you answer every question to the best of your abilities based on your child's behaviors only over the past 6-to-12 months. If you are not sure how to mark some questions, observe your child sleep on two different nights for two hours, beginning ~ 1-2 hours after s/he falls asleep, and then again for 60 minutes around 4:00 or 5:00 a.m.

Please rate your child's behaviors based on the following rating scale:

1 = Never 2 = Rarely 3 = Occasionally 4 = Sometimes 5 = Often 6= Almost Always 7 = Always

Behaviors	Ratings
1. Child stops breathing for 5 or more seconds while sleeping	1 2 3 4 5 6 7
2. Breathes through the mouth while awake	1 2 3 4 5 6 7
3. Breathes through the mouth while asleep	1 2 3 4 5 6 7
4. Appears sleepy more often in daytime than other children of the same age	1 2 3 4 5 6 7
5. Makes repeated leg or arm jerking movements during sleep	1 2 3 4 5 6 7
6. Child has raspy breathing or snores lightly at night	1 2 3 4 5 6 7
7. Snores loudly at night	1 2 3 4 5 6 7
8. Shows confusion or disorientation when awakened	1 2 3 4 5 6 7
9. Child rolls or moves around the bed when sleeping	1 2 3 4 5 6 7
10. Gasps, snorts, or chokes for breath during sleep	1 2 3 4 5 6 7
11. Sweats a lot while asleep	1 2 3 4 5 6 7
12. Is irritable	1 2 3 4 5 6 7
13. Child is very tired during the morning in school between 8:00 and 12:00 a.m., but alert in the afternoon and evening (Check with teachers if unsure)	1 2 3 4 5 6 7
14. Sleeps in strange positions such as cocking the head backwards or sleeping while sitting upright on pillows or kneeling	1 2 3 4 5 6 7
15. Exhibits heavy breathing without exercising	1 2 3 4 5 6 7
16. Wakes up during the night	1 2 3 4 5 6 7
17. Seems tired after getting plenty of sleep	1 2 3 4 5 6 7
18. Takes more than 30 minutes to fall asleep once child is in bed and attempts to sleep	1 2 3 4 5 6 7
19. Student's attempts to change bedtime from a post-11:00 pm to earlier on school nights are unsuccessful because the student is unable to fall asleep earlier	1 2 3 4 5 6 7
20. Falls asleep more during the daytime than other children of the same age	1 2 3 4 5 6 7

Behaviors	Ratings
21. Has a high activity level and has difficulty sitting still	1 2 3 4 5 6 7
22. Student is often touchy or loses temper	1 2 3 4 5 6 7
23. Actively defies or refuses to comply with adults' requests	1 2 3 4 5 6 7
24. Has difficulty falling asleep on school nights before (circle one answer below): (1) No Difficulty (2) 10:00 p.m. (3) 11:00 p.m. (4) 12:00 a.m. (5) 1:30 a.m. (6) 3 a.m. (7) 4 a.m.	
25. Has difficulty falling asleep on weekend nights before (circle one answer below): (1) No Difficulty (2) 10:00 p.m. (3) 11:00 p.m. (4) 12 a.m. (5) 1:30 a.m. (6) 3 a.m. (7) 4 a.m.	
26. Does child grind teeth while sleeping?	1 2 3 4 5 6 7
27. Does child sleep-walk?	1 2 3 4 5 6 7
28. Does child talk in sleep?	1 2 3 4 5 6 7
29. Does child awaken with night terrors (wild-eyed, crying or screaming, unresponsive to parent comforting and cannot remember the night terror the following morning)?	1 2 3 4 5 6 7
30. Does child have bed-wetting episodes?	1 2 3 4 5 6 7

