ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND SLEEP DISTURBANCES:

CONSIDERATION OF

FAMILIAL INFLUENCES

_____

A Dissertation

Presented to

The College of Graduate and Professional Studies

Department of Psychology

Indiana State University

Terre Haute, Indiana

_____

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Psychology

_____

by

Gretchen Stuckert Noble

December 2009

Keywords: attention-deficit/hyperactivity disorder sleep disturbances

VITA

Gretchen S. Noble

EDUCATION

2009   Indiana State University, Terre Haute, Indiana
            Psy.D. in Clinical Psychology

2006   Indiana State University, Terre Haute, Indiana
            M.S. in Psychology

2003   Baylor University, Waco, Texas
            B.A. in Psychology

PROFESSIONAL EXPERIENCE

2009   Children's Medical Center
            Dallas, Texas
            Pediatric Health Psychology Post-Doctoral Fellow

2008-2009   Hawthorn Center, Inpatient Child and Adolescent Psychiatric Hospital
            Northville, Michigan
            Pre-Doctoral Intern

2007-2008   The Willows Intensive Youth Services
            Vincennes, Indiana
            Graduate Therapist

2006-2007   Hamilton Center, Inc., Child and Adolescent Services
            Terre Haute, Indiana
            Graduate Therapist

2006 summer Riley Hospital for Children
            Indianapolis, Indiana
            Simmons Summer Intern, Consultation-Liaison Service

2005-2007   Indiana State University Psychology Clinic
            Terre Haute, Indiana
            Graduate Clinician

COMMITTEE MEMBERS

Committee Chair: Liz O'Laughlin, Ph.D.

Associate Professor

Indiana State University

Committee Member: Michael J. Murphy, Ph.D.

Professor

Indiana State University

Committee Member: Brad Brubaker, Ph.D.

Assistant Professor

Indiana State University

ABSTRACT

The present study examined the extent to which parenting influences problems with sleep in children referred for an evaluation of Attention-Deficit/Hyperactivity Disorder (ADHD). Data was collected from parents and/or legal guardians of sixty-three 4- to 12-year old children referred for assessment at an ADHD Evaluation Clinic located at a Midwestern university. Previous literature linking sleep problems to ADHD has typically derived from community and pediatric sleep clinic samples and has largely overlooked children with sub-clinical sleep impairments and/or those whose sleep problems stem from alternate etiologies. More than 60% of parents/caregivers in the current study reported significant child sleep difficulties. As hypothesized, parenting (as related to the implementation of daily routines) added to the explained variance in sleep problems above and beyond the variance explained by an ADHD diagnosis. However, neither parent use of routines nor parenting stress were significant individual predictors of child sleep problems. Parent report of child internalizing symptomology, but not externalizing symptomology, was significantly correlated with reported problems with sleep. The present results suggest that children who display behaviors associated with anxiety and depression may be particularly likely to exhibit sleep difficulties and that evaluation of sleep difficulties should include consideration of parenting practices (i.e., lack of consistent sleep routines). Given the high percentage of sleep problems reported, current results also suggest that screening for sleep disturbances should be a routine part of child assessment.

ACKNOWLEDGMENTS

I would like to take this opportunity to thank the people who have helped me to reach this monumental milestone. I thank Dr. Mike Murphy and Dr. Brad Brubaker, who so willingly offered their advice and support for this project. I thank Dr. Liz O'Laughlin for her incredible words of wisdom, advice, and encouragement throughout the entire process. She has not only served as the chair of my dissertation, but has and continues to be an exceptional mentor and an inspiring teacher. I undoubtedly credit Dr. O'Laughlin for helping me to become a psychologist who will make a genuine difference in the lives of the children with whom I work over the course of my career.

I thank my parents, Stephen and Cathy Stuckert, who instilled in me an incredible desire to succeed and take every opportunity to learn something new. A large part of my pride in completing this task stems from envisioning the looks on their faces when they first hold a bound copy of this dissertation.

I thank my sister and closest friend, Johanna, for the late-night phone calls and the consistent words of encouragement that helped the thousand miles between us not seem quite so far.

And finally, I thank my husband, Ash, whose love, guidance, and ever-present support has an overwhelming impact on every aspect of my life and motivates me to reach every goal that lies ahead.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Overview

Insufficient sleep can lead to child behavioral problems both in the home and school settings. Attention-Deficit/Hyperactivity Disorder (ADHD) is similarly recognized for contributing to impairment in children's behavior across settings (e.g., most notably at home and school). Daytime symptoms in children who experience poor or insufficient sleep strikingly mirror the inattentive and hyperactive behaviors of children with ADHD (Chervin, Dillon, Bassetti, Ganoczy, & Pituch, 1997). Notably, children with ADHD often have problems with their sleep. Despite sleep problems having the potential to significantly impact behavior, sleep disorders and disturbances (e.g., impairments in the quantity and/or quality of sleep) are largely overlooked and misdiagnosed in child and adolescent populations. Conversely, ADHD is widely recognized as the most commonly diagnosed disorder in childhood, affecting approximately 5% of school-age children (Corkum, Moldofsky, Hogg-Johnson, Humphries, & Tannock, 1999). Behavior problems that occur as a byproduct of insufficient sleep may result in misdiagnosis of an externalizing disorder, such as ADHD or Oppositional Defiant Disorder. Behavior problems may also be representative of a comorbid sleep disorder or sub-clinical disturbance that exists alongside ADHD.

Up to 50% of individuals with ADHD may exhibit disordered sleep (Ball, Tiernan, Janusz, & Furr, 1997; Barkley, 2006; Corkum, Tannock, & Moldofsky, 1998; Trommer, Hoeppner, Rosenberg, Armstrong, & Rothstein, 1988). It has been suggested that approximately one fourth of all children meeting diagnostic criteria for ADHD and a specific sleep disorder (i.e., primary dyssomnia) could have their ADHD symptoms alleviated with appropriate treatment of their symptoms of disordered sleep (Chervin et al., 1997). However, a correct, informed diagnosis is at the core of success in treating both ADHD and sleep disturbances.

ADHD and many facets of disordered sleep appear to produce similarly disruptive symptoms. As noted in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR), a persistent pattern of inattentive and/or hyperactive/impulsive symptoms must be pervasive across settings for a diagnosis of ADHD to be given. Similarly, some sleep disorders may lead to symptoms characterized by inattentive and/or hyperactive/impulsive behaviors (e.g., sleep disordered breathing). Observable symptom presentations of disordered sleep (i.e., motor restlessness) in children may be attributed to ADHD-related behaviors (e.g., hyperactivity, inattention, impulsivity). Interestingly, children are more likely to appear overly active than to exhibit fatigue when not well rested (Corkum, Tannock, Moldofsky, Hogg-Johnson, & Humphries, 2001). Due to the apparent overlap in symptomology of ADHD and sleep problems, children may not receive treatment targeting the true etiology of their symptoms.

The present study sought to determine the extent to which a specific aspect of parenting (i.e., consistency and routine) is associated with sleep problems in children referred for an evaluation of Attention-Deficit/Hyperactivity Disorder (ADHD). Participants included parents of children diagnosed with ADHD as well as children not given an ADHD diagnosis, allowing

exploration of factors associated with sleep problems among children displaying clinical and

subclinical levels of behavioral difficulties.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

Sleep Disturbances and ADHD

It has been suggested that insufficient sleep may be the strongest predictor of child behavioral problems in both the home and school settings. Attention-Deficit/Hyperactivity Disorder (ADHD) is similarly recognized for notable disturbances in children's behavior across settings. Chervin et al. (1997) suggested that symptoms evident during daytime observations of children who experience poor or insufficient sleep markedly mirror the inattentive and hyperactive behaviors of children with ADHD. Notably, children with ADHD often have problems with their sleep. While disordered sleep is acknowledged as having the potential to significantly impact behavior, sleep disorders and disturbances (e.g., impairments in the quantity and/or quality of sleep) are largely overlooked and misdiagnosed in child and adolescent populations. ADHD, however, is recognized as the most commonly presented impairment within the realm of children's mental health, affecting approximately 5% of school-age children (Corkum et al., 1999). Behavior problems stemming from insufficient sleep may result in misdiagnosis, such as ADHD. Behavior problems may also be representative of a comorbid sleep disorder or comparably impairing sub-clinical disturbance, in addition to an ADHD diagnosis, that is not recognized.

The prevalence of comorbidity between ADHD and sleep disorders and/or disturbances is still being debated. Current research suggests that a significant number (e.g., up to 50%) of individuals with ADHD may also exhibit disordered sleep (Ball, Tiernan, Janusz, & Furr, 1997; Barkley, 2006; Corkum, Tannock, & Moldofsky, 1998; Trommer, Hoeppner, Rosenberg, Armstrong, & Rothstein, 1988). Typically, sleep disorders may not be identified until after an ADHD diagnosis is given, if they are uncovered at all. Chervin et al. (1997) suggested that 25% of all children meeting diagnostic criteria for ADHD and a sleep-related breathing disorder could be essentially cured of ADHD symptoms with appropriate treatment targeting their disordered breathing during sleep. However, this desired alleviation of symptoms can only occur if the sleep disorder is recognized and treated.

Given the similarity in disruptive symptoms, the observable effects of disordered sleep in children are typically attributed to other causes (i.e., hyperactivity, inattention, impulsivity), as many children do not tend to show fatigue evident of sleep deprivation (Corkum et al., 2001). Instead, children may be overly active in an attempt to counteract tiredness and/ or may exhibit inattention (Chervin et al., 1997). It is possible that, if overlooked in its early stages, disordered sleep could go untreated or unmanaged throughout an individual's life. If not treated, sleep disorders may increase in severity or manifest into an array of other medical and/or behavioral problems (Kennedy et al., 2004).

Overlooking problems with sleep may result in diagnosing (i.e., "labeling") children with a disorder such as ADHD, which may not represent the true etiology of their impairment. Such children, additionally, may not receive the appropriate treatment. For example, children who are misdiagnosed and/or have a sleep disturbance that is inadequately attended to may be prescribed medication unnecessarily or go without proper treatment of their core symptoms as a

consequence. This may be particularly likely at present given the high level of attention and public awareness of ADHD relative to sleep disorders. The potential for symptoms of disordered sleep to be treated as a byproduct of ADHD may occur as a result of the widespread acceptance and perceived ease of pharmacological management for ADHD (Barkley, 2006). The general awareness of ADHD is significantly higher than that of sleep problems and may stem from a greater likelihood that parents will seek an evaluation for their child as a result of problems with daytime behaviors and school performance than for issues related to sleep. Consequently, clinicians evaluating children who present with hyperactivity, inattention, and impaired daytime functioning need to be adequately informed as to how to integrate current research on sleep problems into their assessment procedures.

<center>Attention-Deficit/Hyperactivity Disorder</center>

Attention-Deficit/Hyperactivity Disorder is a behavioral disorder typically diagnosed in childhood by guidelines set forth in the DSM-IV-TR and includes a persistent pattern of inattention and/or hyperactivity/impulsivity (American Psychiatric Association [APA], 2000). Additionally, as acknowledged in Weiss, Murray, and Weiss (2002), symptoms must be pervasive across multiple settings and lead to significant clinical impairment. The DSM-TR-IV states that the ratio of males to females with ADHD appears to range from approximately 2:1 to 9:1. This ratio fluctuates as a function of the predominant type of ADHD that has been diagnosed, as well as the setting in which the prevalence is being measured (e.g., ADHD occurs in boys approximately 3 times more than in girls in a community sample and 5 to 9 times more in a clinical sample). Consistent with its inclusion as a developmentally linked disorder, the impairments must be developmentally deviant and/or inappropriate (APA, 2000).

Past and Present ADHD Criteria

The 1968 version of the DSM (DSM-II) was the first text to specifically address the behavioral construct and symptom presentation we now know as ADHD. The DSM-II described the notably over-active behaviors of some children with the diagnostic term, Hyperkinetic Reaction of Childhood (APA, 1968). Interestingly, prior to the DSM-II, inattentive and "hyperkinetic" behaviors exhibited by children had been attributed to brain damage (Armas, 2001).

The DSM-III, which was published in 1980, was the first to link impairments in attention with hyperactive behaviors. The condition previously viewed as a hyperactive disorder characterized by motor overactivity became seen as one that included notable cognitive deficits and was considered an attentional disorder. The DSM-III referred to such symptoms as Attention-Deficit Disorder or ADD: a term commonly used today within the general public to describe those children with ADHD who do not show evidence of hyperactivity. The revision of the DSM-III, termed the DSM-III-R, addressed the apparent lack of consideration to hyperactive symptoms by specifying two distinct categories within an ADD diagnosis: ADD with hyperactivity and ADD without hyperactivity (APA, 1980, 1987). Additionally, the DSM-III was the only edition to include diagnostic criterion related to impairment in sleep as a symptom of ADHD. Sleep-related criteria were removed from subsequent editions as a result of the decision that reported problems with sleep were largely anecdotal and did not meet objective standards for inclusion as a common symptom of ADHD (Hoban, 2000).

The current criteria for Attention-Deficit/Hyperactivity Disorder were incorporated in the 4th edition of the DSM (DSM-IV) in 1994. ADD was renamed ADHD and distinct diagnostic factors were implemented to allow for separation of inattentive and hyperactive symptoms

(APA, 1994). By this time, numerous studies in the field had suggested that by providing a diagnosis specific to individuals whose presentation and impairments were predominantly inattentive, the number of girls and adolescents meeting diagnostic criterion would increase and would narrow the substantial gap in the prevalence of the disorder exhibited by boys and girls (Barkley, 2006). The symptoms selected for inclusion in the current criteria were chosen with an enhanced focus on observable and, thus, measurable behaviors. Efforts were also made to eliminate symptoms that were not restricted to a diagnosis of ADHD that had been previously included (i.e., moodiness, difficulty managing stress, sleep difficulties). The DSM-IV-TR has increased diagnostic specificity because of the symptoms chosen to represent each diagnostic factor (i.e., Predominantly Inattentive Type, Predominantly Hyperactive-Impulsive Type: Barkley, 2006). Those displaying impairment associated with both inattentive and hyperactive/impulsive symptoms would meet criteria for Combined Type (APA, 2000). When symptoms do not currently meet full criteria and it is not known if the criteria have been previously met, Attention-Deficit/Hyperactivity Disorder Not Otherwise Specified is diagnosed (See Appendix A for DSM-IV-TR criteria for ADHD).

Comorbidity

It has been reported that up to three of every four children with ADHD meet criteria for at least one other psychiatric disorder. The disorder with the highest rate of comorbidity with ADHD is Oppositional Defiant Disorder (ODD), which occurs in approximately 50-70% of children with ADHD. Furthermore, approximately 15-56% of children and nearly 50% of adolescents with ADHD are diagnosed with Conduct Disorder (CD: Wilens, 2002). The co-occurrence of ADHD with Conduct Disorder is likely preceded by an earlier diagnosis of ADHD and Oppositional Defiant Disorder and a notably early age of onset (Barkley, 2006).

Barkley (2006) notes the high prevalence of comorbid internalizing disorders in clinic-referred children meeting criteria for ADHD. Namely, anxiety disorders co-occur in 10-50% of these children, whereas Major Depressive Disorder (MDD) may co-occur in approximately 15-75% and Bipolar I Disorder may co-occur in 6-27%. It seems probable that a child's repeated failures with peer relationships and academics may result in low self-esteem and discouragements, causing him or her to feel misunderstood, avoid particular situations, and lack confidence. Such experiences may increase a child's vulnerability for an internalizing disorder or an underlying low sense of self-worth or self-efficacy (Biederman, 2005; Edbom, Granlund, Lichtenstein, & Larsson, 2008).

Children with ADHD also have a greatly increased risk for Learning Disabilities (LD) in comparison to non-ADHD children. The reported prevalence for this co-occurrence is highly variable in the literature, indicating that approximately 8-39% of children with ADHD may have a reading disability, 12-27% may have a reading disorder, and 12-30% may have a disability in mathematics. It has been noted that approximately 30% of ADHD children are likely to be placed in a special education program and/or be required to repeat a grade in school (Barkley, 2006).

It has been suggested that up to 50% of children with ADHD may exhibit symptoms indicative of a sleep disorder or sub-clinical sleep impairment (Ball, Tiernan, Janusz, & Furr, 1997; Barkley, 2006; Trommer, Hoeppner, Rosenberg, Armstrong, & Rothstein, 1988). Corkum et al. (1998) reported that 25-55% of parents acknowledge sleep difficulties in their children with ADHD. Corkum et al. (1999) further addressed the co-occurrence of ADHD and sleep problems by highlighting a connection between ADHD and several specific sleep disorders, including:

insomnia, circadian rhythm sleep disorders, sleep-related involuntary movements, and sleep-related breathing disorders.

Related Problems

Children with ADHD typically have associated impairments in a variety of areas, such as development, cognition, physical health, and academics. They commonly display symptoms including, but not limited to: behavioral disinhibition, poor self-regulation of their emotions, delayed motor coordination, impairments in planning and working memory, delayed social and adaptive functioning, impaired verbal fluency, difficulty handling frustration, and limited motivation and perseverance. ADHD symptoms that persist into adolescence tend to be associated with more serious impairments in behavioral, academic, and social skills (Elia, Ambrosini, & Rapport, 1999). Barkley (2006) suggested that children with ADHD may be prone to a greater risk for asthma and sleep problems. Furthermore, Barkley (2006) highlighted previous literature proposing that children with ADHD may exhibit more movement in their sleep, greater difficulty with sleep onset, and/or problems with staying asleep.

Assessment of ADHD

Since the majority of ADHD symptoms are common characteristics of many other disorders, use of standardized behavior rating scales and symptom checklists is recommended to help in recognizing confounding or comorbid disorders (Montano, 2004). Furthermore, children with ADHD comprise a heterogeneous group that likely cover a wide range of functional deficits, some of which may vary significantly in presentation over time as a result of the chronic nature of the disorder (Elia, Ambrosini, & Rapport, 1999). It has been widely suggested that an ideal clinical evaluation of ADHD should include parent/caregiver and teacher report of symptoms, child self report of symptoms (e.g., children school-age and older), review of

academic performance, information on the child's social interactions, and a thorough behavioral, medical, social, and family history (e.g., Barkley, 2006). Additionally, measures of parenting stress, perceived parenting competency, and parenting methods (i.e., use of discipline and consistency in routine) may provide information useful in assessing the influence of parenting on child behavior and vice versa (i.e., impact of child behavior on parent functioning).

Due to the potential for rater bias in most questionnaires and rating scales, objective laboratory measures (i.e., continuous performance tasks) as well as behavioral observation are commonly employed to broaden the range of information integrated into the assessment. Medical examinations are not routinely part of a standard ADHD evaluation. However, this type of examination may be warranted if the evaluator is unsure about the etiology of presented symptoms, believes that a pre-existing medical condition may better account for the ADHD-like behaviors, and/or medication is a likely option for the management of symptoms (Barkley, 2006). Miller & Munson (2002) asserts that a physical examination can be important in accurately diagnosing ADHD in order to assess for confounding or comorbid medical issues. Miller & Munson specifically recommended that assessment for ADHD include questions aimed at determining if a child gets a suitable quantity and quality of sleep.

<div align="center">Treatment of ADHD</div>

Stimulant and Non-stimulant Medication

Medication continues to be the standard first line of treatment for ADHD and has proven to be safe and effective for children (Barkley, 2006; Swanson, McBurnett, Christian, & Wigal, 1995). Safer, Zito, & Fine (1996) reported that approximately 3% of school-aged children were taking stimulant medication to aid in behavior management in the mid 1990's. It merits attention that the strongest results from stimulant medications will likely stem from their integrated use

with psychoeducational treatments that are applied within a multi-modal treatment plan (Kaiser, Hoza, & Hurt, 2008; Ivanenko & Johnson, 2008). Although the efficacy and effectiveness of stimulants are evident, there is noted discrepancy as to how beneficial such medications are in dealing with comorbid diagnoses or with mild symptom presentations (Elia, Ambrosini, & Rapport, 1999). Current literature has suggested that the dose and scheduling of such medications should be established on an individual basis, noting that while stimulants may cause problems related to sleep onset in some children, other children may benefit from a low evening dose that aids in heightened organization and lessened bedtime conflicts. Non-stimulant medication (i.e., atomoxetine) for ADHD has also increased in use over the past decade, most notably for the treatment of children who are unresponsive to stimulants or experience adverse side-effects, have comorbid psychiatric conditions, are at-risk for drug abuse, and/or have problems with eating or sleeping (Barkley, 2006; Biederman & Faraone, 2005; Prasad & Steer, 2008).

Psychological Interventions

There are currently several psychosocial interventions for ADHD that are empirically supported. Behavioral parent training, behavioral classroom management and intensive peer-focused behavioral interventions (i.e., summer day camps for ADHD children) have met criteria for a well-established treatment (Pelham & Fabiano, 2008). It is typically suggested that treatment extend across settings to maximize results, indicating that greater consistency and structure in various environments will likely be of notable benefit. Behavior modifications should be made in both the school and home settings to facilitate continuity. Parent training may also be combined into a multimodal approach with the previously stated interventions. Parent

training targets child behavior management skills that focus on direct attention to the child, positive and negative reinforcements, and increased positive attention (Barkley, 2006).

<div align="center">Sleep Disorders and Sub-clinical Disturbances</div>

Early research addressing the classification and measurement of sleep problems has typically been directed toward adults. However, over the past several decades, extensive research has been directed to increasing understanding and awareness of sleep disorders in children. Varied methods of assessment have been employed to identify and assess sleep problems and to explore treatment options applicable to this population.

Dyssomnias and Parasomnias

Primary Sleep Disorders, as categorized in the DSM-IV-TR, are divided into Dyssomnias and Parasomnias. Dyssomnias specifically refer to sleep disorders characterized by irregularity in the timing, amount, and quality of sleep. Parasomnias, on the other hand, include sleep disorders characterized by the occurrence of atypical behavioral and physiological events that coincide with sleep, specific sleep stages, or shifts between sleep and waking (e.g., sleep walking and sleep terrors). Examples of dyssomnias include, but are not limited to: primary insomnia, breathing-related sleep disorder, and periodic limb movement disorder (PLMD; APA, 2000).

Sleep problems/Disturbances

Sub-clinical symptoms (e.g., disturbances or problems) in sleep may also negatively affect children's daytime behaviors and/or cause impairment in their functioning. Seymour (1987) suggested that many children with disrupted sleep patterns do not attain sufficient sleep and may exhibit troublesome daytime behaviors due to their fatigue. It is unclear whether such subclinical disturbances typically worsen, thereby resulting in the later diagnosis of a sleep

disorder. However, the potential for subclinical sleep difficulties to elicit comparably

maladaptive behaviors appears worthy of further attention.

Associated Problems

Problems with sleep have been noted to co-occur with internalizing disorders such as

Major Depressive Disorder (MDD), Post Traumatic Stress Disorder (PTSD), and Generalized

Anxiety Disorder (GAD) (Forbes et al., 2008; Hudson, Gradisar, Gamble, Schniering, & Rebelo,

2009). Sleep problems have been associated with learning difficulties, as well as differences in

neurocognitive processes (Chervin, Archbold, Panahi, & Pituch, 2001; Gozal & Pope, 2001;

Kennedy et al., 2004; Montgomery-Downs, et al., 2003; Weissbluth, Davis, Poncher, & Reiff,

1983). Specifically, Kennedy et al. (2004) reported that neurocognitive deficits may occur in

children with sleep problems due to the chronic nature of the problems and the potential for sleep

disruption to occur at a time of critical neurocognitive development. Owens, Fernando, &

McGuinn (2005) reported that sleep problems are associated with heightened injury risk. This

propensity for increased injuries may be indicative of a child's decreased attention to his/her

environment or the marked impulsivity and overactivity evidenced in ADHD. Overall, sleep

problems appear to significantly affect a child's day-to-day functioning and potentially cause

notable delays in his/her neurocognitive development.

Assessment of Sleep Disturbances

Much of what is currently known about sleep disturbances in children stems from

parental reports of sleep behaviors. The subjectivity inherent in these reports has been

highlighted as one of the strongest limitations in research on child sleep and is proposed to be

largely responsible for wide-ranging inconsistencies and inconclusive findings. Specifically,

there appears to be a notable tendency for parents to over-pathologize their children's disordered

sleep symptoms (Bullock & Schall, 2005). Adult sleep research has found that adults tend to overestimate sleep difficulties and underestimate total time spent sleeping. However, many studies continue to utilize parental reports, with an increasing number of sleep-related measures being published yearly. One such measure is the Behavioral Evaluation of Disorders of Sleep Scale (BEDS; Schreck, Mulick, & Rojahn, 2003). The BEDS scale was designed to assess 5-to12- year old (e.g., elementary age) children's experience of sleep disturbance, as indicated by their parents' endorsement of symptoms on the scale. In addition to the ability to distinguish between children with and without reported sleep disturbance, this age-normed measure may provide useful information which would allow for differentiation between clinically significant sleep disturbances and developmentally appropriate sleep difficulties (Schreck et al., 2003). The BEDS questionnaire is one of many parent report measures utilized in the assessment of child sleep problems. Similar measures have consistently found greater occurrence of delayed sleep onset, impaired sleep quality, and/or increased night wakings for children with ADHD (Hvolby, Jorgensen, & Bilenberg, 2009; Owens, 2005; Sung, Hiscock, Sciberras, & Efron, 2008).

Objective measures, such as the polysomnograph and actigraph are being used more often in assessment of sleep disorders in children. To enhance the validity of parental reports, polysomnography measures various physiologic variables associated with sleep and is routinely used in sleep study clinics (Dagan et al., 1997). Sensors are placed on a patient's body to record his/her brain's electrical activity, eye and jaw muscle movement, leg muscle movement, airflow, chest and abdominal variations of respiratory effort, EKG, and oxygen saturation. Actigraphs can measure variables such as sleep onset, total duration of sleep, number of awakenings at night, and restlessness by discriminating between sleep/wake states as it monitors body movements. Actigraphy measures may be the most useful when assessing sleep/wake cycles and/or periodic

limb movements. Furthermore, actigraphy can occur in a child's natural sleep environment, monitor a child's sleep continuously, and do so for an extended period of time (Dagan et al., 1997). Both polysomnography and actigraphy have provided valuable data regarding multiple specific sleep disorders that have been found to occur with heightened prevalence in ADHD populations (Corkum et al., 2001; Crabtree, Ivanenko, & Gozal, 2003; Lecendreux, Konofal, Bouvard, Falissard, & Mouren-Simeoni, 2000; O'Brien et al, 2003).

Several hypotheses have been offered to address why parental reports appear to over-estimate the occurrence of sleep problems in children in comparison to more objective measures (i.e., polysomnograph and actigraph). It is important to note, however, that parents are generally able to accurately identify the difference between a child who is unwilling to go to sleep versus a child who is unable to fall asleep (Owens, Maxim, Nobile, McGuinn, & Msall, 2000). Parents may, in fact, not overestimate sleep problems, but rather may be more knowledgeable about a child's chronic sleep habits as compared to those displayed in a brief sleep study. Despite the fact that sleep difficulty may be a common side effect of medication typically used to treat ADHD, Ball, Tiernan, Janusz, & Furr (1997) noted that parents reported few differences in their perceptions of child sleep difficulty when describing medicated and non-medicated children.

<div align="center">Treatment of Sleep Problems</div>

The research documenting the treatment of sleep disorders and/or disturbances suggests that the surgical procedures of adenoidectomy and tonsillectomy are highly successful in resulting in a nearly immediate cure for Obstructive Sleep Apnea in children. In fact, Guilleminault, Winkle, Korobkin, & Simmons (1982) reported that all 25 children who received either of the surgeries in order to treat nocturnal snoring were entirely or substantially relieved of their symptoms. These treatments target increased upper airway resistance which appears to be

prevalent in sleep-disordered breathing. Treatment of sleep-disordered breathing may not only improve sleep, but may also relieve the presence of daytime restlessness, aggressive behaviors, poor task performance, and/or excessive daytime sleepiness (Gozal, O'Brien, & Row, 2004).

Behavioral modifications may be effective in increasing consistency around bedtime and may be of significant assistance should sleep problems center around bedtime resistance and/or challenging behaviors. Furthermore, behavioral treatments have shown efficacy in regard to maintenance of treatment gains following termination of treatment for sleep difficulties (Corkum et al., 2001; Galbraith, Pritchard, & Hewitt, 1993). Adams and Rickert (1989) reported two distinct methods of reducing nighttime tantrums in toddlers and preschoolers: increasing positive bedtime routines and the use of graduated extinction techniques (e.g., ignoring tantrum behavior). The positive routines intervention involved parents engaging with the child in a defined series of 4-7 pleasant activities prior to the child being placed in bed. Although both methods were successful in decreasing the frequency and duration of bedtime tantrums, and the use of positive routines reportedly resulted in more rapid changes and led to parental reports of increased marital satisfaction.

Seymour (1987) similarly found support for the use of standard bedtime routines for parental management of child sleep difficulties in children. Routines may be utilized as cues for desired behaviors (e.g., nighttime settling) and may provide needed structure in a child's environment. Additionally, Seymour suggested that parents should ignore night waking behaviors, enhance positive attention provided prior to bedtime, and limit attention given to the child once he/she is put to bed. By following these guidelines for bedtime routines, parents of four children, age 1- to 4-years old, were able to successfully eliminate persistent night waking and disruptive bedtime behaviors in their children in less than two weeks. Each of the children

exhibited a sustained increase in his/her total sleep duration and half of the children displayed an increase of more than 2 hours of sleep per night (Seymour, 1987). Similar results were reported by Galbraith, Pritchard, and Hewitt (1993) which found that a calm and predictable bedtime routine resulted in decreased delays in child sleep onset. The authors reported that positive parenting strategies promote improved sleep patterns and, consequently, lessen nighttime restlessness.