Please circle either "Yes" or "No" for the following questions

1. Was your child underweight as an infant or preschool-aged child? If yes, circle one: a) mildly underweight b) moderately c) severely	Yes / No
2. Is your child under-weight now? If yes, circle one: a) mildly underweight b) moderately c) severely	Yes / No
3. Is your child overweight now? If yes, circle one: a) mildly overweight b) moderately c) severely	Yes / No
4. Was child under normal height as an infant or preschool-aged child? If yes, circle one: a) mildly under height b) moderately c) severely	Yes / No
5. Is child under normal height for his/her age now? If yes, circle one: a) mildly under height b) moderately c) severely	Yes / No
6. Does your child have multiple ear infections per year?	Yes / No
7. Does your child have multiple respiratory infections per year?	Yes / No
8. Has a physician ever reported that your child has large tonsils?	Yes / No
9. Has your child's tonsils ever been removed?	Yes / No
10. Has a physician ever reported that your child has enlarged adenoids?	Yes / No
11. Has your child's adenoids been removed?	Yes / No

Please be sure you have marked all items

Appendix B: Curriculum-based Measurement Reading Sample Probe

Dad and Rob went fishing. 5
"We will catch fish to eat for lunch," said Dad. 15
They loaded their fishing things into the boat: poles, bait, 25
life jackets, and a net. 30
"Let's catch a fish!" said Rob. 36
Dad made the boat go fast over the water. Rob liked 47
feeling the wind in his hair. He liked feeling the cold water 59
splash his face. 62
Soon they arrived at Dad's secret fishing spot. Dad took a 73
minnow to put it on the hook. 80
"The big fish will try to eat this little fish. Then we will catch 94
him," Dad told Rob. 98
Rob said, "What! We will let a big fish eat this little fish?" 111
Rob looked at Dad with sad eyes. 118
He took the minnow from Dad. He held the little minnow in 130
his hands. 132
"Dad, this little minnow has a family in our bait bucket! He 144
has a mom who will miss him! He has a dad who will be mad 159
at you for taking his baby! All the brother and sister fish will 172
cry!" said Rob. 175
Dad shook his head. He started the motor and steered the 186
boat toward home. Rob smiled. He was happy now because 196
he had saved the little minnow. 202
Dad frowned and said, "I guess we will just have to eat hot 215
dogs for lunch." 218

Appendix C: Curriculum-based Measurement Math Sample Probe

AIMSweb® M-CBM Computation Benchmark #6 - Grade 2 Answer Key

3 - 2 **1** (1)	3 - 2 **1** (1)	7 + 7 **14** (2)	9 - 6 **3** (1)	1 + 3 **4** (1)	5 + 5 **10** (2)	8 (8)
88 - 11 **77** (2)	71 + 88 **159** (3)	44 + 67 **111** (3)	6 + 2 **8** (1)	90 + 28 **118** (3)	11 + 10 **21** (2)	14 (22)
15 - 2 **13** (2)	62 - 61 **1** (1)	17 + 1 **18** (2)	2 + 3 **5** (1)	4 + 6 **10** (2)	1 + 1 **2** (1)	9 (31)
40 - 24 **16** (2)	8 + 9 **17** (2)	8 3 + 9 **20** (2)	8 + 0 **8** (1)	2 + 9 **11** (2)	9 + 4 **13** (2)	11 (42)
11 - 2 **9** (1)	97 + 0 **97** (2)	89 - 8 **81** (2)	32 + 36 **68** (2)	19 + 0 **19** (2)	54 + 80 **134** (3)	12 (54)
13 + 11 **24** (2)	94 + 53 **147** (3)	68 + 39 **107** (3)	9 + 1 **10** (2)	7 - 0 **7** (1)	1 3 + 6 **10** (2)	13 (67)

Page 1 of 2

Appendix D: PedsQL™ 4.0

PedsQL™ Pediatric Quality of Life Inventory Version 4.0 CHILD REPORT (Varni, 1998)

In the Past ONE month, hoe much of a problem has this been for you…

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activities or exercise	0	1	2	3	4
4. It is hard for me to life something heavy	0	1	2	3	4
5. It is hard for me to take a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I hurt or ache	0	1	2	3	4
8. I have low energy	0	1	2	3	4

ABOUT MY FEELINGS (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad or blue	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

HOW I GET ALONG WITH OTHERS (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. I have trouble getting along with other kids	0	1	2	3	4
2. Other kids do not want to be my friend	0	1	2	3	4
3. Other kids tease me	0	1	2	3	4
4. I cannot do things that other kids my age can do	0	1	2	3	4
5. It is hard to keep up when I play with other kids	0	1	2	3	4

ABOUT SCHOOL (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. It is hard to pay attention in class	0	1	2	3	4
2. I forget things	0	1	2	3	4
3. I have trouble keeping up with my schoolwork	0	1	2	3	4
4. I miss school because of not feeling well	0	1	2	3	4
5. I miss school to go to the doctor or hospital	0	1	2	3	4

Appendix E: Student's Life Satisfaction Scale

Students' Life Satisfaction Scale
(Huebner, 1991)

Directions: We would like to know what thoughts about life you have had during the past several weeks. Think about how you spend each day and night and then think about how your life has been during most of this time. Here are some questions that ask you to indicate your satisfaction with your overall life. Circle the words next to each statement that indicate the extent to which you agree or disagree with each statement. For example, if you Strongly Agree with the statement "Life is great," you would circle those words on the following sample item;

Life is great.

Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree

It is important to know what you REALLY think, so please answer the questions the way you really think, not how you should think. This is NOT a test. There are NO right or wrong answers.

1. My life is going well.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
2. My life is just right.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
3. I would like to change many things in my life.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
4. I wish I had a different kind of life.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
5. I have a good life.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
6. I have what I want in life.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
7. My life is better than most kids.					
Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree

Huebner, E. S. (1991). Initial development of the Students' Life Satisfaction Scale. School Psychology International, 12, 231-243.

Appendix F: Parent Consent Form

Parent Consent Form

I am the Brookside School Psychology Intern, a doctoral candidate in school psychology at the University of South Florida, and the Principal Investigator of this study entitled "Effects of Sleep Disorders on School Behavior, Academic Performance, and Quality of Life." Sleep problems are one of the most common issues faced by families. Many if not most children have problems with sleep at one point during childhood. I seek to understand the relationship between children's sleep problems and school performance. I would like your agreement to participate in this study.

Participation in the study involves four things. By consenting to study participation, you are consenting to all parts of the study. First, you as the parent or legal guardian of a Brookside School student will complete the Sleep Disorders Inventory for Students (SDIS-C) which is attached. Second, your child's teacher will complete a brief behavior rating scale on your child's classroom behavior. Third, your child's academic achievement records will be accessed from a schoolwide database. Fourth, your child will be asked to answer a two brief questionnaires on his or her thoughts about school.

By participating in this study, you will assist in building a knowledge base from which we can better understand the relationship between sleep problems and school functioning. This information will assist children suffering from sleep problems get the help that they need. The information gathered will be completely confidential and you or your child will never be identified in any material that is presented or published. You may be contacted for follow-up by telephone in the event that an item on the SDIS-C is left blank or if your response is unclear. If your child has a sleep problem as indicated by questionnaires, you will be personally invited to discuss the report in a one-on-one session with me in order to get appropriate medical help.

Your participation and your child's participation in the study is voluntary. Study participation poses minimal risk to you or your child, and you or your child may discontinue participation at any time without penalty. If you and your child do choose to participate, all identifying information provided will remain anonymous and confidential. **Please complete and return this consent form and the SDIS-C to your child's teacher by March 14, 2006.** It is estimated that it will only take 10 minutes to complete the SDIS-C.

If you have any questions about this study, you may contact me directly by phone at (914) 762-5780x305 or email eax@ossining.k12.ny.us. If you have any questions about your rights as a person taking part in a research study, you may contact a member of the Division of Compliance Services at the University of South Florida at (813) 974-5638.

Sincerely,

Erin E. Ax, M.A.
Ossining UFSD School Psychology Intern
Graduate Student in School Psychology
College of Education
University of South Florida

I understand that my participation and my child's participation in the study poses minimal risk and is voluntary and that I may discontinue participation at any time without penalty.