<div align="center">Co-occurrence of ADHD and Sleep Problems</div>

The additive effects of the comorbid occurrence of ADHD and disordered sleep can cause a wide range of detrimental effects in a child's life (e.g., impairing a child's behavioral and academic functioning), exacerbating the effects of each disorder singularly. There are numerous views regarding the degree to which sleep disorders/disturbances and ADHD co-occur and/or one disorder functions as an inherent, intensifying response to the pre-existing impairment of the other. However, the obvious overlap in symptomology between the two disorders would seem to indicate that both etiologies contribute to inattentive and hyperactive behaviors.

Current research suggests that children with neurobehavioral disorders, such as ADHD, exhibit more sleep difficulties associated with general sleep and breathing problems, behavioral problems, and daytime sleepiness than normal controls, as indicated by parental report of their symptoms (i.e., Marcotte et al., 1998). Related findings suggest delayed sleep onset, sleep-disordered breathing, and sleep duration may vary as a result of ADHD, in addition to difficulties with morning awakening and restless sleep (Hoban, 2004; Owens, Maxim, Nobile, McGuinn, & Msall, 2000). Dagan et al. (1997) proposed that children with ADHD seem to experience reduced sleep quality and a variation in the architecture (e.g., construction, pattern) of their sleep structure. Furthermore, there appears to be a substantial amount of literature supporting greater

occurrence of Sleep-Disordered Breathing (i.e., Obstructive Sleep Apnea) and Periodic Limb Movement Disorder within the ADHD population (Bedard, Montplaisir, Richer, Rouleau, & Malo, 1991; Chervin et al., 1997; Chervin et al., 2002; Gaultney, Terrell, & Gingras, 2005; Hoban & Chervin, 2005; Picchietti et al., 1999).

Several factors appear to contribute to contradictory findings regarding the causal relationship between ADHD and sleep difficulties (Bullock & Schall, 2005; Kooij, Middelkoop, Gils, & Buitelaar, 2001; Lecendreux, Konofal, Bouvard, Falissard, & Mouren-Simeoni, 2000; Mick, Biederman, Jetton, & Faraone, 2000; Ring et al., 1998; Stein et al., 2002). Stimulant medications have proven to be very useful in the treatment of most ADHD cases. However, this type of medication may effectively reduce ADHD symptoms while exacerbating problematic sleep disturbances (Corkum, Panton, Ironside, MacPherson, & Williams, 2008). The high rate of comorbidity between ADHD and other childhood disorders also suggests other potential causes of sleep difficulties (i.e., bedtime resistance among oppositional or anxious children; Mick, Biederman, Jetton, & Faraone, 2000; Stein et al., 2002).

Mick et al. (2000) found no notable differences in sleep disturbance between 140 adolescents with an ADHD diagnosis and a similar group of adolescents without ADHD after controlling for comorbidity and pharmacotherapy with stimulant medication. Specific sleep behaviors among adolescents with ADHD were more directly tied to the occurrence of comorbid depression, anxiety, or other behavioral disorders rather than ADHD diagnosis. Moreover, there was a significant increase in the number of sleep disturbances associated with stimulant therapy; specifically, restlessness, frequent nighttime waking, and repeated trips to the bathroom were more common among the teens taking stimulant medication. Ring et al. (1998) and Lecendreux

(2000), however, reported significant differences in the prevalence of sleep disorders among

ADHD and non-ADHD diagnostic groups.

Stein et al. (2002) sought to assess whether depressive and anxious symptoms, which

may magnify ADHD symptoms and disturb sleep, had a significant influence on the sleep of 67

adolescent males recruited from an Israeli high school who had ADHD diagnoses.

Approximately half of the boys were taking methylphenidate and the other half were

unmedicated. The study included 77 adolescent males who were recruited to serve as controls.

Parents and teachers of the ADHD participants completed behavior rating scales to assess

ADHD-specific behaviors and the severity of symptoms. All participants completed measures of

sleep disturbance and sleep duration. The study found that medicated individuals showed

significant elevations in their endorsement of sleep disturbances, whereas non-medicated

individuals with ADHD did not report more sleep disturbances than those in the control group.

This finding implies that medication has a role in sleep disturbances. Additionally, there was a

positive correlation between sleep disturbance and anxiety in the non-medicated individuals, as

well as a positive correlation between sleep disturbance and depression among the medicated

individuals. However, no explanation was given for these findings. Across groups, depressive

symptoms appeared to significantly influence the frequency of sleep disturbances in the

adolescents, regardless of ADHD symptoms or use of medication. This suggests that adolescents

with ADHD symptoms and comorbid symptoms of depression may have significantly more sleep

disturbances than those with ADHD only; thereby suggesting that depression may have a

stronger influence on sleep than ADHD.

Participants in the Stein et al. (2002) study were recruited from a high school that serves

a specialized population of children (e.g., students with learning disorders, ADHD, or both).

Therefore, participants may have had comorbid disorders (i.e., other disruptive behavior disorders) in addition to those that were assessed as part of the screening process (i.e., depression and anxiety). In addition, no information is available regarding possible ADHD or other disorders in the control group given that the control participants did not respond to anything beyond self-reported disturbances in their sleep. There are noteworthy developmental tendencies that should be addressed in regard to sleep; namely, adolescents' sleep schedules may vary considerably making them more susceptible to disordered sleep.

Contrary to the hypothesis that stimulant medication causes sleep disturbances among children with ADHD, Kooij, Middelkoop, Gils, and Buitelaar (2001) suggested that medication may improve sleep quality. Eight stimulant-medicated adults with an ADHD diagnosis and eight control participants were administered self-report and actigraphy measures to assess nocturnal motor activity, perceived quality of sleep, and the effects of stimulant medication on sleep. Motor activity and self-reported sleep quality were assessed at baseline and again after three weeks, each time for six consecutive nights at a sleep studies clinic. At the baseline assessment, no differences were found between the ADHD and non-ADHD control group (matched by sex) for sleep latency, total time in bed, or number of nocturnal awakenings, although there were noted differences within the group of participants with ADHD. Sleep quality improved and motor and activity levels were reduced at the three week assessment for the individuals with ADHD, all of whom were on a concurrent trial of stimulant medication. Such findings suggest that medication may provide relief for both sleep difficulties and ADHD symptoms among adults.

Gaining an understanding of why medications may aid in reducing sleep difficulties among adults with ADHD could assist in determining why many believe the opposite may be

true for children. However, it would be problematic to generalize results of adult medication studies to children given the differences in physiological response to medication between groups. Additionally, both combined and primarily inattentive-type diagnoses were included in the absence of primarily hyperactive/impulsive type, and there was nearly a 40% prevalence of psychiatric comorbidity in the Kooij et al. (2001) adult sample.

In a recent review of dyssomnia in children with ADHD, Bullock and Schall (2005) concluded that current research does not support a significant effect of stimulant medication on sleep quality. Instead, findings from this review highlighted an increase in rapid eye movement (REM) and sleep latency, and a relative decrease in overall REM sleep in children with ADHD, both on and off medication. This connection between sleep architecture and ADHD was supported by both subjective and objective assessment measures.

A retrospective study of children referred to a pediatric sleep clinic found that parents of ADHD-diagnosed children endorsed a number of sleep-related concerns regarding their children. However, only a small number of their concerns were verified by objective sleep assessments (i.e., polysomnography, actigraphy: Crabtree et al., 2003). This may result because children with ADHD exhibit varied and highly inconsistent sleep patterns that are beyond the scope of a single night's sleep assessment. Yet, similar findings were presented by O'Brien et al. (2003) who found that nearly 80% of parents of children with ADHD reported child sleep disturbances, although polysomnography results were only able to verify disturbances in 20% of those cases. A significant limitation identified in both of these studies was that no adjustment period was provided for the children to adapt to the unfamiliar and potentially uncomfortable surroundings of the sleep clinic before their overnight assessment. These authors suggested that with an

adjustment period and the additive benefits of multiple-night assessment, the children may have exhibited symptoms more closely mirroring the reports of their parents.

In the Crabtree et al. (2003) study, parents reported three principal complaints regarding the sleep of their children with ADHD: snoring and concern about sleep-disordered breathing, restless sleep (e.g., with and without awakenings), and delayed sleep onset. In comparing the subjective and objective measures, a high prevalence of Periodic Leg Movement Disorder and snoring was observed in the sample's polysomnography and actigraphy testing (i.e., nearly 36% and 62% of the cohort, respectively), indicating a significantly higher prevalence of each among ADHD children as compared to norms for the general population. Furthermore, 69% of the children assessed for sleep/wake cycle deficiencies displayed delayed sleep onset on the majority of nights they were monitored.

Due to the fact that all of the children in the aforementioned study had an ADHD diagnosis, the results provide some indication of the prevalence of sleep disorders in a clinical sample (i.e., 69%) although the rate is likely elevated given this group of children had been referred to a sleep disorders clinic. In addition, of the 97 children in the Crabtree et al study, 26% had a comorbid psychiatric diagnosis. This factor greatly limits the inference of causal pathways between ADHD and sleep because of the numerous other considerations brought about by the third variable of a comorbid diagnosis.

O'Brien et al. (2003) found a heightened prevalence of specific facets of disordered sleep in a subset of 5-to 7-year old children with ADHD symptomology who were randomly selected for overnight polysomnography. The sleep study was designed to assess sleep disturbances and neurobehavioral functioning. There was an unusually high prevalence of snoring in children regarded as displaying ADHD-like symptoms. However, there appeared to be no greater

likelihood for a child with ADHD or parentally reported ADHD-like symptoms (e.g., sub-clinical symptoms) to snore than in the general community sample. This finding appears to indicate that impairments such as sleep disordered breathing (SDB) and obstructive sleep apnea (OSA), which are widely regarded as precursors to difficulties with snoring, may result in mild hyperactive or ADHD-like behaviors which are misinterpreted as symptoms of ADHD.

O'Brien et al. (2003) noted that children identified as having "significant" versus "mild" ADHD symptoms (e.g., as indicated by scoring on the Child Behavior Checklist) exhibited an increase in disturbed rapid eye movement (REM) sleep. Specifically, REM latency and the relative proportion of REM sleep were shown to be inversely related to daytime alertness and neurobehavioral functioning of the most impaired subset of children with ADHD symptomology. Therefore, inconsistencies and disturbances in REM sleep may be a predictor of behavioral disruptions.

A limitation of the O'Brien et al. (2003) study is that this study included children without a formal diagnosis of ADHD. However, above average levels of hyperactivity were confirmed in both groups, thereby suggesting that the results may be generalizable to groups with sub-threshold ADHD symptoms that do not meet criteria required for a formal diagnosis. Additionally, this study appears to exemplify the need for objective measures in addition to parental reports in the assessment of sleep problems. The wide variation between parentally reported problems and the degree of disturbance that was objectively identified implies that objective sleep measures should be a standard practice in addressing the potential comorbidity of disordered sleep and ADHD.

Children with ADHD may exhibit increased disruptions in their REM sleep cycles. However, it is unclear whether there is greater potential for sleep/wake disorders in this

population as compared to a general population of children. In a study of 52 five to ten year old

boys (e.g., 26 with ADHD and 26 controls), polysomnography measures were utilized to monitor

nighttime sleep activity, in addition to tests of reaction time and the Multiple Sleep Latency Test

(MSLT), which was conducted on 4 separate occasions during the day following the

polysomnography testing. Polysomnography and the MSLT were utilized as a means of

assessing for the presence of sleep/wake disorders. During the MSLT, the children were

instructed to lie quietly for 20-minute increments of time to assess the length of time that it took

for them to fall asleep. Sleep-onset latency (e.g., the time from closing one's eyes until the initial

continuous period of sleep longer than 2 minutes) was measured for each participant in both the

ADHD and control groups as a means of gauging the number of daytime sleep episodes each

child experienced. Results indicated that the children with ADHD exhibited more frequent

occurrences of daytime sleepiness in comparison to the children without ADHD (Lecendreux et

al., 2000).

Lecendreux et al. (2000) suggested that the MSLT and the reaction time assessments

provided a clear picture of an inherent deficit in alertness in children with ADHD. The boys with

ADHD were sleepier during the day and had slower reaction times as compared to the overall

faster reaction time of the boys in the control group. This evidence is suggestive of possible

abnormalities in sleep/wake mechanisms in the brains of children with ADHD. The study

provided some indication that measures of daytime alertness were indicative of the subtype of

ADHD that the children exhibited. For example, the children diagnosed with ADHD,

Predominantly Hyperactive type, were the most reluctant to participate in the daytime MSLT, yet

were able to fall asleep quickly (during approximately 2 of 4 MSLT) when they chose to

participate. However, the children diagnosed with ADHD, Predominantly Inattentive type, were

continually willing to participate in the MSLT and fell asleep three or more times during the daytime testing.

Lecendreux et al. (2000) provided several intriguing findings. However, the study has several limitations that should be considered. First, the sample of children with ADHD was composed of all boys. Although there are a significantly larger number of boys diagnosed with ADHD than girls, the exclusion of girls from the study limits the conclusions that can be drawn. Additionally, contrary to other polysomnography studies, abnormal breathing patterns were not measured, thereby restricting the ability to determine if such problems played a part in decreased daytime alertness.

Huang et al. (2004) found that approximately two-thirds of a sample of six to twelve year old male Taiwanese children with ADHD displayed one, if not two, noted sleep disorders. The study included 77 children with ADHD, as well as 27 gender-matched children without ADHD. All of the children completed neuropsychological testing, one night of polysomnography, and their parents and teachers completed various questionnaires, thereby providing both objective and more subjective measure of sleep difficulties. Approximately 57% of children diagnosed with ADHD were found to display sleep apnea, whereas only one child without ADHD exhibited sleep apnea symptoms. Additionally, approximately 10% of children in the ADHD group exhibited above average periodic leg movements, whereas none of the control group children did. The authors propose that these results suggest that it is crucial to determine if an underlying sleep disorder may be responsible for symptoms resembling ADHD.

Several unanswered questions have arisen as a result of the increased attention to ADHD and sleep problems in recent years. One question poses whether ADHD symptoms are more strongly related to a specific sleep disorder or general sleepiness (Gaultney, Terrell, & Gingras,

2005; Staton, Hill, & Chen, 2008), and another asks if habitual snoring is actually at the core of overlapping symptomology of ADHD and sleep problems (Arman et al., 2005; Gozal & Pope, 2001). Van der Heijden, Smits, Van Someren, & Gunning (2005) posed several questions regarding the increase in sleep latency in children with ADHD, but have been unable to identify an etiological basis. Furthermore, significant night to night variability in sleep problems among children with ADHD have lead to inconsistencies in reports of average sleep onset timing, sleep efficiency, and movement during sleep (Corkum et al., 1998; Gruber, Sadeh, & Raviv, 2000).

Familial Influence and Daily Routines

The high degree of parent reports of disordered sleep in children without verifiable objective results may be indicative of extrinsic factors causing sleep disturbance (Bullock & Schall, 2005). Previous research has examined environmental influences on child sleep including familial patterns of disordered sleep, as well as parental sleep habits that may cause or intensify disordered sleep in children with ADHD (Handford, Mattison, & Kales, 1996; Sadeh & Anders, 1993). Ring et al. (1998) conducted a comparative study of children with ADHD and their non-ADHD siblings to assess the occurrence of sleep problems among genetically linked siblings. Consistent with their hypothesis, the children with a diagnosis of ADHD displayed a significantly greater incidence of single or multiple sleep disturbances and more specific sleep disorders (i.e., initial and middle insomnia) as compared to their non-ADHD siblings. Eight of the 13 children had parentally reported sleep disturbances, six of whom displayed symptoms of more than one, and five of whom displayed more than two sleep disorders based on objective measurement. The most frequently endorsed disturbances were initial and middle insomnia (e.g., difficulty initiating and maintaining sleep), enuresis, and parasomnias. Similarly, six of the 16 control group siblings demonstrated at least one sleep disturbance, three of whom reportedly had

more than one disturbance, and two who reportedly exhibited symptoms of more than two disturbances. The non-ADHD sibling control group displayed a higher rate of disordered sleep than what is typically found in a non-clinical sample, yet the prevalence of disordered sleep in the ADHD group reached statistical significance in comparison. No significant differences were found with sleep duration or sleep satisfaction. The heightened prevalence of sleep disturbances in the non-ADHD sibling control suggests that familial sleep patterns or habits may affect children with and without ADHD.

Although the Ring et al. findings suggest an environmental link to the emergence and/or facilitation of sleep disturbances within the family system, this study did not assess family bedtime routine, cohesiveness, structure, or degree of agreement between parents in regard to implementation of bedtime routines. Other research (e.g., Shelton, Frick, & Wootton, 1996; Sytsma, Kelley, & Wymer, 2001) has found that the influence exerted by parents in the home (i.e., implementation of structure, predictability, rules) and related discipline practices are linked to disruptive behaviors in children and may serve a significant role in exacerbating bedtime resistance or other behavioral problems. A child's nighttime routine should, therefore, be evaluated to gauge the possible distractions or barriers to sleep that are evident in the sleep environment including irregular parental absences, conflictual parent/child interactions, disordered parental emotional state, negative parental attitude toward child, poor parental motivation, and/or parental stressors (Adams & Rickert, 1989; Galbraith, Pritchard, & Hewitt, 1993).

Wiggs, Montgomery, & Stores (2005) advised that evaluations seeking to address the full scope of problems that may influence the presentation of ADHD symptoms should unquestionably include specific queries regarding the existence of sleep disorders and impaired

sleep physiology. Gruber, Sadeh, and Raviv (2000) suggested that inappropriate or inconsistent bedtimes could lead to significant disruptions in a child's sleep wake cycle. Parents may not be aware of the sleep problems experienced by their child and/or may attribute the sleep problems to oppositional and/or ADHD symptoms as opposed to an actual sleep disorder. Therefore, a variety of questions targeting impairments in sleep should be asked in assessing for ADHD. Children may increase their daytime activity to overcome tiredness, thus in the absence of observable lethargy, parents may not suspect that inadequate sleep is influencing behavior (Gaultney, Terrell, & Gingras, 2005).

Approximately 25% of all children presenting with ADHD have at least one parent who also meets criteria for the disorder. Parental barriers in implementing consistency at bedtime, structuring sleep-related routines, and organizing methods of problem-solving when conflicts arise may be tied to impairments related to ADHD in one or both parents within the family system (Weiss, Hechtman, & Weiss, 2000).

Thunström (2002) reported that in comparing a group of children with ADHD to a non-ADHD group with sleep problems, there were several characteristics of sleep difficulties in infancy that were linked with a later diagnosis of ADHD. Approximately 25% of children with reported infant sleep difficulties were found to meet diagnostic criteria for ADHD by an average age of 5 ½ years old. Behavior problems (e.g., bedtime resistance), extended sleep latency at bedtime, and psychosocial disruptions within the family during infancy were each predictive of a subsequent ADHD diagnosis.

Corkum et al. (1999) considered the influence of parenting practices and parent-child interactions on children's sleep routine, sleep practices, and engagement in bedtime resistance behaviors in a sample of children with and without ADHD who displayed sleep difficulties.

Children with ADHD were reported to have more sleep-related involuntary movements and dyssomnias than a healthy, non-ADHD control group. However, in comparison to a clinical control group (i.e., children who did not meet full criteria for ADHD, but did exhibit other psychopathology), comorbid disorders and treatment with stimulant medication were found to be more associated with sleep difficulties than was a diagnosis of ADHD. Poorer sleep practices and more notable personal and family histories of sleep problems were also more common among children with ADHD as compared to children without ADHD. Thus, this research suggests a complex relationship between ADHD and sleep that may be dependent on the specific sleep problem being assessed and/or the use of stimulant medication. Additionally, the study cites familial influence as something important to consider when assessing ADHD and related impairments with sleep.

Another potential factor related to disturbed sleep in children with ADHD may stem from parenting stress. Belsky (1984) proposed that characteristics of the child and the parent directly influence parenting practices, while McLaughlin & Harrison (2005) noted that child behavioral disturbance and parental sense of competence were both related to less effective parenting practices. More specific to sleep problems, Doo and Wing (2006) found higher parental stress to be positively correlated with child sleep difficulties in a sample of children with pervasive developmental disorders. Additionally, Doo and Wing (2006) noted that sleep disturbances in children are typically chronic, with an early onset. Thus, early interventions for high stress parents may serve to decrease child sleep difficulties.

CHAPTER 3

THE PRESENT STUDY

Current Study

This study examined factors underlying the significant overlap in symptoms of ADHD and disordered sleep, taking into consideration the high potential for misdiagnosis and misguided assumptions of causality. The high co-occurrence of ADHD and sleep disorders/disturbances seems to clearly illustrate the need for enhanced understanding of factors contributing to both disorders. Specifically, this study was designed to explore the extent to which parenting practices related to daily routines predicted child sleep difficulties, after accounting for an ADHD or other externalizing disorder diagnosis. It was predicted that:

1) Over 50% of children referred for an ADHD evaluation would exhibit clinically significant sleep problems, as reported by their parent/guardian on a questionnaire measuring child sleep habits.

2) Parenting practices, in regard to daily routines in the home, would be a significant predictor of sleep problems among children presenting with ADHD-like symptoms.

3) Parenting practices, as reflected by daily routines, would be a significant predictor of sleep problems after accounting for the variance associated with a diagnosis of ADHD and/or other externalizing disorder (e.g., Oppositional Defiant Disorder).

4) Parenting practices, as reflected by daily routines, would be a significant predictor of sleep problems after accounting for variance associated with parent report of externalizing behaviors (i.e., considering both clinical and subclinical levels of externalizing behavior).

5) Parenting stress would be significantly associated with both use of routines in the home and level of child sleep difficulty.

CHAPTER 4

METHODOLOGY

Design of the Study

This study employed a correlational design utilizing multiple regression analysis.

Parental report of use of routines in the home, level of parenting stress at the time of the ADHD

evaluation, and child diagnosis were included as potential predictors of child sleep difficulty.

Participants

The parents and/or legal guardians of 63 four to twelve year old children referred for

assessment at an ADHD Evaluation Clinic participated in the study. The mean age of the child of

focus was 7 years, 8 months old ($SD = 20$ months). Data was collected between November 2007

and May 2009. Children evaluated in the Clinic were typically referred by their teacher, general

physician, or parent as a result of behavior and/or academic problems. Consistent with the local

demographics, the majority of participants (93.7%) were Caucasian. Child gender, mean age of

the children, and the average socioeconomic status of the participants' families were consistent

with the typical population seeking services at the Clinic (Table 1). Over half of the participants

(64%) received an ADHD diagnosis (e.g., ADHD, Combined Type; ADHD, Predominantly

Inattentive Type; ADHD, Not Otherwise Specified), and 25% met diagnostic criteria for another

DSM-IV-TR diagnosis. The remaining 11% of the sample were not given a diagnosis upon

completion of their ADHD evaluation. Of those children who were diagnosed with ADHD, 35%

of them were given a second diagnosis, most commonly Oppositional Defiant Disorder (ODD).

Ten children were on medication for ADHD (i.e., stimulant medication or Strattera) when their

parents participated in the study.

Table 1

Frequencies of Descriptive Variables (n=63)

Variables	f	%
Gender		
Male	43	68.3
Female	20	31.7
Ethnicity		
Caucasian	59	93.7
African American	3	4.8
Asian	1	1.6
Family Income		
Less than $30,000	32	50.8
$30,000 - $60,000	15	23.8
More than $60,000	16	25.4
ADHD diagnosis		
Inattentive Type	10	15.9
Combined Type	26	41.3
ADHD, NOS	4	6.3
No ADHD	16	25.4
No diagnosis	7	11.1

Table 1 (continued)

Variables	f	%
ADHD diagnosis (continued)		
2nd diagnosis		
No 2nd diagnosis	26	41.3
ODD	14	22.2
Anx/Dep	8	12.7
PDD	4	6.3
Adjustment disorder	3	4.8
Other	8	12.7

Note. ADHD, NOS = ADHD, Not Otherwise Specified; No ADHD = No ADHD diagnosis given; No diagnosis = No ADHD or Other diagnosis given; ODD = Oppositional Defiant Disorder; Anx/Dep = Anxiety or Depression; PDD = Pervasive Developmental Disorder.

Assessment Measures

The assessment battery used at the ADHD Evaluation Clinic at Indiana State University adheres to best practices recommendations and includes a DSM-IV based clinical interview with a parent/caregiver, parent and teacher behavior rating scales, a measure of parenting stress, measures of child intelligence and academic achievement, a computerized test of attention, and a developmental history questionnaire. Information from the measure of parenting stress and the parent-version of the behavior-rating scale were used in this study. Demographic information was obtained from a developmental history questionnaire. The behavior rating scale, measure of parenting stress, and developmental questionnaire were collected as part of the standard evaluation.

Behavior Assessment Scale for Children -2- Parent Rating Scale (BASC-2-PRS). The BASC-2-PRS (Reynolds & Kamphaus, 2004) is a 160-item self-report questionnaire in which parents report the frequency of specific behaviors on a 4-point scale (i.e., never, sometimes, often, almost always). The BASC-2-PRS provides scores for both single factor subscales (i.e., Hyperactivity, Aggression, Depression, Somatization) and composite scales (i.e., Internalizing, Externalizing). Subscales of individual behaviors and composite scales compiling a number of behaviors are presented with *T* scores (*M*=50, *SD*=10). The internalizing and externalizing composite scales were utilized as predictors of sleep difficulty.

The 2004 revision of the BASC has four different norm samples including general norms, clinical norms, learning disability norms, and ADHD norms. The general normative scores were used for this study. The BASC-2-PRS displays strong concurrent validity with various other child behavior measures. Furthermore, the composite scores demonstrate high internal-consistency and test-retest reliability for the general norm sample (test-retest reliability coefficient range = .77 to .91, internal consistency coefficient alpha range = .89 to .94; Reynolds and Kamphaus, 2004).

Parenting Stress Index (PSI) – Short Form. The PSI-Short Form (Abidin, 1995) is a 36-item self-report questionnaire on which parents rate the degree to which they agree that a particular item is descriptive of themselves, their child, or their present life circumstances. Level of agreement with each item is recorded on a 5-point scale (i.e., 1 = strongly disagree, 5 = strongly agree). The PSI was developed with the assumptions that parenting stress is a byproduct of both interactions between parent and child, and their individual characteristics. The PSI-Short Form is composed of three subscales labeled Parental Distress (PD), Parent-Child Dysfunctional Interaction (P-CDI), and Difficult Child (DC). The Total Stress (TS) scale, which was focused

upon in this study, presents information indicative of overall parenting stress level by providing a

score obtained by summing the 3 subscales. The comprehensive scale includes stress related to

the overall parental role, stress caused by the child's behavior and interactions with him/her, and

personal distress of the parent. Abidin (1995) reported good test-retest reliability and internal

reliability for the Total Stress scale (test-retest reliability coefficient = .84, internal consistency

coefficient alpha = .91).

Conners-March Developmental Questionnaire (CMDQ). The CMDQ (Conners & March,

1996) was designed to be completed by a parent or guardian and includes demographic

information, (i.e., ethnicity, socioeconomic status, and family makeup), child educational and

developmental history; current medication use; and medical and psychiatric history of the child

and his/her family.

Research Measures

Child Sleep Habits Questionnaire (CSHQ). (Appendix B). The CSHQ (Owens, 2000)

was designed as a screening tool to target the most common problems with sleep exhibited in

children ages 4-12 years. The CSHQ assesses symptoms of both the prominent medically and

behaviorally-based sleep disorders among children in this age group. The CSHQ is a 33-item

measure that provides a total score that incorporates items reflective of eight different subscales

(i.e., Bedtime Resistance, Sleep Onset Delay, Sleep Duration, Sleep Anxiety, Night Wakings,

Parasomnias, Sleep Disordered Breathing, and Daytime Sleepiness). Parents are instructed to rate

items regarding their child's sleep habits and/or problems as they have occurred over the prior

week. An exception is made if the past week has been atypical (e.g., the child has been sick, etc)

in which case the parent is asked to endorse items based on a week more characteristic of the

child's usual habits. Frequency ratings are provided, ranging from occurring usually (i.e., 5 or

more times per week), sometimes (i.e., 2-4 times per week), or rarely (i.e., 0-1 times per week). Additionally, parents identify their perception of whether or not the behavior is problematic (i.e., yes, no, not applicable).

The CSHQ is scored by summing the responses in each of two categories: 1) frequency ratings of child's sleep habits (i.e., child needs parent in the room, child cries at bedtime) which yields the Total Score and 2) parental perception of the habit as problematic which yields the Total Problem score. In the first category, the responses are scored throughout the entire questionnaire as follows: Usually = 3, Sometimes = 2, and Rarely = 1. For the sleepiness items found at the end of the questionnaire, if an item is not checked, the default score is zero. "Very Sleepy" is scored as 1, whereas "Falls Asleep" is scored as 2. The second category of responses (i.e., the column that indicates parent perception of the sleep habit as problematic) is scored Yes = 1, No = 2, and N/A = 3. It is suggested that the clinically significant cut-off for the CSHQ Total Score is 41, indicating that all scores above 41 would fall into the clinically significant range and signify more disturbed sleep.