I agree to study participation _____ _____

Parent/Guardian name Parent/Guardian signature Date

Child: _____Child's Teacher: _____

Please complete and return this consent form and the SDIS-C to your child's teacher by March 14.
THANK YOU!

Appendix G: Teacher Consent Form

Teacher Consent Form

I am the Brookside School Psychology Intern, a doctoral candidate in school psychology at the University of South Florida, and the Principal Investigator of this study entitled "Effects of Sleep Disorders on School Behavior, Academic Performance, and Quality of Life." Sleep problems are one of the most common issues faced by families. Many if not most children have problems with sleep at one point during childhood. I seek to understand the relationship between children's sleep problems and school performance. I would like your agreement to participate in this study.

Participation in the study involves completing part of a brief behavior rating scale on each of your students whose parents consent to study participation. The rating scale, The Behavior Assessment System for Children, Second Edition (BASC-2) is expected to take approximately five minutes to complete per student.

By participating in this study, you will assist in building a knowledge base from which we can better understand the relationship between sleep problems and school functioning. This information will assist children suffering from sleep problems get the help that they need. The information gathered will be completely confidential and your name and the student's name will never be identified in any material that is presented or published.

Your participation in the study is voluntary. Study participation poses minimal risk to you and you may discontinue participation at any time without penalty. If you choose to participate, all identifying information provided will remain anonymous and confidential.

If you have any questions about this study, you may contact me directly by phone at (914) 762-5780x305, email eax@ossining.k12.ny.us, or in person. If you have any questions about your rights as a person taking part in a research study, you may contact a member of the Division of Compliance Services at the University of South Florida at (813) 974-5638.

Sincerely,

Erin E. Ax, M.A.
Ossining UFSD School Psychology Intern
Graduate Student in School Psychology
College of Education
University of South Florida

I understand that my participation in the study poses minimal risk and is voluntary and that I may discontinue participation at any time without penalty.

I agree to study participation _____ _____
Name Date

Appendix H: Student Assent Form

Student Assent Form

I am the school psychology intern is working on a research study called "Effects of Sleep Disorders on School Behavior, Academic Performance, and Quality of Life." Myself and others at Brookside are interested in finding out what you think about your health and activities, your feelings, how you get along with others and about school.

We would like you to complete one questionnaire with 23 questions and another questionnaire with 7 questions. I will read all of the questions to you. Answering the questions will cause little harm. If you want to talk to me after you answer the questions, you can.

The answers that you give will not be shared with your teachers or your parents so it is important that you are honest about how you feel. Your answers will only be seen by me and will be kept in a locked cabinet. I might write about the study but will not use your name.

I understand that participating in the study will not hurt me and I also understand that I do not have to participate. If I decide not to participate, it won't effect my grade.

I agree to participate in the study.

Name: _____

Appendix I: Local R-CBM Norms Based on 2004-2005 Data

Grade	Below Average (wcpm[a])	Average (wcpm[a])	Above Average (wcpm[a])
Second grade (Winter)	0-56	57-110	111+
Second grade (Spring)	0-70	71-126	127+
Third grade (Winter)	0-69	70-135	136+
Third grade (Spring)	0-83	84-144	145+

[a] wcpm = words read correct per minute.

Appendix J: M-CBM Norms Based on 2005-2006 Data and National Norming Procedures

Grade	Below Average (DC[a])	Average (DC[a])	Above Average (DC[a])
Second grade (Fall)	0-7	8-13	14+
Second grade (Expected Winter)	0-11	12-17	18+
Second grade (Expected Spring)	0-15	16-21	22+
Third grade (Fall)	0-12	13-20	21+
Third grade (Expected Winter)	0-17	18-25	26+
Third grade (Expected Spring)	0-22	23-30	31+

[a]DC = digits correct in two minutes.