Owens, Spirito, and McGuinn (2000) reported that the CSHQ has shown satisfactory internal consistency in a clinical sample (α = .78) and a community sample (α = .68). Test-retest reliability has ranged from .62 to .79 in a community sample of parents who completed the CSHQ in two-week intervals. Validity has been established by the measure's repeated ability to appropriately differentiate sleep-disordered and non-sleep-disordered groups. Best practices in assessing sleep disorders adhere to use of objective measures (e.g., polysomnography, actigraphy). However, the CSHQ was utilized in this study due to its repeated use in previously published studies assessing ADHD and sleep disturbances.

Child Routines Inventory (CRI) – Parent Form. (Appendix C). The CRI – Parent Report

Form (Sytsma, Kelley, & Wymer, 2001) is a 36-item questionnaire designed to measure routines

specific to school-aged children in order to assess for structure and predictability in the home.

The CRI consists of four subscales with 5 to 11 items that are endorsed on a 5-point scale (i.e., 0

= never, 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = nearly always). The

subscales include Daily Living Routines, Household Responsibilities, Discipline Routines, and

Homework Routines, asking that parents reply to statements such as, "My child wakes up at

about the same time on weekdays" and "My child brushes teeth before bed." For this study, the

CRI was employed for its utility as a measure of daily routines that may be viewed as a reflection

of parenting practices. Sytsma, Kelley, and Wymer (2001) reported good test-retest reliability

and internal consistency for the measure (r = .86, α = .90). Additionally, the authors describe

evidence of strong construct validity, reporting a moderate inverse relationship between the CRI

and measures of child behavior problems, and a positive relationship with another measure of

family routines. The Daily Living Routines and Household Responsibilities subscales will be

used in the present study.

<center>Procedures</center>

Informed consent was obtained from all parents and/or legal guardians who agreed to

participate in the study prior to administration of the research measures (See Appendix D). Given

that children were not direct participants, child assent was not elicited. Participants completed

the necessary paperwork and measures utilized in the standard ADHD assessment, as well as

those included for the purposes of the current study, while seated in the waiting area of the

ADHD Evaluation Clinic. Approximately half the participants completed the two assessment

measures for the current study during their child's ADHD evaluation and the other 50%

completed the research measures during the feedback session 2-3 weeks after the child's

evaluation. Children were identified by number rather than name on all research measures.

Parents took part in a standard semi-structured diagnostic interview conducted by a

graduate clinician or a licensed psychologist as part of the ADHD evaluation. A licensed

psychologist supervised all graduate clinicians.

All information gathered during the evaluation that was relevant to the present study was

compiled and entered into a secure database by either an upper level graduate clinician or

undergraduate research assistant who had been trained in the appropriate methods of data entry.

Missing and/or incomplete data on the research questionnaires was replaced with means

reflective of the participant's other responses. However, if more than 10% of items were omitted

on either of the research questionnaires, the participant's data was not included in data analysis.

Participants received a unique individual code to serve as their identifier within the database

while ensuring their privacy and maintaining the confidentiality of their responses. All

assessment materials were kept in a locked file cabinet in the ADHD Evaluation Clinic.

CHAPTER 5

RESULTS OF THE STUDY

Results are presented in terms of preliminary, primary, and exploratory analyses. First,

descriptive information for the research measures as well as frequency data related to the

prevalence of sleep problems within the sample is reported. Secondly, correlations between sleep

problems, as measured by the Child Sleep Habits Questionnaire (CSHQ), and other major

variables are presented. Next, hierarchical regression analyses were conducted to evaluate the

extent to which household routines predict child sleep problems after accounting for child

diagnosis, parent report of externalizing behavior problems, and parenting stress. Finally,

exploratory analyses were conducted in an effort to maximize the explained variance in child

sleep difficulty (CSHQ total).

Preliminary Analyses

As seen in Table 2, the mean for the CSHQ was in the clinically significant range,

indicating that the majority of parents reported significant child sleep difficulties. Based on the

suggested cut-off for clinical significance on the CSHQ of 41, approximately 68% of the

children presenting for an ADHD evaluation were reported by a parent/guardian to have

clinically significant sleep problems.

Table 2

Mean, Range, Standard Deviation for Major Variables (n=61)

Variable	Mean	*SD*	Range
CSHQ Total	45.61	11.39	14– 74
PSI Total	65.51	29.01	5– 99
BASCpInt	56.71	15.63	32–110
BASCpExt	63.55	15.60	35–102
DLR	34.10	6.67	14– 44
HR	18.34	6.59	4– 33
Discipline	33.37	6.08	14– 43
Homework	15.08	4.22	0– 20

Note. CSHQ Total = Child Sleep Habit Questionnaire Total, PSI Total = Parenting Stress Inventory Total, BASCpInt = Behavior Assessment Scale for Children Parent Internalizing Composite Score, BASCpExt = Behavior Assessment Scale for Children Parent Externalizing Composite Score, DLR = Daily Living Routines, HR = Household Responsibilities, Discipline = Discipline Routines, Homework = Homework Routines.

Tables 3, 4 and 5 present correlations between the primary variables. As anticipated, parenting stress was significantly associated with both use of routines in the home and level of child sleep difficulty. Specifically, daily living routines, household routines, and discipline routines were each negatively associated with parenting stress. Thus, as overall parenting stress increases, the use of routines in the home significantly decreases. Parenting stress was also significantly correlated with parent-report of child sleep problems (Table 3).

Table 3

Pearson Correlations Between Major Variables

	CSHQ Total	Age	Gender	BASCpInt	BASCpExt	PSI Total
CSHQ Total	1.00	-.10	.15	.31*	.20	.25*
Age	-.10	1.00	.09	-.01	-.31*	-.18
Gender	.15	.09	1.00	.00	.04	-.01
BASCpInt	.31*	-.01	.00	1.00	.46**	.40**
BASCpExt	.20	-.31*	.04	.46**	1.00	.39**
PSI Total	.25*	-.18	-.01	.40**	.39**	1.00

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, BASCpInt = Behavior Assessment Scale for Children Parent Internalizing Composite Score, BASCpExt = Behavior Assessment Scale for Children Parent Externalizing Composite Score, PSI Total = Parenting Stress Inventory Total.
* $p < .05$; ** $p < .01$

Contrary to expectation, child externalizing behavior symptoms (i.e., hyperactivity, impulsivity, oppositionality) did not show a significant correlation with report of sleep problems, whereas internalizing behavior symptoms (i.e., depression and/or anxiety) were significantly associated with the CSHQ. This finding suggests that internalizing symptomology may create or exacerbate problems with sleep, and/or that insufficient quality or quantity of sleep may result in increased anxiety and/or irritability. Both internalizing and externalizing symptomology showed a strong positive association with parenting stress.

The subscales of the Child Routine Inventory were significantly correlated, with the highest correlation occurring between Discipline and Daily Living Routines ($r = .68$). There were significant inverse correlations between CSHQ total and Daily Living Routines (e.g.,

bedtime, dinnertime), and CSHQ total and Household Responsibilities (e.g., putting away dishes,

cleaning room) as reflected in Table 4.

Table 4

Pearson Correlations Between Sleep Problems, Routine Inventory Variables, and Parenting

Stress

	CSHQ Total	DLR	HR	Discipline	Homework	PSI Total
CSHQ Total	1.00	-.26*	-.27*	-.05	-.10	.25*
DLR	-.26*	1.00	.39**	.68**	.35**	-.36**
HR	-.27*	.39**	1.00	.48**	.11	-.37**
Discipline	-.05	.68**	.48**	1.00	.31*	-.29*
Homework	-.10	.35**	.11	.31*	1.00	-.11
PSI Total	.25*	-.36**	-.37**	0.29*	-.11	1.00

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, DLR = Daily Living
Routines, HR = Household Responsibilities, Discipline = Discipline Routines, Homework =
Homework Routines, PSI Total = Parenting Stress Inventory Total.
* $p < .05$; ** $p < .01$

Of note, there were no significant correlations between Daily Living Routines and child

age or between Household Responsibilities and child age. The non-significant inverse

correlation between these variables does, however, suggest that as child age increases, use of

routines may decrease. Annual family income was not significantly correlated with child sleep

problems or use of routines in the home (Table 5).

Table 5

Pearson Correlations Between Demographic and Major Variables

	CSHQ Total	Age	FamIncome	DLR	HR
CSHQ Total	1.00	-.10	.08	-.26*	-.27*
Age	-.10	1.00	.00	-.24	-.18
FamIncome	.08	.00	1.00	-.02	-.10
DLR	-.26*	-.24	-.02	1.00	.39**
HR	-.27*	-.18	-.10	.39**	1.00

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, FamIncome = Annual Household Income, DLR = Daily Living Routines, HR = Household Responsibilities. * $p < .05$; ** $p < .01$

Primary Analysis

A hierarchical regression was conducted in order to determine if daily routines predicted parent report of child sleep problems above and beyond the variance accounted for by an ADHD diagnosis and parent report of child internalizing and externalizing behavior. In the first step of the regression, ADHD diagnosis (dummy coded as Yes/No), BASC-2 Internalizing and Externalizing composite scales, child age, and total parenting stress were entered as predictors of total CSHQ. The model was not significant, but explained 16% of the variance in CSHQ scores, $F (5, 55) = 2.04$, $p = .09$. There were no significant individual predictors. In the second step of the regression, two subscales of the Child Routines Inventory (i.e., Daily Living Routines and Household Responsibilities) were entered. Although results of the second model were not significant, the addition of the DLR and HR resulted in an increase to 21% of the variance in CSHQ scores, $F (7, 53) = 2.35$, $p = .07$. Daily living routines [$t(60) = -1.90$, $p = .06$] approached

significance as an individual predictor (Table 6). Overall, the addition of the child routines

subscales added approximately 5% to the explained variance.

Table 6

Regression Models Predicting Total CSHQ

Variable	B	SE B	β	t
Step 1				
ADHD diagnosis	1.80	2.82	.08	.64
BASCpInt	.18	.10	.27	1.85
BASCpExt	.02	.10	.02	.15
Age	.04	.08	.07	.55
PSI Total	.06	.05	.17	1.20
Step 2				
ADHD diagnosis	-.28	3.05	-.01	-.09
BASCpInt	.17	.10	.25	1.61
BASCpExt	-.02	.10	-.03	-.20
Age	-.02	.08	-.03	-.23
PSI Total	.02	.06	.07	.43
DLR	-.46	.24	-.28	-1.90
HR	-.08	.26	-.05	-.32

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, ADHD diagnosis = yes/no ADHD diagnosis, BASCpInt = Behavior Assessment Scale for Children Parent Internalizing Composite Score, BASCpExt = Behavior Assessment Scale for Children Parent Externalizing Composite Score, Age = child's age in months, PSI Total = Parenting Stress Inventory Total, DLR = Daily Living Routines, HR = Household Responsibilities. $R^2 = .16$ for Step 1; $R^2 = .21$ for Step 2.

Exploratory Analysis

Given that BASC-2 Externalizing total and child age were not associated with total

CSHQ in the preliminary correlational analyses, an exploratory analysis was performed entering

ADHD diagnosis, BASC-2 Internalizing, and PSI TOTAL in the first step (Table 7) and Daily

Living Routines and Household Responsibilities in the second step of the model. The first step of

the model was not significant, $F(3, 58) = 2.51$, $p = .07$, but accounted for 12% of the variance.

With the addition of the two daily routines

Table 7

Regression Models Predicting Total CSHQ

Variable	B	SE B	β	t
Step 1				
ADHD diagnosis	.27	2.95	.01	.09
BASCpInt	.18	.10	.25	1.82
PSI Total	.06	.05	.16	1.15
Step 2				
ADHD diagnosis	-1.68	3.23	-.07	-.52
BASCpInt	.14	.11	.19	1.28
PSI Total	.04	.06	.09	.65
DLR	-.28	.25	-.16	-1.14
HR	-.19	.26	-.11	-.70

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, ADHD diagnosis = yes/no ADHD diagnosis, BASCpInt = Behavior Assessment Scale for Children Parent Internalizing Composite Score, PSI Total = Parenting Stress Inventory Total, DLR = Daily Living Routines, HR = Household Responsibilities. $R^2 = .12$ for Step 1; $R^2 = .15$ for Step 2.

variables in the second step, the model approached significance, $F(5, 56) = 2.25$, $p = .06$, and the

R^2 increased slightly to 15%. There were no significant individual predictors.

Table 8

Regression Models Predicting Total CSHQ

Variable	B	SE B	β	t
Step 1				
ADHD diagnosis	.45	3.07	.02	.15
2nd diagnosis	-.78	3.51	-.03	-.22
BASCpInt	.18	.10	.24	1.79
PSI Total	6.06	.06	.15	1.11
Step 2				
ADHD diagnosis	-1.50	3.36	-.06	-.45
2nd diagnosis	-.78	3.51	-.03	-.22
BASCpInt	.13	.11	.19	1.25
PSI Total	3.52	.06	.09	.61
DLR	-.28	.25	-.16	-1.12
HR	-.19	.27	-.11	-.70

Note. CSHQ Total = Total Child Sleep Habits Questionnaire score, ADHD diagnosis = yes/no ADHD diagnosis, 2nd diag = yes/no Oppositional Defiant Disorder diagnosis, BASCpInt = Behavior Assessment Scale for Children Parent Internalizing Composite Score, DLR = Daily Living Routines, HR = Household Responsibilities. $R^2 = .12$ for Step 1; $R^2 = .15$ for Step 2.

A second exploratory regression was conducted to assess whether or not a diagnosis of

oppositional defiant disorder (ODD) was predictive of child sleep difficulties. In the first step of

the regression, child ADHD diagnosis (i.e., yes/no), ODD diagnoses (i.e., yes/no), BASC-2

Internalizing total and Parenting Stress total were entered as predictors (Table 8). Results of the model were not significant, but accounted for 12% of the variance in CSHQ scores, $F(4, 57) = 1.87$, $p = .13$. Routine variables (i.e., DLR, HR) were entered in the second step and resulted in an increase to 15% of the variance in CSHQ scores, $F(6, 55) = 1.60$, $p = .17$. There were no significant individual predictors.

CHAPTER 6

DISCUSSION

The present study sought to determine the extent to which a specific aspect of parenting (i.e., consistency and routine) is associated with sleep problems in children referred for an evaluation of Attention-Deficit/Hyperactivity Disorder (ADHD). Participants included parents of children diagnosed with ADHD as well as children not given an ADHD diagnosis, allowing for exploration of factors associated with sleep problems among children displaying clinical and subclinical levels of behavioral difficulties.

It was hypothesized that over 50% of all children referred for an ADHD evaluation would exhibit clinically significant sleep problems, as reported by their parent/guardian on a questionnaire measuring child sleep habits (i.e., CSHQ). The percentage of parents reporting significant child sleep difficulties was 68%, suggesting that sleep difficulties are common among children who present with behavior problems suggestive of ADHD. However, it should also be noted that the current study relied on parent report of child sleep difficulties and previous research has found parent report of child sleep problems to be significantly higher than sleep problems determined by more objective measures (Bullock & Schall, 2005). It is possible that parents/caregivers in the current study may have provided inflated or exaggerated ratings of child sleep difficulties, or that reports of sleep difficulties were more strongly associated with bedtime resistance than more pervasive sleep problems.

Given the documented benefits of consistent routine in facilitating child sleep habits (i.e., Adams & Rickert, 1989; Christodulu & Durand, 2004), it was anticipated that use of daily routines in the home would predict decreased sleep problems among children presenting with ADHD-related behavior concerns. This hypothesis was partially supported, as household routines and daily living routines contributed slightly to the predicted variance in child sleep problems. However, the child routines variables did not significantly predict child sleep difficulty likely due in part to the small sample size. As predicted, both daily living routines and household routines were negatively associated with sleep problems.

The next two hypotheses predicted that parent report of daily routines would be a significant predictor of sleep problems after accounting for the variance associated with a diagnosis of ADHD and parent report of externalizing behavior as measured by the BASC-2. Results supported the first portion of this hypothesis in that predictive power did increase slightly beyond the variance explained by an ADHD diagnosis and BASC-2 Externalizing behavior. Contrary to expectations, neither diagnosis of ADHD nor parent-report of externalizing symptomology (as shown in the BASC-2 Externalizing Scale) was significantly correlated with child sleep difficulties. Likewise, diagnosis of ODD was not a significant predictor of parent report of sleep difficulties. Rather, parent report of child internalizing symptomology was a significant predictor of child sleep problems. This coincides with recent studies that have suggested that comorbid oppositionality did not appear to add to problematic bedtime behaviors above and beyond those associated with an ADHD diagnosis, whereas comorbid anxiety and/or depression was associated with increased sleep difficulties (Hvolby, Jorgensen, & Bilenberg, 2009; Mayes, et al., 2009; Willoughby, Angold, & Egger, 2008).

The final hypothesis of the study proposed that parenting stress would be significantly associated with both use of routines in the home and level of child sleep difficulty. As predicted, there was a significant negative correlation between parenting stress and parent report of routines (i.e., Household Responsibilities and Daily Living Routines), as well as a significant positive correlation between parenting stress and parent report of child sleep difficulty. Parenting stress was not, however, a significant individual predictor of child sleep problems in the regression analyses. One possibility is that the relationship between parent stress and child sleep difficulties is moderated by household routines. Parents experiencing high levels of stress are likely less apt to implement routines and consistent structure in their parenting. Lack of consistent structure and routine in turn contributes to child sleep difficulty. Doo and Wing (2006) reported a significant association between parenting stress and sleep problems in a sample of children diagnosed with a pervasive developmental disorder. Further research that involves a larger sample size and considers mediating and moderating variables is needed to better understand the relationships between parenting stress and child sleep difficulties within children exhibiting ADHD-like symptomology.

<center>Implications</center>

The present study found that parents of approximately 7 of every 10 children referred for an ADHD evaluation report child sleep problems in the clinically significant range, strongly supporting the need for routine assessment of sleep problems when providing assessment or treatment for ADHD or ADHD-like symptoms. It is commonly recommended that assessment of child sleep difficulties be included as a standard clinical practice (Archbold, 2006; Hvolby, Jorgensen, & Bilenberg, 2009; Ivanenko & Johnson, 2008; Owens, 2009; Wickwire, Roland, Elkin, & Schumacher, 2008). Gau & Chiang (2009) recently reported that adolescents with a

childhood diagnosis of ADHD are likely to have both current and lifetime sleep difficulties that are further exacerbated by other psychiatric comorbidities. This study also supports attention to persistent and subthreshold symptomology in regard to disruptive and inattentive behaviors, as these are commonly linked to poor sleep quality and/or quantity.

Impairments in sleep are believed to have a global impact on a child's functioning (i.e., daytime behavior, academic performance, interpersonal interactions) and are likely to manifest into chronic difficulties that continue to worsen if untreated. This highlights the need for thorough and informed attention not only to all sleep-related symptoms, but to all possible sources of those symptoms. Routine screening for sleep impairment in both medical and non-medical settings would likely result in more accurate diagnosis and significantly enhance the potential for success with ensuing treatment. Due to the widespread impact that poor sleep may have on children, early intervention for sleep problems may provide substantial benefits to both the child and his/her family, as resulting behavioral, social, emotional, and academic difficulties of sleep deficits influence everyone in a child's environment (Adams & Rickert, 1989; Sung et al., 2008).

Results of this study also lend support to increasing focus on sleep problems associated with internalizing symptomology (i.e., depression, anxiety) in children. Current literature suggests that impairments in sleep quality and quantity commonly present alongside a diagnosis of depression (Hill, 1994; Ivanenko & Johnson, 2008; Spoormaker & van den Bout, 2005; Tsuno, Besset, & Ritchie, 2005). Little is known about the degree to which children's presentation of depressive symptomology (i.e., commonly evidencing greater irritability than overt sadness) may specifically affect nighttime behavior and sleep hygiene; however, authors such as Stein et al. (2002) suggest that the addition of internalizing symptoms to ADHD may

notably exacerbate symptoms of sleep impairment. Common symptoms of childhood anxiety include excessive worries, irrational fears, hypervigilence, and difficulty separating from parents (Ivanenko & Johnson, 2008). Each of these symptoms have the potential to trigger sleep problems (e.g., fear of the dark, difficulty separating from caregiver at bedtime) and/or may arise following the experience of disrupted and/or poor sleep. Of note, neither ADHD nor ODD diagnosis predicted child sleep problems in the present study, whereas parental report of internalizing symptoms was significantly associated. This suggests the need to consider the influence of sub-clinical internalizing problems (i.e., mild anxiety or irritable mood) on children's sleep and vice versa. Alfano, Zakem, Costa, Taylor, & Weems (2009) suggested that poor sleep quality and/or quantity negatively influences a child's coping skills and affective regulation. As mentioned previously, it may be the case that children lacking sufficient sleep are more likely to display anxious or irritable behavior. Knowledge of the association between internalizing symptoms and sleep difficulties is important for both parents and clinicians to avoid misdiagnosis and better pinpoint the most effective path of intervention (Hill, 1994; Hudson et al., 2009; Koffel & Watson, 2009).

Results of the current study suggest that future research should continue to examine the influence of parenting, both in terms of parenting stress and use of routine/structure, on child sleep difficulties. The current findings suggests that parents experiencing higher levels of stress are less likely to provide a predictable and structured environment that may facilitate improved sleep habits. In addition, parenting stress was also associated with greater report of child sleep difficulties. Similar findings were reported in Gregory et al. (2004, as cited in Ivanenko & Johnson, 2008), as negative family dynamics and disorganization were found to be significantly associated with child anxiety symptoms and child sleep problems.

The current findings have many implications for parent-focused interventions. Parents could perhaps benefit from interventions and psychoeducation focused on the impact of child behavior (and sleep difficulties) on parental functioning and the importance of maintaining structure and routine, particularly in regard to bedtime routines. Parenting interventions might also include education on specific types of daily living and household routines to implement in the home, ways to improve a child's sleep hygiene (e.g., limiting active activities in the evening, removing a television from the bedroom, etc.), and/or the amount of sleep recommended for children of various ages (Schroeder & Gordon, 2002). Buckhalt, Wolfson, and El-Sheikh (2009) reported that parent education may be the most influential and accessible means of preventing and/or improving child sleep difficulty.

Stress may also impede a parent's ability to maintain an active and productive parenting role. Sung, Hiscock, Sciberras, & Efron (2008) suggested that parents of children with ADHD, who also had moderately to severely impaired sleep, had poorer mental health and were nearly three times more likely to experience depression, anxiety, and/or stress than parents of children without sleep problems. Interventions to enhance positive time between parent/child may notably improve nighttime interactions and child's sleep (Adams & Rickert, 1989). Additionally, increasing the parent's feelings of self-efficacy regarding his/her ability to effectively manage the child's behavior (e.g., decreasing parenting stress) would likely positively influence the home environment and, consequently, have a positive effect on child behavior.

The psychosocial treatment of choice (i.e., empirically supported treatment) for children with ADHD, is behavioral parent training (Barkley, 2006). Such training instructs parents in the creation and implementation of behavior management plans using contingencies and reinforcement to shape child behavior. This model of treatment provides an excellent medium for

clinicians to incorporate additional ways to increase structure and stability in the home (i.e., use of routines). Clinicians could guide parent training to not only include goals related to disruptive daytime behaviors, but also those nighttime behaviors that likely result in increased bedtime struggles, delayed sleep onset, poor sleep hygiene, and/or conflictual interactions between parent and child.

Limitations

A primary limitation of the current study involves the small sample size. Although a significant proportion of parents reported sleep problems in the clinically significant range, there was minimal variability in parent report of household routines, likely contributing to the limited findings for these variables. It is quite likely that stronger findings related to parenting stress and parent use of routines may emerge in a larger sample of participants.

Another possible limitation of the study stems from defining the implementation of routines as a reflection of the more global concept of parenting within the home. Use of daily routines is only one aspect of overall family dynamics and parenting practices and, therefore, can only provide a subset of information regarding how such practices may influence the structure of the household and the functioning of the children in this study. Although use of routines is associated with structure and predictability in the home, it cannot capture the full spectrum of parental influence. Future research may wish to examine other aspects of parenting (i.e. authoritarian parenting style) that may foster and/or maintain child sleep difficulties.

Furthermore, only one parent or guardian provided information for the study, providing only one perspective on child behavior, sleep difficulties and parenting practices. It may be the case that one parent is consistent with household routines whereas the other parent is not. Thus, the information collected on parenting routines may not fully capture what is experienced by the

child in the home. Additionally, there may be other adults and/or siblings in the household experiencing notable stress and/or other individual influences (i.e., a sibling with a disruptive behavior disorder) that affect the sleep of the target child. Some the children whose parents participated in the study reside in multiple households (i.e., divorced parents). These children may experience an assortment of very different routines that may manifest into varied sleep patterns in different households.

In regard to the assessment of child sleep problems, there are clear limits to solely utilizing parental report versus more objective sleep measures. Best practices for assessing sleep impairment involves utilizing objective measures such as polysomnography or actigraphy. Measures such as the CSHQ are useful in screening for sleep problems; however more direct assessment of sleep behavior would be needed in order to formally diagnose a pediatric sleep disorder and objectively confirm the presence of parent-reported symptoms. Thus, it is impossible to determine if any of the children in the present study met full criteria for a sleep disorder. Parental report of child sleep problems over the course of one week may or may not provide a truly valid representation of a child's recurring sleep hygiene habits and/or sleep-related behaviors.

Finally, the present study does not provide information about the direction of influence between the predictor variables and sleep difficulties in children. As mentioned, it is possible that lack of sufficient sleep in children contributes to lack of consistency in routines in parenting, as tired children may be less cooperative or responsive to parental efforts to implement consistent routines. Likewise, parenting stress may be a result of child sleep difficulties rather than a cause. Finally, lack of sufficient sleep may lead children to experience more symptoms of anxiety and/or depressed mood, rather than depressed mood or anxious feelings leading to sleep

difficulties. Further research utilizing more rigorous design and analysis (e.g., path modeling) is needed to better understand the relationship between child sleep difficulties, internalizing symptoms, and parenting influences.

Future Research

In addition to consideration of parenting routines within a larger sample size, future research may wish to include other parenting variables such as parenting style, parent diagnosis of ADHD or other psychiatric disorder, and/or parental sleep hygiene. Only a small percentage of variance in sleep difficulties was explained in the present results, thus future research should explore other factors that may help in better understanding child sleep difficulties.

Research assessing specific factors that influence sleep may also look into specific areas of sleep impairment. A follow-up to this study might analyze parental responses on the CSHQ subscales to determine the types of sleep problems most commonly experienced by children with hyperactive, impulsive, and/or inattentive behaviors (e.g., bedtime resistance, sleep onset delay, parasomnias, etc). This information could be used to guide treatment recommendations and to provide greater insight into whether sleep problems with these children tend to be more physiological or behavioral in nature.

The moderate correlation between sleep problems and child internalizing symptomology elicits several questions. First of all, this study was unable to evaluate whether depressive or anxious symptomology has a greater effect on sleep problems. Mood diagnoses and anxiety diagnoses were compiled into one category reflective of internalizing disorders, as was the report of depressive and anxious symptomology within the behavior rating scale. Therefore, the present study was unable to determine which of these types of disorders (or sub-clinical symptom presentations) may have had a stronger influence in predicting child sleep difficulty within the

sample. Secondly, it remains unclear which internalizing behaviors may result in impairment in child sleep (i.e., avoidance, worry, poor parent/child interactions, etc.). Future research is required to provide additional information regarding internalizing symptoms in a sample of children referred for evaluation of their disruptive externalizing and/or inattentive behaviors.

Future research should pay further attention to the strong neurobiological basis of ADHD and/or internalizing disorders, as children with these diagnoses may have one or more parents who also have the disorder or exhibit sub-clinical symptoms. This has significant implications in regard to determining the degree to which parental psychiatric diagnosis and/or symptomology may influence child sleep problems in this population. Kashdan et al. (2004) suggested that overall familial functioning is affected in a variety of ways by parental internalizing symptoms (e.g., parent/child interaction, parental involvement, discipline, etc). Additionally, Elgar et al. (2007) reported that parental depressive symptomology may enhance risk of childhood internalizing and externalizing impairments, alongside decreasing child prosocial behaviors by negatively affecting their nurturance, monitoring, and interactions with their child. Future research may be able to establish to what degree a parental ADHD or internalizing disorder diagnosis may affect a parent's ability/willingness to implement increased structure (i.e., routines), manage day-to-day stressors in the home, and/or create a healthy sleep environment for their child.

Finally, future research on child sleep problems should further consider the influence of parental stress. Current literature suggests that child disruptive behaviors (e.g., ADHD or ADHD-like symptomology) are commonly linked to impairment in parent mental health and their capacity to cope with stressors (Harrison & Sofronoff, 2002; Mash & Johnston, 1983). Parental stress may negatively influence parent/child relationships and interactions, impede a

parent's ability to manage disruptive behaviors, and/or hinder their attention to their child's specific needs (Kashdan et al., 2004). It appears likely that parental stress and child behavioral symptoms may continuously interact and create a negative, repetitive cycle of interactions and behaviors, thus having the potential to significantly influence a child's sleep by increasing environmental stressors and/or impeding a parent's capacity to establish sleep-related routines or facilitate proper sleep hygiene. Future research may seek to more clearly understand the reciprocal relationship between parental stress and parental use of routine and structure within the home and child sleep difficulties.