Appendix K: Study Participant Characteristics by Sleep Disorders Symptoms

Characteristic	OSAS (N=17)	PLMD (N=9)	DSPS (N=22)	EDS (N=11)
Gender				
Female	8 (47.1%)	5 (55.6%)	8 (36.4%)	7 (63.6%)
Male	9 (52.9%)	4 (44.4%)	13 (59.1%)	4 (36.4%)
Special Education Classification				
LD	1 (5.9%)	1 (11.1%)	0 (0.0%)	2 (18.2%)
SLI	2 (11.8%)	2 (22.2%)	3 (13.6%)	2 (18.2%)
Autistic	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Multiple Disabilities	1 (5.9%)	1 (11.1%)	1 (4.5%)	0 (0.0%)
OHI	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
504[a]	1 (5.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
None	12 (70.6%)	5 (55.6%)	17 (77.3%)	7 (63.6%)
Ethnicity				
Caucasian	9 (52.9%)	4 (44.4%)	10 (45.5%)	5 (45.5%)
Hispanic	5 (29.4%)	4 (44.4%)	7 (31.8%)	4 (36.4%)
Black/African American	3 (17.6%)	1 (11.1%)	4 (18.2%)	2 (18.2%)
Asian	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Lunch Status				
Full Priced Lunch	10 (58.8%)	5 (55.6%)	13 (59.1%)	5 (45.5%)
Free or Reduced Lunch	7 (41.2%)	4 (44.4%)	8 (36.4%)	6 (54.5%)

[a]Section 504 requires a written accommodation plan. A student is eligible as long he/she currently has, has had, or is regarded as having a physical or mental impairment which substantially limits a major life activity.

Appendix L: Study Participant Characteristics by Number of Potential Sleep Disorders

Characteristic	One (N=25,67.6%)	Two (N=6,16.2%))	Three (N=3, 8.1%)	Four (N=3, 8.1%)
Gender				
Female	10 (40.0%)	2 (33.3%)	2 (66.7%)	2 (66.7%)
Male	15 (60.0%)	4 (66.7%)	1 (33.3%)	1 (33.3%)
Ethnicity				
Caucasian	11 (44.0%)	3 (50.0%)	1 (33.3%)	2 (66.7%)
Hispanic	8 (32.0%)	1 (16.7%)	2 (66.7%)	1 (33.3%)
Black/African American	6 (24.0%)	2 (33.3%)	0 (0.0%)	0 (0.0%)
Asian	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Special Education Classification				
LD	1 (4.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)
SLI	4 (16.0%)	1 (16.7%)	1 (33.3%)	0 (0.0%
Autistic	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Multiple Disabilities	0 (0.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)
OHI	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
504[a]	1 (4.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
None	19 (76.0%)	5 (83.3%)	0 (0.0%)	3 (100.0%)
Lunch Status				
Full Priced Lunch	15 (60.0%)	2 (33.3%)	2 (66.7%)	2 (66.7%)
Free or Reduced Lunch	10 (40.0%)	4 (66.7%)	1 (33.3%)	1 (33.3%)

[a]Section 504 requires a written accommodation plan. A student is eligible as long he/she currently has, has had, or is regarded as having a physical or mental impairment which substantially limits a major life activity.

Appendix M: Correlations Between Dependent Variables

Instruments	1	2	3	4	5	6
1. Externalizing	--	.56	-.26	-.19	-.01	-.22
2. Internalizing		--	-.23	-.21	-.15	-.06
3. R-CBM			--	.44	-.07	.06
4. M-CBM				--	-.09	.03
5. PedsQL™ 4.0					--	.32
6. SLSS						--

About the Author

Erin Elizabeth Ax received her Ph.D. in School Psychology from the University of South Florida. While at USF, Erin was involved in many projects related to academic and behavioral assessment and intervention. She also specialized in pediatric health issues focusing on collaboration between pediatricians and educators as well as sleep disorders and their impact on schooling. Erin received the Florida Association of School Psychologists' Graduate Student of the Year Award in 2005. She has published articles and book chapters related to academics and pediatric health issues. Erin currently resides in New York City where she works as a school psychologist and educational consultant.