REFERENCES

Abidin, R. R. (1995). *Parenting stress index: Test manual.* Charlottesville, VA: Pediatric Psychology Press.

Adams, L. A., & Rickert, V. I. (1989). Reducing bedtime tantrums: Comparison between positive routines and graduated extinction. *Pediatrics, 84,* 756-761.

Alfano, C. A., Zakem, A. H., Costa, N. M., Taylor, L. K., & Weems, C. F. (2009). Sleep problems and their relation to cognitive factors, anxiety, and depressive symptoms in children and adolescents. *Depression and Anxiety, 26,* 503-512.

American Psychiatric Association. (1968). *Diagnostic and statistical manual of mental disorders* (2nd ed). Washington, DC: Author.

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed). Washington, DC: Author.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed. rev). Washington, DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed, text rev.). Washington, DC: Author.

Archbold, K. H. (2006). Sleep disorders and attention-deficit/hyperactivity disorder in children: A missing differential diagnosis. *Journal of the American Psychiatric Nurses Association, 12*, 216-224.

Arman, A. R. et al. (2005). Symptoms of inattention and hyperactivity in children with habitual snoring: Evidence from a community-based study in Istanbul. *Child: Care, Health, and Development, 31*, 707-717.

Armas, V. (2001). *A concise analysis of attention deficit/hyperactivity disorder*. Washington, DC: Magination Press.

Ball, J. D., Tiernan, M., Janusz, J., & Furr, A. (1997). Sleep patterns among children with attention-deficit/hyperactivity disorder: a reexamination of parent perceptions. *Journal of Pediatric Psychology, 22,* 389-398.

Barkley, R. A. (2006). *Attention-deficit/hyperactivity disorder: A handbook for diagnosis and treatment* (3rd ed). New York: Guilford Press.

Bedard, M., Montplaisir, J., Richer, F., Rouleau, I., & Malo, J. (1991). Obstructive sleep apnea syndrome: Pathogenesis of neuropsychological deficits. *Journal of Clinical and Experimental Neuropsychology, 13*, 950-964.

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development, 55*(1), 83-96.

Biederman, J. (2005). Attention-deficit/hyperactivity disorder: A selective overview. *Biological Psychiatry, 57*, 1215-1220.

Biederman, J., & Faraone, S. V. (2005). Attention-deficit/hyperactivity disorder. *Lancet, 366,* 237-248.

Buckhalt, J. A., Wolfson, A. R., & El-Sheikh, M. (2009). Children's sleep and school psychology practice. *School Psychology Quarterly, 24*(1), 60-69.

Bullock, G. L., & Schall, U. (2005). Dyssomnia in children diagnosed with attention-deficit/hyperactivity disorder: A critical review. *Australian and New Zealand Journal of Psychiatry, 39,* 373-377.

Chervin et al. (2002). Inattention, hyperactivity, and symptoms of sleep-disordered breathing. *Pediatrics, 109*, 449-455.

Chervin, R. D., Archbold, K. H., Panahi, P., & Pituch, K. J. (2001). Sleep problems seldom addressed at two general pediatric clinics. *Pediatrics, 107*, 1375-1380.

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

Christodulu, K., & Durand, V. (2004). Reducing bedtime disturbance and night waking using positive bedtime routines and sleep restriction. *Focus on Autism & Other Developmental Disabilities, 19*(3), 130-139.

Conners, C., & March, J. (1996). *The Conners-March developmental questionnaire*. Toronto: Multihealth Systems.

Corkum, P., Tannock, R., & Moldofsky, H. (1998). Sleep disturbances in children with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 37,* 637-646.

Corkum, P., Moldofsky, H., Hogg-Johnson, S., Humphries, T., & Tannock, R. (1999). Sleep problems in children with attention-deficit/hyperactivity disorder: Impact of subtype, comorbidity, and stimulant medication. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*, 1285-1293.

Corkum, P., Panton, R., Ironside, S., MacPherson, M., & Williams, T. (2008). Acute impact of immediate release methylphenidate administered three times a day on sleep in children with attention-deficit/hyperactivity disorder. *Journal of Pediatric Psychology, 33*, 368-379.

Corkum, P., Tannock, R., Moldofsky, H., Hogg-Johnson, S., & Humphries, T. (2001). Actigraphy and parental rating of sleep in children with attention-deficit/hyperactivity disorder (ADHD). *Sleep, 24*, 303-311.

Crabtree, V. M., Ivanenko, A., & Gozal, D. (2003). Clinical and parental assessments of sleep in children with attention-deficit/hyperactivity disorder referred to a pediatric sleep medicine center. *Clinical Pediatrics, 42,* 807-813.

Dagan, Y. et al. (1997). Sleep quality in children with attention-deficit/hyperactivity disorder: An actigraphic study. *Psychiatry and Clinical Neurosciences, 51,* 383-386.

Doo, S., & Wing, Y.K. (2006). Sleep problems of children with pervasive developmental disorders: Correlation with parental stress. *Developmental Medicine and Child Neurology, 48*, 650-655.

Edbom, T., Granlund, M., Lichtenstein, P., & Larsson, J. O. (2008). ADHD symptoms related to profiles of self-esteem in a longitudinal study of twins. *Journal of Child and Adolescent Psychiatric Nursing, 21*, 228-237.

Elgar, F. J., Mills, R. S., McGrath, P. J., Waschbusch, D. A., & Brownridge, D. A. (2007). Maternal and paternal depression symptoms and child maladjustment: The mediating role of parental behavior. *Journal of Abnormal Child Psychology, 35,* 943-955.

Elia, J., Ambrosini, P. J., & Rapoport, J. L. (1999). Treatment of attention-deficit/hyperactivity disorder. *The New England Journal of Medicine, 340*, 780-788.

Forbes, E. E. et al. (2008). Objective sleep in pediatric anxiety disorders and major depressive disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 47(2),* 148-155.

Galbraith, L., Hewitt, K. E., & Pritchard, L. (1993). Behavioral treatment for sleep disturbances. *Health Visitor, 66,* 169-171.

Gau, S., & Chiang, H. L. (2009). Sleep problems and disorders among adolescents with persistent and subthreshold attention-deficit/hyperactivity disorders. *Sleep, 32*, 671-679.

Gaultney, J. F., Terrell, D. F., & Gingras, J. L. (2005). Parent-reported periodic limb movement, sleep disordered breathing, bedtime resistance behaviors, and ADHD. *Behavioral Sleep Medicine, 3,* 32-43.

Gozal, D., O'Brien, L., & Row, B. W. (2004). Consequences of snoring and sleep disordered breathing in children. *Pediatric Pulmonology, 26,* 166-168.

Gozal, D., & Pope, Jr., D. W. (2001). Snoring during early childhood and academic performance at ages thirteen to fourteen years. *Pediatrics, 107*, 1394-1399.

Gruber, R., Sadeh, A., & Raviv, A. (2000). Instability of sleep patterns in children with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 495-501.

Guilleminault, C., Winkle, R., Korobkin, R., & Simmons, B. (1982). Children and nocturnal snoring: Evaluation of the effects of sleep related respiratory resistive load and daytime functioning. *European Journal of Pediatrics, 139,* 165-171.

Handford, H. A., Mattison, R. E. & Kales, A. (1996). Sleep disturbances and disorders. In M. Lewis (Ed.), *Child and Adolescent Psychiatry (*2nd ed., pp. 716-726). Baltimore: Williams & Witkins.

Harrison, C., & Sofronoff, K. (2002). ADHD and parental psychological distress: Role of demographics, child behavioral characteristics, and parental cognitions. *Journal of the American Academy of Child and Adolescent Psychiatry, 41,* 703-711.

Hill, P. (1994). Sleep disturbances in depression and anxiety: Issues in childhood and adolescence. *Journal of Psychosomatic Research, 38,* 61-67.

Hoban, T. F. (2000). Sleeplessness in children with neurodevelopmental disorders: Epidemiology and management. *CNS Drugs, 14,* 11-22.

Hoban, T. F. (2004). Assessment and treatment of disturbed sleep in attention-deficit/hyperactivity disorder. *Neurotherapeutics, 4(2),* 307-316.

Hoban, T. F., & Chervin, R. D. (2005). Pediatric sleep-related breathing disorders and restless leg syndrome: How children are different. *The Neurologist, 11(6),* 325-337.

Huang, Y. S., Chen, N. H., Li, H. Y., Wu, Y. Y., Chao, C. C., & Guilleminault, C. (2004). Sleep disorders in Taiwanese children with attention-deficit/hyperactivity disorder. *Journal of Sleep Research, 13,* 269-277.

Hudson, J. L., Gradisar, M., Gamble, A, Schniering, C.A., & Rebelo, I. (2009). The sleep patterns and problems of clinically anxious children. *Behaviour Research and Therapy, 47,* 339-344.

Hvolby, A., Jorgensen, J., & Bilenberg, N. (2009). Parental rating of sleep in children with attention-deficit/hyperactivity disorder. *European Child and Adolescent Psychiatry, 18,* 429-438.

Ivanenko, A., & Johnson, K. (2008). Sleep disturbances in children with psychiatric disorders. *Seminars in Pediatric Neurology, 15(2),* 70-78.

Kaiser, N. M., Hoza, H., & Hurt, E. A. (2008). Multimodal treatment for childhood attention-deficit/hyperactivity disorder. *Expert Review of Neurotherapeutics, 8*, 1573-1583.

Kashdan, T. B. et al. (2004). Depression and anxiety in parents of children with ADHD and varying levels of oppositional defiant behaviors: Modeling relationships with family functioning. *Journal of Clinical Child and Adolescent Psychology, 33,* 169-181.

Kennedy, J. D. et al. (2004). Reduced neurocognition in children who snore. *Pediatric Pulmonology, 37*, 330-337.

Koffel, E., & Watson, D. (2009). The two-factor structure of sleep complaints and its relation to depression and anxiety. *Journal of Abnormal Psychology, 118,* 183-194.

Kooij, J. J., Middelkoop, H. A., Gils, K.van, & Buitelaar, J. K. (2001). The effects of stimulants on nocturnal motor activity and sleep quality in adults with ADHD: An open-label case-control study. *Journal of Clinical Psychiatry, 62*, 952-956.

Lecendreux, M., Konofal, E., Bouvard, M., Falissard, B., & Mouren-Simeoni, M. C. (2000). Sleep and alertness in children with ADHD. *Association for Child Psychology and Psychiatry, 41,* 803-812.

Marcotte, A.C. et al. (1998). Parental report of sleep problems in children with attentional and learning disorders. *Developmental and Behavioral Pediatrics, 19*(3), 178-185.

Mash, E. J., & Johnston, C. (1983). Parental perceptions of child behavior problems, parenting self-esteem, and mothers' reported stress in younger and older hyperactive and normal children. *Journal of Consulting and Clinical Psychology, 51,* 86-99.

Mayes, S. D. et al. (2009). ADHD subtypes and comorbid anxiety, depression, and oppositional-defiant disorders: Differences in sleep problems. *Journal of Pediatric Psychology, 34*, 328-337.

McLaughlin, D. P., & Harrison, C. A. (2006). Parenting practices of mothers of children with ADHD: The role of maternal and child factors. *Child and Adolescent Mental Health, 11*(2), 82-88.

Mick, E., Biederman, J., Jetton, J., & Faraone, S. (2000). Sleep disturbances associated with attention-deficit/hyperactivity disorder: The impact of psychiatric comorbidity and pharmacotherapy. *Journal of Child and Adolescent Psychopharmacology, 10*, 223-231.

Miller, K. J., & Munson, S. W. (2002). Attention-Deficit/Hyperactivity Disorder. In D. L. Kaye, M. E. Montgomery, & S. W. Munson (Eds.), *Child and adolescent mental health* (pp. 184-210). Philadelphia: Lippincott, Williams, & Wilkins.

Montano, B. (2004). Diagnosis and treatment of ADHD in adults in primary care. *Journal of Clinical Psychiatry, 65,* 18-21.

Montgomery-Downs, H. E., Jones, V. F., Molfese, V. J., & Gozal, D. (2003). Snoring in preschoolers: Associations with sleepiness, ethnicity, and learning. *Clinical Pediatrics, 42*, 719-726.

O'Brien, L. M. et al. (2003). Neurobehavioral implications of habitual snoring in children. *Pediatrics, 114,* 44-49.

Owens, J. A. (2005). The ADHD and sleep conundrum: A review. *Journal of Developmental and Behavioral Pediatrics, 26*, 312-322.

Owens, J. A. (2009). A clinical overview of sleep and attention-deficit/hyperactivity disorder in children and adolescents. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 18*(2), 92-102.

Owens, J. A., Fernando, S., & McGuinn, M. (2005). Sleep disturbance and injury risk in young children. *Behavioral Sleep Medicine, 3,* 18-31.

Owens, J. A., Maxim, R., Nobile, C., McGuinn, M., & Msall, M. (2000). Parental and self-report of sleep in children with attention-deficit/hyperactivity disorder. *Archives of Pediatric and Adolescent Medicine, 154,* 549-555.

Owens, J. A., Spirito, A., & McGuinn, M. (2000). The children's sleep habits questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep, 23*, 1043-1051.

Pelham, W. E., & Fabiano, G. (2008). Evidence-based psychosocial treatments for Attention Deficit/Hyperactivity Disorder. *Journal of Child and Adolescent Psychology, 37*, 184-214.

Picchietti, D. L. et al. (1999). Further studies of periodic limb movement disorder and restless leg syndrome in children with attention-deficit/hyperactivity disorder. *Movement Disorders: Official Journal of the Movement Disorder Society*, *14*, 1000-1007.

Prasad, S., & Steer, C. (2008). Switching from neurostimulant therapy to atomoxetine in children and adolescents with attention-deficit/hyperactivity disorder: Clinical approaches and review of current available evidence. *Pediatric Drugs, 10,* 39-47

Reynolds, C. R., & Kamphaus, R. W. (2004). *Behavior assessment system for children: Second edition manual.* Circle Pines, MN: AGS Publishing.

Ring, A., Stein, D. Barak, Y., Teicher, A., Hadjez, J., & Elizur, A., et al. (1998). Sleep disturbances in children with attention-deficit/hyperactivity disorder: A comparative study with healthy siblings. *Journal of Learning Disabilities, 31,* 572-578.

Sadeh, A., & Anders, T. F. (1993). Infant sleep problems: Origins, assessment, intervention. *Infant Mental Health Journal, 14,* 1-34.

Safer, D. J., Zito, J. M., & Fine, E. M. (1996). Increased methylphenidate usage for attention-deficit disorder in the 1990s. *Pediatrics, 98,* 1084-1088.

Schrek, K. A., Mulick, J. A., & Rojahn, J. (2003). Development of the Behavioral Evaluation of Disorders of Sleep scale. *Journal of Child and Family Studies, 12,* 349-359.

Schroeder, C. S., & Gordon, B. N. (2002). Sleep. In *Assessment and Treatment of Childhood Problems: A Clinician's Guide* (2nd ed, pp.186-216). New York: Guilford.

Shelton, K. K., Frick, P. J., & Wootton, J. (1996). Assessment of parenting practices in families of elementary school-age children. *Journal of Clinical Child Psychology, 25*, 317-329.

Seymour, F. W. (1987). Parent management of sleep difficulties in young children. *Behaviour Change, 4,* 39-48.

Spoormaker, V. I., & Bout, J. van den. (2005). Depression and anxiety complaints: Relations with sleep disturbances. *European Psychiatry, 20,* 243-245.

Staton, D., Hill, C. M., & Chen, W. (2008). ADHD, sleep onset, and pediatric bipolar disorder. *Journal of Sleep Research, 17*, 240.

Stein, D., Pat-Horencyzk, R., Blank, S., Dagan, Y., Barak, Y., & Gumpel, T. (2002). Sleep disturbances in adolescents with symptoms of attention-deficit/hyperactivity disorder. *Journal of Learning Disabilities, 35*, 268-275.

Sung, V., Hiscock, H., Sciberras, E., & Efron, D. (2008). Sleep problems in children with attention-deficit/hyperactivity disorder: Prevalence and the effect on the child and family. *Archives of Pediatric and Adolescent Medicine, 162*, 336-342.

Swanson, J. M., McBurnett, K., Christian, D. L., & Wigal, T. (1995). Stimulant medications and the treatment of children with ADHD. *Advances in Clinical Child Psychology, 17,* 265-322.

Sytsma, S. E., Kelley, M. L., & Wymer, J. H. (2001) Development and initial validation of the Child Routines Inventory. *Journal of Psychopathology and Behavioral Assessment, 23*, 241-251.

Thunström, M. (2002). Severe sleep problems in infancy associated with subsequent development of attention-deficit/hyperactivity disorder at 5.5 years of age. *Acta Paediatr, 91,* 584-592.

Trommer, B. L., Hoeppner, J. B., Rosenberg, R. S., Armstrong, K. J., & Rothstein, J. A. (1988). Sleep disturbance in children with attention-deficit/hyperactivity disorder. *Annals of Neurology, 24*, 322.

Tsuno, N., Besset, A., & Ritchie, K. (2005). Sleep and depression. *Journal of Clinical Psychiatry, 66,* 1254-1269.

Van der Heijden, K. B., Smits, M. G., Van Someren, E. J. W., & Gunning, W. B. (2005). Idiopathic chronic sleep onset insomnia in attention-deficit/hyperactivity disorder: A circadian rhythm sleep disorder. *Chronobiology International, 22*, 559-570.

Weiss, M., Murray, C., & Weiss, G. (2002). Adults with attention-deficit/hyperactivity disorder: Current Concepts. *Journal of Psychiatric Practice, 8,* 99-110.

Weiss, M., Hechtman, L., & Weiss, G. (2000). ADHD in parents. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 1059-1061.

Weissbluth, M., Davis, A. T., Poncher, J., & Reiff, J. (1983). Signs of airway obstruction during sleep and behavioral, developmental, and academic problems. *Developmental and Behavioral Pediatrics, 4*(2), 119-121.

Wickwire, E. M., Roland, M. M. S., Elkin, T. D., & Schumacher, J. A. (2008). Sleep disorders. In M. Herson and D. Reitman (Eds.) *Handbook of psychological assessment, case conceptualization, and treatment: Vol. 2. Children and adolescents* (pp. 622-651). Hoboken, NJ: Wiley.

Wiggs, L., Montgomery, P., & Stores, G. (2005). Actigraphic and parent reports of sleep patterns and sleep disorders in children with subtypes of attention-deficit/hyperactivity disorder. *Sleep, 28*, 1437-1445.

Willoughby, M. T., Angold, A., & Egger, H. L. (2008). Parent-reported attention-deficit/hyperactivity disorder symptomology and sleep problems in a preschool-age pediatric clinic sample. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 1086-1094.

APPENDIX A: DIAGNOSTIC CRITERIA FOR ATTENTION-DEFICIT/HYPERACTIVITY

DISORDER

A. Either (1) or (2):

   (1) six or more of the following symptoms of inattention have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

      (a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities

      (b) often has difficulty sustaining attention in tasks or play activities

      (c) often does not seem to listen when spoken to directly

      (d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)

      (e) often has difficulty organizing tasks and activities

      (f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)

      (g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)

      (h) is often easily distracted by extraneous stimuli

      (i) is often forgetful in daily activities

   (2) six or more of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

      (a) often fidgets with hands or feet or squirms in seat

      (b) often leaves seat in classroom or in other situations in which remaining seated is expected

      (c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)

(d) often has difficulty playing or engaging in leisure activities quietly

(e) is often "on the go" or often acts as if "driven by a motor"

(f) often talks excessively

(g) often blurts out answers before questions have been completed

(h) often has difficulty awaiting turn

(i) often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home)

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Attention-Deficit/Hyperactivity Disorder, Combined Type: if both Criteria A1 and A2 are met for the past 6 months

Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type: if Criterion A1 is met but Criterion A2 is not met for the past 6 months

Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type: if Criterion A2 is met but Criterion A1 is not met for the past 6 months

Taken from Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision, American Psychiatric Association, 2000.

APPENDIX B: CHILD'S SLEEP HABITS QUESTIONNAIRE (CSHQ)

The following statements are about your child's sleep habits and possible difficulties with sleep. Think about the past week in your child's life when answering the questions. If the last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well or the TV set was broken), choose the most recent typical week. Answer USUALLY if something occurs 5 or more times in a week; answer SOMETIMES if it occurs 2-4 times in a week; answer RARELY if something occurs never or 1 time during a week. Also, please indicate whether or not the sleep habit is a problem by circling "Yes," "No," or "Not applicable (N/A)"

Bedtime
Write in child's bedtime: _____

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
1) Child goes to bed at the same time at night (R)	☐	☐	☐	Yes No N/A
2) Child falls asleep within 20 minutes after going to bed (R)	☐	☐	☐	Yes No N/A
3) Child falls asleep alone in own bed (R)	☐	☐	☐	Yes No N/A
4) Child falls asleep in parent's or sibling's bed	☐	☐	☐	Yes No N/A
5) Child needs parent in the room to fall asleep	☐	☐	☐	Yes No N/A
6) Child struggles at bedtime (cries, refuses to stay in bed, etc.)	☐	☐	☐	Yes No N/A
7) Child is afraid of sleeping in the dark	☐	☐	☐	Yes No N/A
8) Child is afraid of sleeping alone	☐	☐	☐	Yes No N/A

Sleep Behavior
Child's usual amount of sleep each day: _____ hours and _____ minutes
(combining nighttime sleep and naps)

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
9) Child sleeps too little	☐	☐	☐	Yes No N/A
10) Child sleeps the right amount (R)	☐	☐	☐	Yes No N/A
11) Child sleeps about the same amount each day (R)	☐	☐	☐	Yes No N/A
12) Child wets the bed at night	☐	☐	☐	Yes No N/A
13) Child talks during sleep	☐	☐	☐	Yes No N/A
14) Child is restless and moves a lot during sleep	☐	☐	☐	Yes No N/A
15) Child sleepwalks during the night	☐	☐	☐	Yes No N/A
16) Child moves to someone else's bed during the night (parent, brother, sister, etc.)	☐	☐	☐	Yes No N/A
17) Child grinds teeth during sleep (your dentist may have told you this)	☐	☐	☐	Yes No N/A
18) Child snores loudly	☐	☐	☐	Yes No N/A
19) Child seems to stop breathing during sleep	☐	☐	☐	Yes No N/A
20) Child snorts and/or gasps during sleep	☐	☐	☐	Yes No N/A

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
21) Child has trouble sleeping away from home (visiting relatives, vacation)	☐	☐	☐	Yes No N/A
22) Child awakens during night screaming, sweating, and inconsolable	☐	☐	☐	Yes No N/A
23) Child awakens alarmed by a frightening dream	☐	☐	☐	Yes No N/A

Waking During the Night

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
24) Child awakes once during the night	☐	☐	☐	Yes No N/A
25) Child awakes more than once during the night	☐	☐	☐	Yes No N/A

Write the number of minutes a night waking usually lasts: _____

Morning Waking/Daytime Sleepiness
Write in the time of day child usually wakes in the morning: _____

	Usually (5-7)	Sometimes (2-4)	Rarely (0-1)	Problem?
26) Child wakes up by him/herself (R)	☐	☐	☐	Yes No N/A
27) Child wakes up in negative mood	☐	☐	☐	Yes No N/A
28) Adults or siblings wake up child	☐	☐	☐	Yes No N/A
29) Child has difficulty getting out of bed in the morning	☐	☐	☐	Yes No N/A
30) Child takes a long time to become alert in the morning	☐	☐	☐	Yes No N/A
31) Child seems tired	☐	☐	☐	Yes No N/A

Child has appeared very sleepy or fallen asleep during the following (check all that apply):

	Not Sleepy	Very Sleepy	Falls Asleep
32) Watching TV	☐	☐	☐
33) Riding in a car	☐	☐	☐

APPENDIX C: CHILD ROUTINES INVENTORY (CRI)

1. My child takes turns with family members talking about their day.
     0   1   2   3   4

2. My child does the same things each night before bed (e.g., brushing teeth, reads story, says prayers, and kisses parent goodnight).
     0   1   2   3   4

3. My child has a set routine for getting ready in the morning (e.g., brushing teeth, washing face, doing hair, and dressing).
     0   1   2   3   4

4. My child wakes up at about the same time on weekdays.
     0   1   2   3   4

5. My child eats meals with family at the table each day.
     0   1   2   3   4

6. My child hugs/kisses parent before bed.
     0   1   2   3   4

7. My child goes to bed at about the same time on week nights.
     0   1   2   3   4

8. My child spends special time talking with parent (e.g., in the car or before bed) each day.
     0   1   2   3   4

9. My child eats breakfast at about the same time and place (e.g., at kitchen table or at school) each morning.
     0   1   2   3   4

10. My child eats dinner at about the same time each day.
     0   1   2   3   4

11. My child brushes teeth before bed.
     0   1   2   3   4

Never (0), Almost Never (1), Sometimes (2), Often (3), or Nearly Always (4).

12. My child picks up dirty clothes after changing.
      0   1   2   3   4

13. My child cleans up food mess after snack.
      0   1   2   3   4

14. My child picks up toys and puts them away when done playing.
      0   1   2   3   4

15. My child straightens bedroom daily.
      0   1   2   3   4

16. My child washes hands before mealtime.
      0   1   2   3   4

17. My child has regular chores (e.g., takes out trash, helps with laundry, feeds/cares for pet)
      0   1   2   3   4

18. My child helps clean up after meals.
      0   1   2   3   4

19. My child washes hands after using toilet.
      0   1   2   3   4

20. My child says prayers before meals.
      0   1   2   3   4

21. My child receives smaller punishment for minor misbehavior (e.g., not following instructions) and larger punishment for major misbehavior (e.g., fighting).
      0   1   2   3   4

22. My child is disciplined for misbehavior (e.g., time out, loss of a privilege, or spanking)
      0   1   2   3   4

23. My child knows what will happen if he or she doesn't follow parent instructions or rules.
      0   1   2   3   4

24. My child is praised or rewarded for specific good behavior (e.g., "I like the way you put away your toys").
      0   1   2   3   4

Never (0), Almost Never (1), Sometimes (2), Often (3), or Nearly Always (4).

25. My child receives rewards or privileges for specific good behavior (e.g., finishing homework or completing chores).
       0   1   2   3   4

26. My child helps decide and prepare for family fun or events.
       0   1   2   3   4

27. My child has time limits on fun activities (e.g., outside play, TV, video games, or phone use).
       0   1   2   3   4

28. My child takes part in "family time" each week when the family does planned activities together (e.g., plays games, watches movies and goes out to eat).
       0   1   2   3   4

29. My child has household rules such as "No cursing," "No talking while eating," or "No running inside."
       0   1   2   3   4

30. My child must finish household responsibilities (e.g., homework or chores) before play time.
       0   1   2   3   4

31. My child helps put things away after shopping.
       0   1   2   3   4

32. My child studies for tests (e.g., weekly spelling tests).
       0   1   2   3   4

33. My child is supervised by an adult who helps child with homework by explaining tasks, demonstrating the task, and/or checking the answers when it is completed.
       0   1   2   3   4

34. My child begins homework at about the same time and place (e.g., at the kitchen table) during the week.
       0   1   2   3   4

35. My child completes homework
       0   1   2   3   4

36. My child shows parent school work after school (e.g., art work or spelling test).
       0   1   2   3   4

APPENDIX D: CONSENT TO PARTICIPATE

Dr. Elizabeth O'Laughlin, Ph.D. and Gretchen Noble, M.S. of the Psychology Department at Indiana State University are conducting a study to examine the co-occurrence of ADHD and sleep difficulties in school-aged children. Parents of children referred to the ADHD Clinic at Indiana State University will be invited to participate. Parents/guardians who agree to participate will be asked to complete two additional questionnaires as a part of their child's ADHD assessment. The questionnaires will take approximately 15 minutes to complete. Secondly, participation would involve granting the researcher permission to use information from your child's ADHD assessment including non-identifying demographic information (gender and age of child, ethnicity, family income), parent rating scale responses, and diagnoses from the final evaluation report. Participation in this study is voluntary. If you decline to participate or later withdraw from the study, there will be no penalty or change in services from the ADHD Assessment Clinic.

All information gathered from this study will be kept confidential. It will be kept separate from your child's ADHD Assessment Clinic file and identified only by a code number. All researchers, including Dr. O'Laughlin, will review results identified by code number only. If a publication or presentation results from this study, no individual participants will be identified and only average results for groups of participants will be presented.

This study has been reviewed and approved by the ISU Institutional Review Board (IRB) as adequately protecting the rights of participants. Any concerns or questions regarding your rights and welfare as a research study participant may be addressed to the IRB chairperson at (812) 237-8217 or irb@indstate.edu. Questions specifically about this study should be directed to Liz O'Laughlin at (812) 237-2455 or Gretchen Noble at (812) 237-2445. Generally, participating in this study is no more risky than everyday activities. Benefits of participation could include specific feedback for parents regarding helpful parenting interventions, information useful in treatment planning, and identification of child sleep difficulties.

I, _____, the parent or legal guardian of _____,
      (print name)   (print child's name)

have received a copy of this consent form describing the procedures and the risks and benefits of participating in this study. I understand that by signing this document I am consenting to participate in this study and to complete two additional questionnaires as part of the ADHD evaluation. I also understand that I may withdraw from participation at any time by informing the researcher during the evaluation or by contacting Dr. O'Laughlin at any time at the phone number above.

_____   _____
Participant Signature   Date